►B DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources (recast)

(Text with EEA relevance)

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►C1 Corrigendum, OJ L 311, 25.9.2020, p. 11 (2018/2001)

►C2 Corrigendum, OJ L 41, 22.2.2022, p. 37 (2018/2001)

▼B

DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 11 December 2018

on the promotion of the use of energy from renewable sources

(recast)

(Text with EEA relevance)

Article 1

Subject matter

This Directive establishes a common framework for the promotion of energy from renewable sources. It sets a binding Union target for the overall share of energy from renewable sources in the Union's gross final consumption of energy in 2030. It also lays down rules on financial support for electricity from renewable sources, on self-consumption of such electricity, on the use of energy from renewable sources in the heating and cooling sector and in the transport sector, on regional cooperation between Member States, and between Member States and third countries, on guarantees of origin, on administrative procedures and on information and training. It also establishes sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels.

Article 2

Definitions

For the purposes of this Directive, the relevant definitions in Directive 2009/72/EC of the European Parliament and of the Council [1] apply.

The following definitions also apply:

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(1) ‘energy from renewable sources’ or ‘renewable energy’ means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, osmotic energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas;

(1a) ‘industrial grade roundwood’ means saw logs, veneer logs, round or split pulpwood, as well as all other roundwood that is suitable for industrial purposes, excluding roundwood the characteristics of which, such as species, dimensions, rectitude and node density, make it unsuitable for industrial use as defined and duly justified by Member States according to the relevant forest and market conditions;

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(2) ‘ambient energy’ means naturally occurring thermal energy and energy accumulated in the environment with constrained boundaries, which can be stored in the ambient air, excluding in exhaust air, or in surface or sewage water;

[1] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (OJ L 211, 14.8.2009, p. 55).

▼B

(3) ‘geothermal energy’ means energy stored in the form of heat beneath the surface of solid earth;

▼M2

(4) ‘gross final consumption of energy’ means the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, the consumption of electricity and heat by the energy branch for electricity and heat production, and losses of electricity and heat in distribution and transmission;

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(5) ‘support scheme’ means any instrument, scheme or mechanism applied by a Member State, or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased, including but not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and sliding or fixed premium payments;

(6) ‘renewable energy obligation’ means a support scheme requiring energy producers to include a given share of energy from renewable sources in their production, requiring energy suppliers to include a given share of energy from renewable sources in their supply, or requiring energy consumers to include a given share of energy from renewable sources in their consumption, including schemes under which such requirements may be fulfilled by using green certificates;

(7) ‘financial instrument’ means a financial instrument as defined in point (29) of Article 2 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council ([1]);

(8) ‘SME’ means a micro, small or medium-sized enterprise as defined in Article 2 of the Annex to Commission Recommendation 2003/361/EC ([2]);

([1]) Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 (OJ L 193, 30.7.2018, p. 1).

([2]) Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (OJ L 124, 20.5.2003, p. 36).

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(9) ‘waste heat and cold’ means unavoidable heat or cold generated as by-product in industrial or power generation installations, or in the tertiary sector, which would be dissipated unused in air or water without access to a district heating or cooling system, where a cogeneration process has been used or will be used or where cogeneration is not feasible;

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(9a) ‘renewables acceleration area’ means a specific location or area, whether on land, sea or inland waters, which a Member State designated as particularly suitable for the installation of renewable energy plants;

(9b) ‘solar energy equipment’ means equipment that converts energy from the sun into thermal or electrical energy, in particular solar thermal and solar photovoltaic equipment;

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(10) ‘repowering’ means renewing power plants that produce renewable energy, including the full or partial replacement of installations or operation systems and equipment for the purposes of replacing capacity or increasing the efficiency or capacity of the installation;

(11) ‘distribution system operator’ means an operator as defined in point (6) of Article 2 of Directive 2009/72/EC and in point (6) of Article 2 of Directive 2009/73/EC of the European Parliament and of the Council [1];

(12) ‘guarantee of origin’ means an electronic document which has the sole function of providing evidence to a final customer that a given share or quantity of energy was produced from renewable sources;

(13) ‘residual energy mix’ means the total annual energy mix for a Member State, excluding the share covered by cancelled guarantees of origin;

(14) ‘renewables self-consumer’ means a final customer operating within its premises located within confined boundaries or, where permitted by a Member State, within other premises, who generates renewable electricity for its own consumption, and who may store or sell self-generated renewable electricity, provided that, for a non-household renewables self-consumer, those activities do not constitute its primary commercial or professional activity;

▼M2

(14a) ‘bidding zone’ means a bidding zone as defined in Article 2, point (65), of Regulation (EU) 2019/943 of the European Parliament and of the Council [2];

[1] Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC (OJ L 211, 14.8.2009, p. 94).

[2] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (OJ L 158, 14.6.2019, p. 54).

▼**M2**

(14b) ‘innovative renewable energy technology’ means renewable energy generation technology that improves, in at least one way, comparable state-of-the-art renewable energy technology or that renders renewable energy technology that is not fully commercialised or that involves a clear degree of risk exploitable;

(14c) ‘smart metering system’ means a smart metering system as defined in Article 2, point (23), of Directive (EU) 2019/944 of the European Parliament and of the Council ([1]);

(14d) ‘recharging point’ means a recharging point as defined in Article 2, point (48), of Regulation (EU) 2023/1804 of the European Parliament and of the Council ([2]);

(14e) ‘market participant’ means a market participant as defined in Article 2, point (25), of Regulation (EU) 2019/943;

(14f) ‘electricity market’ means electricity markets as defined in Article 2, point (9), of Directive (EU) 2019/944;

(14g) ‘domestic battery’ means a stand-alone rechargeable battery of rated capacity greater than 2 kwh, which is suitable for installation and use in a domestic environment;

(14h) ‘electric vehicle battery’ means an electric vehicle battery as defined in Article 3(1), point (14), of Regulation (EU) 2023/1542 of the European Parliament and of the Council ([3]);

(14i) ‘industrial battery’ means an industrial battery as defined in Article 3(1), point (13), of Regulation (EU) 2023/1542;

(14j) ‘state of health’ means state of health as defined in Article 3(1), point (28), of Regulation (EU) 2023/1542;

(14k) ‘state of charge’ means state of charge as defined in Article 3(1), point (27), of Regulation (EU) 2023/1542;

(14l) ‘power set point’ means the dynamic information held in a battery’s management system prescribing the electric power settings at which the battery should optimally operate during a recharging or a discharging operation, so that its state of health and operational use are optimised;

([1]) Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

([2]) Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU (OJ L 234, 22.9.2023, p. 1).

([3]) Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L 191, 28.7.2023, p. 1).

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(14m) ‘smart recharging’ means a recharging operation in which the intensity of electricity delivered to the battery is adjusted dynamically, on the basis of information received through electronic communication;

(14n) ‘regulatory authority’ means a regulatory authority as defined in Article 2, point (2), of Regulation (EU) 2019/943;

(14o) ‘bi-directional recharging’ means bi-directional recharging as defined in Article 2, point (11), of Regulation (EU) 2023/1804;

(14p) ‘normal power recharging point’ means a normal power recharging point as defined in Article 2, point (37), of Regulation (EU) 2023/1804;

(14q) ‘renewable energy purchase agreement’ means a contract under which a natural or legal person agrees to purchase renewable energy directly from a producer, which encompasses, but is not limited to, renewables power purchase agreements and renewables heating and cooling purchase agreements;

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(15) ‘jointly acting renewables self-consumers’ means a group of at least two jointly acting renewables self-consumers in accordance with point (14) who are located in the same building or multi-apartment block;

(16) ‘renewable energy community’ means a legal entity:

(a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity;

(b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities;

(c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits;

(17) ‘renewables power purchase agreement’ means a contract under which a natural or legal person agrees to purchase renewable electricity directly from an electricity producer;

(18) ‘peer-to-peer trading’ of renewable energy means the sale of renewable energy between market participants by means of a contract with pre-determined conditions governing the automated execution and settlement of the transaction, either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator. The right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregators;

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(18a) ‘industry’ means undertakings and products that fall under sections B, C, and F and under section J, division (63) of the statistical classification of economic activities (NACE REV.2), as set out in Regulation (EC) No 1893/2006 of the European Parliament and of the Council ([1]);

(18b) ‘non-energy purpose’ means the use of fuels as raw materials in an industrial process, rather than to produce energy;

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(19) ‘district heating’ or ‘district cooling’ means the distribution of thermal energy in the form of steam, hot water or chilled liquids, from central or decentralised sources of production through a network to multiple buildings or sites, for the use of space or process heating or cooling;

(20) ‘efficient district heating and cooling’ means efficient district heating and cooling as defined in point (41) of Article 2 of Directive 2012/27/EU;

(21) ‘high-efficiency cogeneration’ means high-efficiency cogeneration as defined in point (34) of Article 2 of Directive 2012/27/EU;

(22) ‘energy performance certificate’ means energy performance certificate as defined in point (12) of Article 2 of Directive 2010/31/EU;

▼M2

(22a) ‘renewable fuels’ means biofuels, bioliquids, biomass fuels and renewable fuels of non-biological origin;

(22b) ‘energy efficiency first’ means energy efficiency first as defined in Article 2, point (18), of Regulation (EU) 2018/1999;

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(23) ‘waste’ means waste as defined in point (1) of Article 3 of Directive 2008/98/EC, excluding substances that have been intentionally modified or contaminated in order to meet this definition;

(24) ‘biomass’ means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin;

(25) ‘agricultural biomass’ means biomass produced from agriculture;

(26) ‘forest biomass’ means biomass produced from forestry;

(27) ‘biomass fuels’ means gaseous and solid fuels produced from biomass;

([1]) Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037/90 as well as certain EC Regulations on specific statistical domains (OJ L 393, 30.12.2006, p. 1).

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(28) ‘biogas’ means gaseous fuels produced from biomass;

(29) ‘biowaste’ means biowaste as defined in point (4) of Article 3 of Directive 2008/98/EC;

(30) ‘sourcing area’ means the geographically defined area from which the forest biomass feedstock is sourced, from which reliable and independent information is available and where conditions are sufficiently homogeneous to evaluate the risk of the sustainability and legality characteristics of the forest biomass;

(31) ‘forest regeneration’ means the re-establishment of a forest stand by natural or artificial means following the removal of the previous stand by felling or as a result of natural causes, including fire or storm;

(32) ‘bioliquids’ means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass;

(33) ‘biofuels’ means liquid fuel for transport produced from biomass;

(34) ‘advanced biofuels’ means biofuels that are produced from the feedstock listed in Part A of Annex IX;

(35) ‘recycled carbon fuels’ means liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC, or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations;

▼M2

(36) ‘renewable fuels of non-biological origin’ means liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass;

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(37) ‘low indirect land-use change-risk biofuels, bioliquids and biomass fuels’ means biofuels, bioliquids and biomass fuels, the feedstock of which was produced within schemes which avoid displacement effects of food and feed-crop based biofuels, bioliquids and biomass fuels through improved agricultural practices as well as through the cultivation of crops on areas which were previously not used for cultivation of crops, and which were produced in accordance with the sustainability criteria for biofuels, bioliquids and biomass fuels laid down in Article 29;

(38) ‘fuel supplier’ means an entity supplying fuel to the market that is responsible for passing fuel through an excise duty point or, in the case of electricity or where no excise is due or where duly justified, any other relevant entity designated by a Member State;

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(39) ‘starch-rich crops’ means crops comprising mainly cereals, regardless of whether the grains alone or the whole plant, such as in the case of green maize, are used; tubers and root crops, such as potatoes, Jerusalem artichokes, sweet potatoes, cassava and yams; and corm crops, such as taro and cocoyam;

(40) ‘food and feed crops’ means starch-rich crops, sugar crops or oil crops produced on agricultural land as a main crop excluding residues, waste or ligno-cellulosic material and intermediate crops, such as catch crops and cover crops, provided that the use of such intermediate crops does not trigger demand for additional land;

(41) ‘ligno-cellulosic material’ means material composed of lignin, cellulose and hemicellulose, such as biomass sourced from forests, woody energy crops and forest-based industries' residues and wastes;

(42) ‘non-food cellulosic material’ means feedstock mainly composed of cellulose and hemicellulose, and having a lower lignin content than ligno-cellulosic material, including food and feed crop residues, such as straw, stover, husks and shells; grassy energy crops with a low starch content, such as ryegrass, switchgrass, miscanthus, giant cane; cover crops before and after main crops; ley crops; industrial residues, including from food and feed crops after vegetal oils, sugars, starches and protein have been extracted; and material from biowaste, where ley and cover crops are understood to be temporary, short-term sown pastures comprising grass-legume mixture with a low starch content to obtain fodder for livestock and improve soil fertility for obtaining higher yields of arable main crops;

(43) ‘residue’ means a substance that is not the end product(s) that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it;

(44) ‘agricultural, aquaculture, fisheries and forestry residues’ means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing;

▼M2

(44a) ‘plantation forest’ means a plantation forest as defined in Article 2, point (11), of Regulation (EU) 2023/1115 of the European Parliament and of the Council ([1]);

([1]) Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (OJ L 150, 9.6.2023, p. 206).

▼M2

(44b) ‘osmotic energy’ means energy created from the difference in salt concentration between two fluids, such as fresh water and salt water;

(44c) ‘system efficiency’ means the selection of energy-efficient solutions where they also enable a cost-effective decarbonisation pathway, additional flexibility and the efficient use of resources;

(44d) ‘co-located energy storage’ means an energy storage facility combined with a facility producing renewable energy and connected to the same grid access point;

(44e) ‘solar-electric vehicle’ means a motor vehicle equipped with a powertrain containing only non-peripheral electric machines as energy converter, with an electric rechargeable energy storage system which can be recharged externally, and with vehicle-integrated photovoltaic panels;

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(45) ‘actual value’ means the greenhouse gas emissions savings for some or all of the steps of a specific biofuel, bioliquid or biomass fuel production process, calculated in accordance with the methodology laid down in Part C of Annex V or Part B of Annex VI;

(46) ‘typical value’ means an estimate of the greenhouse gas emissions and greenhouse gas emissions savings for a particular biofuel, bioliquid or biomass fuel production pathway, which is representative of the Union consumption;

(47) ‘default value’ means a value derived from a typical value by the application of pre-determined factors and that may, in circumstances specified in this Directive, be used in place of an actual value.

Article 3

Binding overall Union target for 2030

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1. Member States shall collectively ensure that the share of energy from renewable sources in the Union’s gross final consumption of energy in 2030 is at least 42,5 %.

Member States shall collectively endeavour to increase the share of energy from renewable sources in the Union’s gross final consumption of energy in 2030 to 45 %.

Member States shall set an indicative target for innovative renewable energy technology of at least 5 % of newly installed renewable energy capacity by 2030.

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2. Member States shall set national contributions to meet, collectively, the binding overall Union target set in paragraph 1 of this Article as part of their integrated national energy and climate plans in accordance with Articles 3 to 5 and 9 to 14 of Regulation (EU) 2018/1999. In preparing their draft integrated national energy and climate plans, Member States may consider the formula referred to in Annex II to that Regulation.

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If, on the basis of the assessment of the draft integrated national energy and climate plans submitted pursuant to Article 9 of Regulation (EU) 2018/1999, the Commission concludes that the national contributions of the Member States are insufficient for the collective achievement of the binding overall Union target, it shall follow the procedure laid down in Articles 9 and 31 of that Regulation.

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3. Member States shall take measures to ensure that energy from biomass is produced in a way that minimises undue distortive effects on the biomass raw material market and an adverse impact on biodiversity, the environment and the climate. To that end, they shall take into account the waste hierarchy set out in Article 4 of Directive 2008/98/EC and shall ensure the application of the principle of the cascading use of biomass, with a focus on support schemes and with due regard to national specificities.

Member States shall design support schemes for energy from biofuels, bioliquids and biomass fuels in such a way as to avoid incentivising unsustainable pathways and distorting competition with the material sectors, with a view to ensuring that woody biomass is used according to its highest economic and environmental added value in the following order of priorities:

(a) wood-based products;

(b) extending the service life of wood-based products;

(c) re-use;

(d) recycling;

(e) bioenergy; and

(f) disposal.

3a. Member States may derogate from the principle of the cascading use of biomass referred to in paragraph 3 where needed to ensure security of energy supply. Member States may also derogate from that principle where the local industry is quantitatively or technically unable to use forest biomass for an economic and environmental added value that is higher than energy production, for feedstocks coming from:

(a) necessary forest management activities, aiming to ensure pre-commercial thinning operations or carried out in accordance with national law on wildfire prevention in high-risk areas;

(b) salvage logging following documented natural disturbances; or

(c) the harvest of certain woods whose characteristics are not suitable for local processing facilities.

▼M2

3b. Member States shall, no more than once a year, notify the Commission of a summary of the derogations from the principle of the cascading use of biomass pursuant to paragraph 3a, together with the reasons for such derogations and the geographical scale to which they apply. The Commission shall make public the notifications received, and may issue a public opinion with regard to any of them.

3c. Member States shall not grant direct financial support for:

(a) the use of saw logs, veneer logs, industrial grade roundwood, stumps and roots to produce energy;

(b) the production of renewable energy from the incineration of waste, unless the separate collection obligations laid down in Directive 2008/98/EC have been complied with.

3d. Without prejudice to paragraph 3, Member States shall not grant new support or renew any support for the production of electricity from forest biomass in electricity-only installations, unless such electricity meets at least one of the following conditions:

(a) it is produced in a region identified in a territorial just transition plan established in accordance with Article 11 of Regulation (EU) 2021/1056 of the European Parliament and of the Council ([1]) due to its reliance on solid fossil fuels, and it meets the relevant requirements set out in Article 29(11) of this Directive;

(b) it is produced applying biomass CO_2 capture and storage and it meets the requirements set out in Article 29(11), second subparagraph;

(c) it is produced in an outermost region as referred to in Article 349 TFEU, for a limited period and with the objective of phasing down, to the greatest extent possible, the use of forest biomass without affecting access to safe and secure energy.

By 2027, the Commission shall publish a report on the impact of the Member States' support schemes for biomass, including on biodiversity, on the climate and the environment, and on possible market distortions, and shall assess the possibility for further limitations regarding support schemes for forest biomass.

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4. From 1 January 2021, the share of energy from renewable sources in each Member State's gross final consumption of energy shall not be lower than the baseline share shown in the third column of the table in Part A of Annex I to this Directive. Member States shall take the necessary measures to ensure compliance with that baseline share. If a Member State does not maintain its baseline share as measured over any one-year period, the first and second subparagraphs of Article 32(4) of Regulation (EU) 2018/1999 shall apply.

([1]) Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund (OJ L 231, 30.6.2021, p. 1).

▼M2

4a. Member States shall establish a framework, which may include support schemes and measures facilitating the uptake of renewables power purchase agreements, enabling the deployment of renewable electricity to a level that is consistent with the Member State's national contribution referred to in paragraph 2 of this Article and at a pace that is consistent with the indicative trajectories referred to in Article 4, point (a)(2), of Regulation (EU) 2018/1999. In particular, that framework shall tackle remaining barriers to a high level of renewable electricity supply, including those related to permit-granting procedures, and to the development of the necessary transmission, distribution and storage infrastructure, including co-located energy storage. When designing that framework, Member States shall take into account the additional renewable electricity required to meet demand in the transport, industry, building and heating and cooling sectors and for the production of renewable fuels of non-biological origin. Member States may include a summary of the policies and measures under the framework and an assessment of their implementation, respectively, in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and in their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation.

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5. The Commission shall support the high ambition of Member States through an enabling framework comprising the enhanced use of Union funds, including additional funds to facilitate a just transition of carbon intensive regions towards increased shares of renewable energy, in particular financial instruments, especially for the following purposes:

(a) reducing the cost of capital for renewable energy projects;

(b) developing projects and programmes for integrating renewable sources into the energy system, for increasing flexibility of the energy system, for maintaining grid stability and for managing grid congestions;

(c) developing transmission and distribution grid infrastructure, intelligent networks, storage facilities and interconnections, with the objective of arriving at a 15 % electricity interconnection target by 2030, in order to increase the technically feasible and economically affordable level of renewable energy in the electricity system;

(d) enhancing regional cooperation between Member States and between Member States and third countries, through joint projects, joint support schemes and the opening of support schemes for renewable electricity to producers located in other Member States.

6. The Commission shall establish a facilitative platform in order to support Member States that use cooperation mechanisms to contribute to the binding overall Union target set in paragraph 1.

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Article 4

Support schemes for energy from renewable sources

1. In order to reach or exceed the Union target set in Article 3(1), and each Member State's contribution to that target set at a national level for the deployment of renewable energy, Member States may apply support schemes.

2. Support schemes for electricity from renewable sources shall provide incentives for the integration of electricity from renewable sources in the electricity market in a market-based and market-responsive way, while avoiding unnecessary distortions of electricity markets as well as taking into account possible system integration costs and grid stability.

3. Support schemes for electricity from renewable sources shall be designed so as to maximise the integration of electricity from renewable sources in the electricity market and to ensure that renewable energy producers are responding to market price signals and maximise their market revenues.

To that end, with regard to direct price support schemes, support shall be granted in the form of a market premium, which could be, *inter alia*, sliding or fixed.

Member States may exempt small-scale installations and demonstration projects from this paragraph, without prejudice to the applicable Union law on the internal market for electricity.

4. Member States shall ensure that support for electricity from renewable sources is granted in an open, transparent, competitive, non-discriminatory and cost-effective manner.

Member States may exempt small-scale installations and demonstration projects from tendering procedures.

Member States may also consider establishing mechanisms to ensure the regional diversification in the deployment of renewable electricity, in particular to ensure cost-efficient system integration.

5. Member States may limit tendering procedures to specific technologies where opening support schemes to all producers of electricity from renewable sources would lead to a suboptimal result, in view of:

(a) the long-term potential of a particular technology;

(b) the need to achieve diversification;

(c) grid integration costs;

(d) network constraints and grid stability;

(e) for biomass, the need to avoid distortions of raw materials markets.

6. Where support for electricity from renewable sources is granted by means of a tendering procedure, Member States shall, in order to ensure a high project realisation rate:

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(a) establish and publish non-discriminatory and transparent criteria to qualify for the tendering procedure and set clear dates and rules for delivery of the project;

(b) publish information about previous tendering procedures, including project realisation rates.

7. In order to increase the generation of energy from renewable sources in the outermost regions and small islands, Member States may adapt financial support schemes for projects located in those regions in order to take into account the production costs associated with their specific conditions of isolation and external dependence.

8. By 31 December 2021 and every three years thereafter, the Commission shall report to the European Parliament and to the Council on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union, analysing in particular the ability of tendering procedures to:

(a) achieve cost-reduction;

(b) achieve technological improvement;

(c) achieve high realisation rates;

(d) provide non-discriminatory participation of small actors and, where applicable, local authorities;

(e) limit environmental impact;

(f) ensure local acceptability;

(g) ensure security of supply and grid integration.

9. This Article shall apply without prejudice to Articles 107 and 108 TFEU.

Article 5

Opening of support schemes for electricity from renewable sources

1. Member States shall have the right, in accordance with Articles 7 to 13 of this Directive, to decide to which extent they support electricity from renewable sources which is produced in another Member State. However, Member States may open participation in support schemes for electricity from renewable sources to producers located in other Member States, subject to the conditions laid down in this Article.

When opening participation in support schemes for electricity from renewable sources, Member States may provide that support for an indicative share of the newly-supported capacity, or of the budget allocated thereto, in each year is open to producers located in other Member States.

Such indicative shares may, in each year, amount to at least 5 % from 2023 to 2026 and at least 10 % from 2027 to 2030, or, where lower, to the level of interconnectivity of the Member State concerned in any given year.

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In order to acquire further implementation experience, Member States may organise one or more pilot schemes where support is open to producers located in other Member States.

2. Member States may require proof of physical import of electricity from renewable sources. To that end, Member States may limit participation in their support schemes to producers located in Member States with which there is a direct connection via interconnectors. However, Member States shall not change or otherwise affect cross-zonal schedules and capacity allocation due to producers participating in cross-border support schemes. Cross-border electricity transfers shall be determined only by the outcome of capacity allocation pursuant to Union law on the internal market in electricity.

3. If a Member State decides to open participation in support schemes to producers located in other Member States, the relevant Member States shall agree on the principles of such participation. Such agreements shall cover at least the principles of allocation of renewable electricity that is the subject of cross-border support.

4. The Commission shall, upon the request of the relevant Member States, assist them throughout the negotiation process with the setting up of cooperation arrangements by providing information and analysis, including quantitative and qualitative data on the direct and indirect costs and benefits of cooperation, as well as with guidance and technical expertise. The Commission may encourage or facilitate the exchange of best practices and may develop templates for cooperation agreements in order to facilitate the negotiation process. The Commission shall assess, by 2025, the costs and benefits of the deployment of electricity from renewable sources in the Union pursuant to this Article.

5. By 2023, the Commission shall carry out an evaluation of the implementation of this Article. That evaluation shall assess the need to introduce an obligation on Member States partially to open participation in their support schemes for electricity from renewable sources to producers located in other Member States with a view to a 5 % opening by 2025 and a 10 % opening by 2030.

Article 6

Stability of financial support

1. Without prejudice to adaptations necessary to comply with Articles 107 and 108 TFEU, Member States shall ensure that the level of, and the conditions attached to, the support granted to renewable energy projects are not revised in a way that negatively affects the rights conferred thereunder and undermines the economic viability of projects that already benefit from support.

2. Member States may adjust the level of support in accordance with objective criteria, provided that such criteria are established in the original design of the support scheme.

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3. Member States shall publish a long-term schedule anticipating the expected allocation of support, covering, as a reference, at least the following five years, or, in the case of budgetary planning constraints, the following three years, including the indicative timing, the frequency of tendering procedures where appropriate, the expected capacity and budget or maximum unitary support expected to be allocated, and the expected eligible technologies, if applicable. That schedule shall be updated on an annual basis or, where necessary, to reflect recent market developments or expected allocation of support.

4. Member States shall, at least every five years, assess the effectiveness of their support schemes for electricity from renewable sources and their major distributive effects on different consumer groups, and on investments. That assessment shall take into account the effect of possible changes to the support schemes. The indicative long-term planning governing the decisions of the support and design of new support shall take into account the results of that assessment. Member States shall include the assessment in the relevant updates of their integrated national energy and climate plans and progress reports in accordance with Regulation (EU) 2018/1999.

Article 7

Calculation of the share of energy from renewable sources

1. The gross final consumption of energy from renewable sources in each Member State shall be calculated as the sum of:

(a) gross final consumption of electricity from renewable sources;

(b) gross final consumption of energy from renewable sources in the heating and cooling sector; and

(c) final consumption of energy from renewable sources in the transport sector.

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With regard to the first subparagraph, point (a), (b), or (c), gas and electricity from renewable sources shall be considered only once for the purposes of calculating the share of gross final consumption of energy from renewable sources.

Energy produced from renewable fuels of non-biological origin shall be counted in the sector – electricity, heating and cooling, or transport – where it is consumed.

Without prejudice to the third subparagraph, Member States may agree, via a specific cooperation agreement, to count all or part of the renewable fuels of non-biological origin consumed in one Member State towards the share of gross final consumption of energy from renewable sources in the Member State where those fuels are produced. In order to monitor whether the same renewable fuels of non-biological origin are not counted in both the Member State where they are produced and in the Member State where they are consumed and in order to record the amount counted, Member States shall notify the Commission of any such cooperation agreement. Such a cooperation agreement shall include the amount of renewable fuels of non-biological origin to be counted in total and for each Member State and the date on which the cooperation agreement is to become operational.

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Subject to the second subparagraph of Article 29(1), biofuels, bioliquids and biomass fuels that do not fulfil the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) shall not be taken into account.

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2. For the purposes of paragraph 1, first subparagraph, point (a), gross final consumption of electricity from renewable sources shall be calculated as the quantity of electricity produced in a Member State from renewable sources, including the production of electricity from renewables self-consumers and renewable energy communities and electricity from renewable fuels of non-biological origin and excluding the production of electricity in pumped storage units from water that has previously been pumped uphill as well as the electricity used to produce renewable fuels of non-biological origin.

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In multi-fuel plants using renewable and non-renewable sources, only the part of electricity produced from renewable sources shall be taken into account. For the purposes of that calculation, the contribution of each energy source shall be calculated on the basis of its energy content.

The electricity generated by hydropower and wind power shall be accounted for in accordance with the normalisation rules set out in Annex II.

3. For the purposes of point (b) of the first subparagraph of paragraph 1, gross final consumption of energy from renewable sources in the heating and cooling sector shall be calculated as the quantity of district heating and cooling produced in a Member State from renewable sources, plus the consumption of other energy from renewable sources in industry, households, services, agriculture, forestry and fisheries, for heating, cooling and processing purposes.

In multi-fuel plants using renewable and non-renewable sources, only the part of heating and cooling produced from renewable sources shall be taken into account. For the purposes of that calculation, the contribution of each energy source shall be calculated on the basis of its energy content.

Ambient and geothermal energy used for heating and cooling by means of heat pumps and district cooling systems shall be taken into account for the purposes of point (b) of the first subparagraph of paragraph 1, provided that the final energy output significantly exceeds the primary energy input required to drive the heat pumps. The quantity of heat or cold to be considered to be energy from renewable sources for the purposes of this Directive shall be calculated in accordance with the methodology set out in Annex VII and shall take into account energy use in all end-use sectors.

Thermal energy generated by passive energy systems, under which lower energy consumption is achieved passively through building design or from heat generated by energy from non-renewable sources, shall not be taken into account for the purposes of point (b) of the first subparagraph of paragraph 1.

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By 31 December 2021, the Commission shall adopt delegated acts in accordance with Article 35 to supplement this Directive by establishing a methodology for calculating the quantity of renewable energy used for cooling and district cooling and to amend Annex VII.

That methodology shall include minimum seasonal performance factors for heat pumps operating in reverse mode.

4. For the purposes of point (c) of the first subparagraph of paragraph 1, the following requirements shall apply:

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(a) Final consumption of energy from renewable sources in the transport sector shall be calculated as the sum of all biofuels, biogas and renewable fuels of non-biological origin consumed in the transport sector. That shall include renewable fuels supplied to international marine bunkers.

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(b) For the calculation of final consumption of energy in the transport sector, the values regarding the energy content of transport fuels, as set out in Annex III, shall be used. For the determination of the energy content of transport fuels not included in Annex III, Member States shall use the relevant European Standards Organisation (ESO) standards in order to determine the calorific values of fuels. Where no ESO standard has been adopted for that purpose, Member States shall use the relevant International Organization for Standardisation (ISO) standards.

5. The share of energy from renewable sources shall be calculated as the gross final consumption of energy from renewable sources divided by the gross final consumption of energy from all energy sources, expressed as a percentage.

For the purposes of the first subparagraph of this paragraph, the sum referred to in the first subparagraph of paragraph 1 of this Article shall be adjusted in accordance with Articles 8, 10, 12 and 13.

In calculating a Member State's gross final consumption of energy for the purposes of measuring its compliance with the targets and indicative trajectory laid down in this Directive, the amount of energy consumed in aviation shall, as a proportion of that Member State's gross final consumption of energy, be considered to be no more than 6,18 %. For Cyprus and Malta the amount of energy consumed in aviation shall, as a proportion of those Member States' gross final consumption of energy, be considered to be no more than 4,12 %.

6. The methodology and definitions used in the calculation of the share of energy from renewable sources shall be those provided for in Regulation (EC) No 1099/2008.

Member States shall ensure coherence of the statistical information used in calculating those sectoral and overall shares and of the statistical information reported to the Commission pursuant to that Regulation.

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Article 8

Union renewable development platform and statistical transfers between Member States

1. Member States may agree on the statistical transfer of a specified amount of energy from renewable sources from one Member State to another Member State. The transferred quantity shall be:

(a) deducted from the amount of energy from renewable sources that is taken into account in calculating the renewable energy share of the Member State making the transfer for the purposes of this Directive; and

(b) added to the amount of energy from renewable sources that is taken into account in calculating the renewable energy share of the Member State accepting the transfer for the purposes of this Directive.

2. In order to facilitate the achievement of the Union target set in Article 3(1) of this Directive and of each Member State's contribution to that target in accordance with Article 3(2) of this Directive, and to facilitate statistical transfers in accordance with paragraph 1 of this Article, the Commission shall establish a Union renewable development platform ('URDP'). Member States may, on a voluntary basis, submit to the URDP annual data on their national contributions to the Union target or any benchmark set for monitoring progress in Regulation (EU) 2018/1999, including the amount by which they expect to fall short of or exceed their contribution, and an indication of the price at which they would accept to transfer any excess production of energy from renewable sources from or to another Member State. The price of those transfers shall be set on a case-by-case basis based on the URDP demand-and-supply matching mechanism.

3. The Commission shall ensure that the URDP is able to match the demand for and supply of the amounts of energy from renewable sources that are taken into account in the calculation of the renewable energy share of a Member State based on prices or other criteria specified by the Member State accepting the transfer.

The Commission is empowered to adopt delegated acts in accordance with Article 35 to supplement this Directive by establishing the URDP and setting the conditions for the finalisation of transfers as referred to in paragraph 5 of this Article.

4. The arrangements referred to in paragraphs 1 and 2 may have a duration of one or more calendar years. Such arrangements shall be notified to the Commission or finalised on the URDP not later than 12 months after the end of each year in which they have effect. The information sent to the Commission shall include the quantity and price of the energy involved. For transfers finalised on the URDP, the parties involved and the information on the particular transfer shall be disclosed to the public.

5. Transfers shall become effective after all Member States involved in the transfer have notified the transfer to the Commission or after all clearing conditions are met on the URDP, as applicable.

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Article 9

Joint projects between Member States

1. Two or more Member States may cooperate on all types of joint projects with regard to the production of electricity, heating or cooling from renewable sources. Such cooperation may involve private operators.

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1a. By 31 December 2025, each Member State shall agree to establish a framework for cooperation on joint projects with one or more other Member States for the production of renewable energy, subject to the following:

(a) by 31 December 2030, Member States shall endeavour to agree on establishing at least two joint projects;

(b) by 31 December 2033, Member States with an annual electricity consumption of more than 100 TWh shall endeavour to agree on establishing a third joint project.

The identification of joint offshore renewable energy projects shall be consistent with the needs identified in the high-level strategic integrated offshore network development plans for each sea-basin referred to in Article 14(2) of Regulation (EU) 2022/869 of the European Parliament and of the Council ([1]) and the Union-wide ten-year network development plan referred to in Article 30(1), point (b), of Regulation (EU) 2019/943, but may go beyond those needs and may involve local and regional authorities and private undertakings.

Member States shall work towards a fair distribution of the costs and benefits of joint projects. To that end, Member States shall take into account all the relevant costs and benefits of the joint project in the relevant cooperation agreement.

Member States shall notify the Commission of cooperation agreements, including the date on which the joint projects are expected to become operational. Projects financed by national contributions under the Union renewable energy financing mechanism established by Commission Implementing Regulation (EU) 2020/1294 ([2]) shall be deemed to satisfy the obligations referred to in the first subparagraph for the Member States involved.

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2. Member States shall notify the Commission of the proportion or amount of electricity, heating or cooling from renewable sources produced by any joint project in their territory that became operational after 25 June 2009, or by the increased capacity of an installation that was refurbished after that date, which is to be regarded as counting towards the renewable energy share of another Member State for the purposes of this Directive.

([1]) Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013 (OJ L 152, 3.6.2022, p. 45).

([2]) Commission Implementing Regulation (EU) 2020/1294 of 15 September 2020 on the Union renewable energy financing mechanism (OJ L 303, 17.9.2020, p. 1).

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3. The notification referred to in paragraph 2 shall:

(a) describe the proposed installation or identify the refurbished installation;

(b) specify the proportion or amount of electricity or heating or cooling produced from the installation which is to be regarded as counting towards the renewable energy share of the other Member State;

(c) identify the Member State in whose favour the notification is being made; and

(d) specify the period, in whole calendar years, during which the electricity or heating or cooling produced by the installation from renewable sources is to be regarded as counting towards the renewable energy share of the other Member State.

4. The duration of a joint project as referred to in this Article may extend beyond 2030.

5. A notification made under this Article shall not be varied or withdrawn without the joint agreement of the Member State making the notification and the Member State identified in accordance with point (c) of paragraph 3.

6. The Commission shall, upon the request of the Member States concerned, facilitate the establishment of joint projects between Member States, in particular via dedicated technical assistance and project development assistance.

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7a. On the basis of the indicative goals for offshore renewable energy generation to be deployed within each sea basin, identified in accordance with Article 14 of Regulation (EU) 2022/869, the Member States concerned shall publish information on the volumes of offshore renewable energy that they plan to achieve through tenders, taking into account technical and economic feasibility for the grid infrastructure and the activities that already take place. Member States shall endeavour to allocate space for offshore renewable energy projects in their maritime spatial plans, taking into account the activities that already take place in the affected areas. In order to facilitate permit-granting for joint offshore renewable energy projects, Member States shall reduce the complexity and increase the efficiency and transparency of the permit-granting procedure, shall enhance cooperation among themselves and shall, where appropriate, establish a single contact point. In order to enhance public acceptance, Member States may include renewable energy communities in joint offshore renewable energy projects.

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Article 10

Effects of joint projects between Member States

1. Within three months of the end of each year falling within the period referred to in point (d) of Article 9(3), the Member State that made the notification under Article 9 shall issue a letter of notification stating:

(a) the total amount of electricity or heating or cooling produced from renewable sources during that year by the installation which was the subject of the notification under Article 9; and

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(b) the amount of electricity or heating or cooling produced from renewable sources during that year by that installation which is to count towards the renewable energy share of another Member State in accordance with the terms of the notification.

2. The notifying Member State shall submit the letter of notification to the Member State in whose favour the notification was made and to the Commission.

3. For the purposes of this Directive, the amount of electricity or heating or cooling from renewable sources notified in accordance with point (b) of paragraph 1 shall be:

(a) deducted from the amount of electricity or heating or cooling from renewable sources that is taken into account in calculating the renewable energy share of the Member State issuing the letter of notification pursuant to paragraph 1; and

(b) added to the amount of electricity or heating or cooling from renewable sources that is taken into account in calculating the renewable energy share of the Member State receiving the letter of notification pursuant to paragraph 2.

Article 11

Joint projects between Member States and third countries

1. One or more Member States may cooperate with one or more third countries on all types of joint projects with regard to the production of electricity from renewable sources. Such cooperation may involve private operators and shall take place in full respect of international law.

2. Electricity from renewable sources produced in a third country shall be taken into account for the purposes of calculating the renewable energy shares of the Member States only where the following conditions are met:

(a) the electricity is consumed in the Union, which is deemed to be met where:

(i) an equivalent amount of electricity to the electricity accounted for has been firmly nominated to the allocated interconnection capacity by all responsible transmission system operators in the country of origin, the country of destination and, if relevant, each third country of transit;

(ii) an equivalent amount of electricity to the electricity accounted for has been firmly registered in the schedule of balance by the responsible transmission system operator on the Union side of an interconnector; and

(iii) the nominated capacity and the production of electricity from renewable sources by the installation referred to in point (b) refer to the same period of time;

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(b) the electricity is produced by an installation that became operational after 25 June 2009 or by the increased capacity of an installation that was refurbished after that date, under a joint project as referred to in paragraph 1;

(c) the amount of electricity produced and exported has not received support from a support scheme of a third country other than investment aid granted to the installation; and

(d) the electricity has been produced in accordance with international law, in a third country that is a signatory to the Council of Europe Convention for the Protection of Human Rights and Fundamental Freedoms, or other international conventions or treaties on human rights.

3. For the purposes of paragraph 4, Member States may apply to the Commission for account to be taken of electricity from renewable sources produced and consumed in a third country, in the context of the construction of an interconnector with a very long lead-time between a Member State and a third country where the following conditions are met:

(a) construction of the interconnector started by 31 December 2026;

(b) it is not possible for the interconnector to become operational by 31 December 2030;

(c) it is possible for the interconnector to become operational by 31 December 2032;

(d) after it becomes operational, the interconnector will be used for the export to the Union, in accordance with paragraph 2, of electricity from renewable sources;

(e) the application relates to a joint project that fulfils the criteria set out in points (b) and (c) of paragraph 2 and that will use the interconnector after it becomes operational, and to a quantity of electricity that is no greater than the quantity that will be exported to the Union after the interconnector becomes operational.

4. The proportion or amount of electricity produced by any installation in the territory of a third country, which is to be regarded as counting towards the renewable energy share of one or more Member States for the purposes of this Directive, shall be notified to the Commission. When more than one Member State is concerned, the distribution between Member States of that proportion or amount shall be notified to the Commission. The proportion or amount shall not exceed the proportion or amount actually exported to, and consumed in, the Union, shall correspond to the amount referred to in point (a)(i) and (ii) of paragraph 2 and shall meet the conditions set out in point (a) of that paragraph. The notification shall be made by each Member State towards whose overall national target the proportion or amount of electricity is to count.

5. The notification referred to in paragraph 4 shall:

(a) describe the proposed installation or identify the refurbished installation;

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(b) specify the proportion or amount of electricity produced from the installation which is to be regarded as counting towards the renewable energy share of a Member State as well as, subject to confidentiality requirements, the corresponding financial arrangements;

(c) specify the period, in whole calendar years, during which the electricity is to be regarded as counting towards the renewable energy share of the Member State; and

(d) include a written acknowledgement of points (b) and (c) by the third country in whose territory the installation is to become operational and an indication of the proportion or amount of electricity produced by the installation which will be used domestically by that third country.

6. The duration of a joint project as referred to in this Article may extend beyond 2030.

7. A notification made under this Article shall be varied or withdrawn only where there is a joint agreement between the Member State making the notification and the third country that has acknowledged the joint project in accordance with point (d) of paragraph 5.

8. Member States and the Union shall encourage the relevant bodies of the Energy Community to take, in conformity with the Energy Community Treaty, the measures necessary to allow the Contracting Parties to apply the provisions on cooperation between Member States laid down in this Directive.

Article 12

Effects of joint projects between Member States and third countries

1. Within 12 months of the end of each year falling within the period specified under point (c) of Article 11(5), the notifying Member State shall issue a letter of notification stating:

(a) the total amount of electricity produced from renewable sources during that year by the installation which was the subject of the notification under Article 11;

(b) the amount of electricity produced from renewable sources during that year by that installation which is to count towards its renewable energy share in accordance with the terms of the notification under Article 11; and

(c) evidence of compliance with the conditions laid down in Article 11(2).

2. The Member State referred to in paragraph 1 shall submit the letter of notification to the Commission and to the third country that has acknowledged the project in accordance with point (d) of Article 11(5).

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3. For the purposes of calculating the renewable energy shares under this Directive, the amount of electricity from renewable sources notified in accordance with point (b) of paragraph 1 shall be added to the amount of energy from renewable sources that is taken into account in calculating the renewable energy shares of the Member State issuing the letter of notification.

Article 13

Joint support schemes

1. Without prejudice to the obligations of Member States under Article 5, two or more Member States may decide, on a voluntary basis, to join or partly coordinate their national support schemes. In such cases, a certain amount of energy from renewable sources produced in the territory of one participating Member State may count towards the renewable energy share of another participating Member State, provided that the Member States concerned:

(a) make a statistical transfer of specified amounts of energy from renewable sources from one Member State to another Member State in accordance with Article 8; or

(b) set up a distribution rule agreed by participating Member States that allocates amounts of energy from renewable sources between the participating Member States.

A distribution rule as referred to in point (b) of the first subparagraph shall be notified to the Commission not later than three months after the end of the first year in which it takes effect.

2. Within three months of the end of each year, each Member State that has made a notification under the second subparagraph of paragraph 1 shall issue a letter of notification stating the total amount of electricity or heating or cooling from renewable sources produced during the year which is to be the subject of the distribution rule.

3. For the purposes of calculating the renewable energy shares under this Directive, the amount of electricity or heating or cooling from renewable sources notified in accordance with paragraph 2 shall be reallocated between the Member States concerned in accordance with the notified distribution rule.

4. The Commission shall disseminate guidelines and best practices, and, upon the request of the Member States concerned, facilitate the establishment of joint support schemes between Member States.

Article 14

Capacity increases

For the purposes of Article 9(2) and point (b) of Article 11(2), units of energy from renewable sources imputable to an increase in the capacity of an installation shall be treated as if they were produced by a separate installation becoming operational at the moment at which the increase of capacity occurred.

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Article 15

Administrative procedures, regulations and codes

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1. Member States shall ensure that any national rules concerning the authorisation, certification and licensing procedures that are applied to plants and associated transmission and distribution networks for the production of electricity, heating or cooling from renewable sources, to the process of transformation of biomass into biofuels, bioliquids, biomass fuels or other energy products, and to renewable fuels of non-biological origin are proportionate and necessary and contribute to the implementation of the energy efficiency first principle.

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Member States shall, in particular, take the appropriate steps to ensure that:

(a) administrative procedures are streamlined and expedited at the appropriate administrative level and predictable timeframes are established for the procedures referred to in the first subparagraph;

(b) rules concerning authorisation, certification and licensing are objective, transparent and proportionate, do not discriminate between applicants and take fully into account the particularities of individual renewable energy technologies;

(c) administrative charges paid by consumers, planners, architects, builders and equipment and system installers and suppliers are transparent and cost-related; and

(d) simplified and less burdensome authorisation procedures, including a simple-notification procedure, are established for decentralised devices, and for producing and storing energy from renewable sources.

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2. Member States shall clearly define any technical specifications which are to be met by renewable energy equipment and systems in order to benefit from support schemes and to be eligible under public procurement. Where harmonised standards or European standards exist, including technical reference systems established by the European standardisation organisations, such technical specifications shall be expressed in terms of those standards. Precedence shall be given to harmonised standards, the references of which have been published in the *Official Journal of the European Union* in support of Union law, including Regulation (EU) 2017/1369 of the European Parliament and of the Council [1] and Directive 2009/125/EC of the European Parliament and of the Council [2]. In their absence, other harmonised

[1] Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU (OJ L 198, 28.7.2017, p. 1).

[2] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (OJ L 285, 31.10.2009, p. 10).

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standards and European standards shall be used, in that order. Such technical specifications shall not prescribe where the equipment and systems are to be certified and shall not impede the proper functioning of the internal market.

2a. Member States shall promote the testing of innovative renewable energy technology for producing, sharing and storing of renewable energy through pilot projects in a real-world environment, for a limited period, in accordance with the applicable Union law and accompanied by appropriate safeguards to ensure the secure operation of the energy system and avoid disproportionate impact on the functioning of the internal market, under the supervision of a competent authority.

3. Member States shall ensure that their competent authorities at national, regional and local level include provisions for the integration and deployment of renewable energy, including for renewables self-consumption and renewable energy communities, and for the use of unavoidable waste heat and cold when planning, including early spatial planning, designing, building and renovating urban infrastructure, industrial, commercial or residential areas and energy and transport infrastructure, including electricity, district heating and cooling, natural gas and alternative fuel networks. Member States shall, in particular, encourage local and regional administrative bodies to include heating and cooling from renewable sources in the planning of city infrastructure where appropriate, and to consult the network operators to reflect the impact of energy efficiency and demand-response programmes as well as specific provisions on renewables self- consumption and renewable energy communities, on the infrastructure development plans of the network operators.

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8. Member States shall assess the regulatory and administrative barriers to long-term renewable energy purchase agreements, and shall remove unjustified barriers to, and promote the uptake of, such agreements, including by exploring how to reduce the financial risks associated with them, in particular by using credit guarantees. Member States shall ensure that those agreements are not subject to disproportionate or discriminatory procedures or charges, and that any associated guarantees of origin can be transferred to the buyer of the renewable energy under the renewable energy purchase agreement.

Member States shall describe their policies and measures promoting the uptake of renewable energy purchase agreements in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation. They shall also provide, in those progress reports, an indication of renewable energy generation that is supported by renewable energy purchase agreements.

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Following the assessment referred to in the first subparagraph, the Commission shall analyse the barriers to long-term renewable energy purchase agreements and in particular to the deployment of cross-border renewable energy purchase agreements and shall issue guidance on the removal those barriers.

9. By 21 November 2025, the Commission shall consider if additional measures are needed to support Member States in the implementation of the permit-granting procedures provided for in this Directive, including by means of developing indicative key performance indicators.

Article 15a

Mainstreaming renewable energy in buildings

1. In order to promote the production and use of renewable energy in the building sector, Member States shall determine an indicative national share of renewable energy produced on-site or nearby as well as renewable energy taken from the grid in final energy consumption in their building sector in 2030 that is consistent with an indicative target of at least a 49 % share of energy from renewable sources in the building sector in the Union's final energy consumption in buildings in 2030. Member States shall include their indicative national share in the integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 as well as information on how they plan to achieve it.

2. Member States may count waste heat and cold towards the indicative national share referred to in paragraph 1, up to a limit of 20 % of that share. If they decide to do so, the indicative national share shall increase by half of the percentage of waste heat and cold counted towards that share.

3. Member States shall introduce appropriate measures in their national regulations and building codes and, where applicable, in their support schemes, to increase the share of electricity and heating and cooling from renewable sources produced on-site or nearby as well as renewable energy taken from the grid in the building stock. Such measures may include national measures relating to substantial increases in renewables self-consumption, renewable energy communities, local energy storage, smart recharging and bi-directional recharging, other flexibility services such as demand response, and in combination with energy efficiency improvements relating to cogeneration and major renovations which increase the number of nearly zero energy buildings and buildings that go beyond minimum energy performance requirements provided for in Article 4 of Directive 2010/31/EU.

In order to achieve the indicative share of renewable energy provided for in paragraph 1, Member States shall, in their national regulations and building codes and, where applicable, in their support schemes or by other means with equivalent effect, require the use of minimum levels of energy from renewable sources produced on-site or nearby as well as renewable energy taken from the grid, in new buildings and in existing buildings that are undergoing major renovation or a renewal of the heating system, in accordance with Directive 2010/31/EU, where that is economically, technically and functionally feasible. Member States shall allow those minimum levels to be fulfilled through, inter alia, efficient district heating and cooling.

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For existing buildings, the first subparagraph shall apply to the armed forces only to the extent that its application does not cause any conflict with the nature and primary aim of the activities of the armed forces and with the exception of material used exclusively for military purposes.

4. Member States shall ensure that public buildings at national, regional and local level fulfil an exemplary role as regards the share of renewable energy used, in accordance with Article 9 of Directive 2010/31/EU and Article 5 of Directive 2012/27/EU. Member States may allow that obligation to be fulfilled by, inter alia, providing for the roofs of public or mixed private-public buildings to be used by third parties for installations that produce energy from renewable sources.

5. Where deemed to be relevant, Member States may promote co-operation between local authorities and renewable energy communities in the building sector, particularly through the use of public procurement.

6. In order to achieve the indicative share of renewable energy provided for in paragraph 1, Member States shall promote the use of renewable heating and cooling systems and equipment and may promote innovative technology, such as smart and renewable-based electrified heating and cooling systems and equipment, complemented, where applicable, with smart management of energy consumption in buildings. To that end, Member States shall use all appropriate measures, tools and incentives, including, energy labels developed under Regulation (EU) 2017/1369, energy performance certificates established pursuant to Article 11 of Directive 2010/31/EU, and other appropriate certificates or standards developed at Union or national level, and shall ensure the provision of adequate information and advice on renewable, highly energy efficient alternatives as well as on financial instruments and incentives available to promote an increased replacement rate of old heating systems and an increased switch to solutions based on renewable energy.

Article 15b

Mapping of areas necessary for national contributions towards the overall Union renewable energy target for 2030

1. By 21 May 2025, Member States shall carry out a coordinated mapping for the deployment of renewable energy in their territory to identify the domestic potential and the available land surface, sub-surface, sea or inland water areas that are necessary for the installation of renewable energy plants and their related infrastructure, such as grid and storage facilities, including thermal storage, that are required in order to meet at least their national contributions towards the overall Union renewable energy target for 2030 set in Article 3(1) of this Directive. To that end, Member States may use or build upon their existing spatial planning documents or plans, including maritime

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spatial plans set up pursuant to Directive 2014/89/EU of the European Parliament and of the Council ([1]). Member States shall ensure coordination among all the relevant national, regional and local authorities and entities, including network operators, in the mapping of the necessary areas, where appropriate.

Member States shall ensure that such areas, including the existing renewable energy plants and cooperation mechanisms, are commensurate with the estimated trajectories and total planned installed capacity by renewable energy technology set out in their national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999.

2. For the purpose of identifying the areas referred to in paragraph 1, Member States shall take into account in particular:

(a) the availability of energy from renewable sources and the potential for renewable energy production of the different types of technology in the land surface, sub-surface, sea or inland water areas;

(b) the projected demand for energy, taking into account the potential flexibility of the active demand response, expected efficiency gains and energy system integration;

(c) the availability of relevant energy infrastructure, including grids, storage and other flexibility tools or the potential to create or upgrade such grid infrastructure and storage.

3. Member States shall favour multiple uses of the areas referred to in paragraph 1. Renewable energy projects shall be compatible with pre-existing uses of those areas.

4. Member States shall periodically review and, where necessary, update the areas referred to in paragraph 1 of this Article, in particular in the context of the updates of their national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999.

Article 15c

Renewables acceleration areas

1. By 21 February 2026, Member States shall ensure that competent authorities adopt one or more plans designating, as a sub-set of the areas referred to in Article 15b(1), renewables acceleration areas for one or more types of renewable energy sources. Member States may exclude biomass combustion and hydropower plants. In those plans, competent authorities shall:

(a) designate sufficiently homogeneous land, inland water, and sea areas where the deployment of a specific type or specific types of renewable energy sources is not expected to have a significant environmental impact, in view of the particularities of the selected area, while:

([1]) Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (OJ L 257, 28.8.2014, p. 135).

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(i) giving priority to artificial and built surfaces, such as rooftops and facades of buildings, transport infrastructure and their direct surroundings, parking areas, farms, waste sites, industrial sites, mines, artificial inland water bodies, lakes or reservoirs and, where appropriate, urban waste water treatment sites, as well as degraded land not usable for agriculture;

(ii) excluding Natura 2000 sites and areas designated under national protection schemes for nature and biodiversity conservation, major bird and marine mammal migratory routes as well as other areas identified on the basis of sensitivity maps and the tools referred to in the point (iii), except for artificial and built surfaces located in those areas such as rooftops, parking areas or transport infrastructure;

(iii) using all appropriate and proportionate tools and datasets to identify the areas where the renewable energy plants would not have a significant environmental impact, including wildlife sensitivity mapping, while taking into account the data available in the context of the development of a coherent Natura 2000 network, both as regards habitat types and species under Council Directive 92/43/EEC ([1]), as well as birds and sites protected under Directive 2009/147/EC of the European Parliament and of the Council ([2]);

(b) establish appropriate rules for the renewables acceleration areas on effective mitigation measures to be adopted for the installation of renewable energy plants and co-located energy storage, as well as assets necessary for the connection of such plants and storage to the grid, in order to avoid the adverse environmental impact that may arise or, where that is not possible, to significantly reduce it, where appropriate ensuring that appropriate mitigation measures are applied in a proportionate and timely manner to ensure compliance with the obligations laid down in Article 6(2) and Article 12(1) of Directive 92/43/EEC, Article 5 of Directive 2009/147/EEC and Article 4(1), point (a)(i), of Directive 2000/60/EC of the European Parliament and of the Council ([3]) and to avoid deterioration and achieve good ecological status or good ecological potential in accordance with Article 4(1), point (a), of Directive 2000/60/EC.

The rules referred to in point (b) of the first subparagraph shall be targeted to the specificities of each identified renewables acceleration area, to the type or types of renewable energy technology to be deployed in each area and to the identified environmental impact.

([1]) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p. 7).

([2]) Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ L 20, 26.1.2010, p. 7).

([3]) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1).

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Compliance with the rules referred to in the first subparagraph, point (b), of this paragraph and the implementation of the appropriate mitigation measures by the individual projects shall result in the presumption that projects are not in breach of those provisions without prejudice to Article 16a(4) and (5) of this Directive. Where novel mitigation measures to prevent, to the extent possible, the killing or disturbance of species protected under Directives 92/43/EEC and 2009/147/EC, or any other environmental impact, have not been widely tested as regards their effectiveness, Member States may allow their use for one or several pilot projects for a limited time period, provided that the effectiveness of such mitigation measures is closely monitored and appropriate steps are taken immediately if they prove not to be effective.

Competent authorities shall explain in the plans designating renewables acceleration areas referred to in the first subparagraph the assessment made to identify each designated renewables acceleration area on the basis of the criteria set out in point (a) of the first subparagraph and to identify appropriate mitigation measures.

2. Before their adoption, the plans designating renewables acceleration areas shall be subject to an environmental assessment pursuant to Directive 2001/42/EC of the European Parliament and of the Council ([1]), and, if they are likely to have a significant impact on Natura 2000 sites, to the appropriate assessment pursuant to Article 6(3) of Directive 92/43/EEC.

3. Member States shall decide the size of renewables acceleration areas, in view of the specificities and requirements of the type or types of technology for which they set up renewables acceleration areas. While retaining the discretion to decide on the size of those areas, Member States shall aim to ensure that the combined size of those areas is significant and that they contribute to the achievement of the objectives set out in this Directive. The plans designating renewables acceleration areas referred to in paragraph 1, first subparagraph, of this Article shall be made publicly available and shall be reviewed periodically, as appropriate, in particular in the context of the updating of the integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999.

4. By 21 May 2024, Member States may declare as renewables acceleration areas specific areas which have already been designated to be areas suitable for an accelerated deployment of one or more types of renewable energy technology, provided that all of the following conditions are met:

(a) such areas are outside Natura 2000 sites, areas designated under national protection schemes for nature and biodiversity conservation and identified bird migratory routes;

([1]) Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (OJ L 197, 21.7.2001, p. 30).

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(b) the plans identifying such areas have been the subject of a strategic environmental assessment pursuant to Directive 2001/42/EC and, where appropriate, of an assessment pursuant to Article 6(3) of Directive 92/43/EEC;

(c) the projects located in such areas implement appropriate and proportionate rules and measures to address the adverse environmental impact that may arise.

5. The competent authorities shall apply the permit-granting procedure and deadlines referred to in Article 16a to individual projects in renewables acceleration areas.

Article 15d

Public participation

1. Member States shall ensure public participation regarding the plans designating renewables acceleration areas referred to in Article 15c(1), first subparagraph, in accordance with Article 6 of Directive 2001/42/EC, including identifying the public affected or likely to be affected.

2. Member States shall promote public acceptance of renewable energy projects by means of direct and indirect participation of local communities in those projects.

Article 15e

Areas for grid and storage infrastructure necessary to integrate renewable energy into the electricity system

1. Member States may adopt one or more plans to designate dedicated infrastructure areas for the development of grid and storage projects that are necessary to integrate renewable energy into the electricity system where such development is not expected to have a significant environmental impact, such an impact can be duly mitigated or, where not possible, compensated for. The aim of such areas shall be to support and complement the renewables acceleration areas. Those plans shall:

(a) for grid projects, avoid Natura 2000 sites and areas designated under national protection schemes for nature and biodiversity conservation, unless there are no proportionate alternatives for their deployment, taking into account the objectives of the site;

(b) for storage projects, exclude Natura 2000 sites and areas designated under national protection schemes;

(c) ensure synergies with the designation of renewables acceleration areas;

(d) be subject to an environmental assessment pursuant to Directive 2001/42/EC and, where applicable, to an assessment pursuant to Article 6(3) of Directive 92/43/EEC; and

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(e) establish appropriate and proportionate rules, including on proportionate mitigation measures to be adopted for the development of grid and storage projects in order to avoid adverse effects on the environment that may arise, or, where it is not possible to avoid such effects, to significantly reduce them.

While preparing such plans, Member States shall consult the relevant infrastructure system operators.

2. By way of derogation from Article 2(1) and Article 4(2) of and Annex I, point 20, and Annex II, point (3)(b), to Directive 2011/92/EU of the European Parliament and of the Council [1], and by way of derogation from Article 6(3) of Directive 92/43/EEC, Member States may, under justified circumstances, including where needed to accelerate the deployment of renewable energy in order to achieve the climate and renewable energy targets, exempt grid and storage projects which are necessary to integrate renewable energy into the electricity system from the environmental impact assessment pursuant to Article 2(1) of Directive 2011/92/EU, from an assessment of their implications for Natura 2000 sites pursuant to Article 6(3) of Directive 92/43/EEC and from the assessment of their implications on species protection pursuant to Article 12(1) of Directive 92/43/EEC and to Article 5 of Directive 2009/147/EC, provided that the grid or storage project is located in a dedicated infrastructure area designated in accordance with paragraph 1 of this Article and that it complies with the rules established, including on proportionate mitigation measures to be adopted, in accordance with paragraph 1, point (e), of this Article. Member States may also grant such exemptions in relation to infrastructure areas designated before 20 November 2023 if they were subject to an environmental assessment pursuant to Directive 2001/42/EC. Such derogations shall not apply to projects that are likely to have significant effects on the environment in another Member State or where a Member State likely to be significantly affected so requests, as provided for in Article 7 of Directive 2011/92/EU.

3. Where a Member State exempts grid and storage projects pursuant to paragraph 2 of this Article from the assessments referred to in that paragraph, the competent authorities of that Member State shall carry out a screening process of projects that are located in dedicated infrastructure areas. Such a screening process shall be based on existing data from the environmental assessment pursuant to Directive 2001/42/EC. The competent authorities may request the applicant to provide additional available information. The screening process shall be finalised within 30 days. It shall aim to identify if any of such projects is highly likely to give rise to significant unforeseen adverse effects, in view of the environmental sensitivity of the geographical areas where they are located, that were not identified during the environmental assessment of the plans designating dedicated infrastructure areas carried out pursuant to Directive 2001/42/EC and, where relevant, to Directive 92/43/EEC.

[1] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ L 26, 28.1.2012, p. 1).

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4. Where the screening process identifies a project to be highly likely to give rise to significant unforeseen adverse effects as referred to in paragraph 3, the competent authority shall ensure, on the basis of existing data, that appropriate and proportionate mitigation measures are applied to address those effects. Where it is not possible to apply such mitigation measures, the competent authority shall ensure that the operator adopts appropriate compensatory measures to address those effects, which, if other proportionate compensatory measures are not available, may take the form of a monetary compensation for species protection programmes, in order to ensure or improve the conservation status of the species affected.

5. Where the integration of renewable energy into the electricity system requires a project to reinforce the grid infrastructure in or outside dedicated infrastructure areas, and such a project is subject to a screening process carried out pursuant to paragraph 3 of this Article, to a determination whether the project requires an environmental impact assessment or to an environmental impact assessment pursuant to Article 4 of Directive 2011/92/EU, such a screening process, determination or environmental impact assessment shall be limited to the potential impact arising from the change or extension compared to the original grid infrastructure.

Article 16

Organisation and main principles of the permit-granting procedure

1. The permit-granting procedure shall cover all relevant administrative permits to build, repower and operate renewable energy plants, including those combining different renewable energy sources, heat pumps, and co-located energy storage, including power and thermal facilities, as well as assets necessary for the connection of such plants, heat pumps and storage to the grid, and to integrate renewable energy into heating and cooling networks, including grid-connection permits and, where required, environmental assessments. The permit-granting procedure shall comprise all administrative stages from the acknowledgment of the completeness of the permit application in accordance with paragraph 2 to the notification of the final decision on the outcome of the permit-granting procedure by the relevant competent authority or authorities.

2. Within 30 days, for renewable energy plants located in renewables acceleration areas, and within 45 days, for renewable energy plants located outside renewables acceleration areas, of receipt of an application for a permit, the competent authority shall acknowledge the completeness of the application or, if the applicant has not sent all the information required to process the application, request that the applicant submit a complete application without undue delay. The date of acknowledgement of the completeness of the application by the competent authority shall serve as the start of the permit-granting procedure.

3. Member States shall set up or designate one or more contact points. Those contact points shall, upon the request of the applicant, guide and facilitate the applicant during the entire administrative permit-application and permit-granting procedure. The applicant shall not be required to contact more than one contact point during the entire procedure. The contact point shall guide the applicant through the administrative permit-application procedure, including the steps relating to the protection of the environment, in a transparent manner

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up to the delivery of one or more decisions by the competent authorities at the end of the permit-granting procedure, provide the applicant with all necessary information and, where appropriate, involve, other administrative authorities. The contact point shall ensure that the deadlines for the permit-granting procedures set out in this Directive are met. Applicants shall be allowed to submit relevant documents in digital form. By 21 November 2025 Member States shall ensure that all permit-granting procedures are carried out in electronic form.

4. The contact point shall make available a manual of procedures for developers of renewable energy plants and shall provide that information online, addressing distinctly also small-scale renewable energy projects, renewables self-consumers projects and renewable energy communities. The online information shall indicate the contact point relevant to the application in question. If a Member State has more than one contact point, the online information shall indicate the contact point relevant to the application in question.

5. Member States shall ensure that applicants and the general public have easy access to simple procedures for the settlement of disputes concerning the permit-granting procedure and the issuance of permits to build and operate renewable energy plants, including, where applicable, alternative dispute resolution mechanisms.

6. Member States shall ensure that administrative and judicial appeals in the context of a project for the development of a renewable energy plant, the connection of that plant to the grid, and the assets necessary for the development of the energy infrastructure networks required to integrate energy from renewable sources into the energy system, including appeals related to environmental aspects, are subject to the most expeditious administrative and judicial procedure that is available at the relevant national, regional and local level.

7. Member States shall provide adequate resources to ensure qualified staff, upskilling and reskilling of their competent authorities in line with the planned installed renewable energy generation capacity provided for in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. Member States shall assist regional and local authorities in order to facilitate the permit-granting procedure.

8. Except when it coincides with other administrative stages of the permit-granting procedure, the duration of the permit-granting procedure shall not include:

(a) the time during which the renewable energy plants, their grid connections and, with a view to ensuring grid stability, grid reliability and grid safety, the related necessary grid infrastructure, are being built or repowered;

(b) the time for the administrative stages necessary for significant upgrades of the grid required to ensuring grid stability, grid reliability and grid safety;

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(c) the time for any judicial appeals and remedies, other proceedings before a court or tribunal, and alternative dispute resolution mechanisms, including complaint procedures and non-judicial appeals and remedies.

9. Decisions resulting from the permit-granting procedures shall be made publicly available in accordance with the applicable law.

Article 16a

Permit-granting procedure in renewables acceleration areas

1. Member States shall ensure that the permit-granting procedure referred to in Article 16(1) shall not exceed 12 months for renewable energy projects in renewables acceleration areas. However, in the case of offshore renewable energy projects, the permit-granting procedure shall not exceed two years. Where duly justified on the ground of extraordinary circumstances, Member States may extend either of those periods by up to six months. Member States shall inform the project developer clearly of the extraordinary circumstances that justify such an extension.

2. The permit-granting procedure for the repowering of renewable energy power plants, for new installations with an electrical capacity of less than 150 kW, for co-located energy storage, including power and thermal facilities, as well as for their grid connection, where located in renewables acceleration areas, shall not exceed six months. However, in the case of offshore wind energy projects, the permit-granting procedure shall not exceed 12 months. Where duly justified on the ground of extraordinary circumstances, such as on grounds of overriding safety reasons where the repowering project has a substantial impact on the grid or on the original capacity, size or performance of the installation, Member States may extend the six-month period by up to three months and the 12-month period for offshore wind energy projects by up to six months. Member States shall inform the project developer clearly about the extraordinary circumstances that justify such an extension.

3. Without prejudice to paragraphs 4 and 5 of this Article, by way of derogation from Article 4(2) of and Annex II, points 3(a), (b), (d), (h), (i), and 6(c), alone or in conjunction with point 13(a), to Directive 2011/92/EU, with regard to renewable energy projects, new applications for renewable energy plants, including plants combining different types of renewable energy technology and the repowering of renewable energy power plants in designated renewables acceleration areas for the relevant technology and co-located energy storage, as well as the connection of such plants and storage to the grid, shall be exempt from the requirement to carry out a dedicated environmental impact assessment pursuant to Article 2(1) of Directive 2011/92/EU, provided that those projects comply with Article 15c(1), point (b), of this Directive. That derogation shall not apply to projects which are likely to have significant effects on the environment in another Member State or where a Member State that is likely to be significantly affected so requests, pursuant to Article 7 of Directive 2011/92/EU.

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By way of derogation from Article 6(3) of Directive 92/43/EEC, the renewable energy plants referred to in the first subparagraph of this paragraph, shall not be subject to an assessment of their implications for Natura 2000 sites provided that those renewable energy projects comply with the rules and measures established in accordance with Article 15c(1), point (b), of this Directive.

4. The competent authorities shall carry out a screening process of the applications referred to in paragraph 3 of this Article. Such a screening process shall aim to identify if any of the renewable energy projects is highly likely to give rise to significant unforeseen adverse effects in view of the environmental sensitivity of the geographical areas where they are located, which were not identified during the environmental assessment of the plans designating renewables acceleration areas referred to in Article 15c(1), first subparagraph, of this Directive carried out pursuant to Directive 2001/42/EC and, where relevant, to Directive 92/43/EEC. Such a screening process shall also aim to identify if any of such renewable energy projects falls within the scope of Article 7 of Directive 2011/92/EU due to its likelihood of significant effects on the environment in another Member State or due to the request of a Member State which is likely to be significantly affected.

For the purpose of such a screening process, the project developer shall provide information on the characteristics of the renewable energy project, on its compliance with the rules and measures identified pursuant to Article 15c(1), point (b), for the specific renewables acceleration area, on any additional measures adopted by the project developer, and on how those measures address environmental impact. The competent authority may request the project developer to provide additional available information. The screening process relating to applications for new renewable energy plants shall be finalised within 45 days from the date of submission of sufficient information necessary for that purpose. However, in the case of applications for installations with an electrical capacity of less than 150 kW and new applications for the repowering of renewable energy power plants, the screening process shall be finalised within 30 days.

5. Following the screening process, the applications referred to in paragraph 3 of this Article shall be authorised from an environmental perspective without requiring any express decision from the competent authority, unless the competent authority adopts an administrative decision, setting out due reasons on the basis of clear evidence, to the effect that a specific project is highly likely to give rise to significant unforeseen adverse effects in view of the environmental sensitivity of the geographical area where the project is located that cannot be mitigated by the measures identified in the plans designating acceleration areas or proposed by the project developer. Such decisions shall be made publicly available. Such renewable energy projects shall be subject to an environmental impact assessment pursuant to Directive 2011/92/EU and, if applicable, to an assessment pursuant to Directive 92/43/EEC, which shall be carried out within six months of the administrative decision identifying a high likelihood of significant unforeseen adverse effects. Where duly justified on the grounds of extraordinary circumstances, that six-month period may be extended by up to six months.

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In the event of justified circumstances, including where needed to accelerate the deployment of renewable energy to achieve the climate and renewable energy targets, Member States may exempt wind and solar photovoltaic projects from such assessments.

Where Member States exempt wind and solar photovoltaics projects from those assessments, the operator shall adopt proportionate mitigation measures or, where such mitigation measures are not available, compensatory measures, which, if other proportionate compensatory measures are not available, may take the form of monetary compensation, in order to address any adverse effects. Where those adverse effects have an impact on species protection, the operator shall pay a monetary compensation for species protection programmes for the duration of the operation of the renewable energy plant in order to ensure or improve the conservation status of the species affected.

6. In the permit-granting procedure referred to in paragraphs 1 and 2, Member States shall ensure that the lack of reply by the relevant competent authorities within the established deadline results in the specific intermediary administrative steps to be considered as approved, except where the specific renewable energy project is subject to an environmental impact assessment pursuant to paragraph 5 or where the principle of administrative tacit approval does not exist in the national legal system of the Member State concerned. This paragraph shall not apply to final decisions on the outcome of the permit-granting procedure, which shall be explicit. All decisions shall be made publicly available.

Article 16b

Permit-granting procedure outside renewables acceleration areas

1. Member States shall ensure that the permit-granting procedure referred to in Article 16(1) shall not exceed two years for renewable energy projects located outside renewables acceleration areas. However, in the case of offshore renewable energy projects, the permit-granting procedure shall not exceed three years. Where duly justified on the grounds of extraordinary circumstances, including where they require extended periods needed for assessments under applicable Union environmental law, Member States may extend either of those periods by up to six months. Member States shall inform the project developer clearly of the extraordinary circumstances that justify such an extension.

2. Where an environmental assessment is required pursuant to Directive 2011/92/EU or 92/43/EEC, it shall be carried out in a single procedure that combines all relevant assessments for a given renewable energy project. When any such environmental impact assessment is required, the competent authority, taking into account the information provided by the project developer, shall issue an opinion on the scope and level of detail of the information to be included by the project developer in the environmental impact assessment report, of which the scope shall not be extended subsequently. Where a renewable energy project has adopted necessary mitigation measures, any killing or disturbance of the species protected under Article 12(1) of Directive 92/43/EEC and Article 5 of Directive 2009/147/EC shall not be considered to be

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deliberate. Where novel mitigation measures to prevent as much as possible the killing or disturbance of species protected under Directives 92/43/EEC and 2009/147/EC, or any other environmental impact, have not been widely tested as regards their effectiveness, Member States may allow their use for one or several pilot projects for a limited time period, provided that the effectiveness of such mitigation measures is closely monitored and appropriate steps are taken immediately if they do not prove to be effective.

The permit-granting procedure for the repowering of renewable energy power plants, for new installations with an electrical capacity of less than 150 kW and for co-located energy storage, as well as for the connection of such plants, installations and storage to the grid, located outside renewables acceleration areas shall not exceed 12 months, including with regard to environmental assessments where required by the relevant law. However, in the case of offshore renewable energy projects, the permit-granting procedure shall not exceed two years. Where duly justified on the ground of extraordinary circumstances, Member States may extend either of those periods by up to three months. Member States shall inform the project developer clearly of the extraordinary circumstances that justify such an extension.

Article 16c

Accelerating the permit-granting procedure for repowering

1. Where repowering of a renewable energy power plant does not result in an increase of the capacity of a renewable energy power plant beyond 15 %, and without prejudice to any assessment of potential environmental impact required pursuant to paragraph 2, Member States shall ensure that permit granting procedures for connections to the transmission or distribution grid shall not exceed three months following application to the relevant entity unless there are justified safety concerns or there is technical incompatibility of the system components.

2. Where the repowering of a renewable energy power plant is subject to the screening process provided for in Article 16a(4), to a determination whether the project requires an environmental impact assessment or to an environmental impact assessment pursuant to Article 4 of Directive 2011/92/EU, such a screening process, determination or environmental impact assessment shall be limited to the potential impact arising from a change or extension compared to the original project.

3. Where the repowering of solar installations does not entail the use of additional space and complies with the applicable environmental mitigation measures established for the original solar installation, the project shall be exempt from any applicable requirements to carry out a screening process as provided for in Article 16a(4), to determine whether the project requires an environmental impact assessment, or to carry out an environmental impact assessment pursuant to Article 4 of Directive 2011/92/EU.

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Article 16d

Permit-granting procedure for the installation of solar energy equipment

1. Member States shall ensure that the permit-granting procedure referred to in Article 16(1) for the installation of solar energy equipment and co-located energy storage, including building-integrated solar installations, in existing or future artificial structures, with the exclusion of artificial water surfaces, shall not exceed three months, provided that the primary aim of such artificial structures is not solar energy production or energy storage. By way of derogation from Article 4(2) of and Annex II, points 3(a) and (b), alone or in conjunction with point 13(a), to Directive 2011/92/EU, such installation of solar equipment shall be exempt from the requirement, if applicable, to carry out a dedicated environmental impact assessment pursuant to Article 2(1) of that Directive.

Member States may exclude certain areas or structures from the application of the first subparagraph for the purpose of protecting cultural or historical heritage, national defence interests, or safety reasons.

2. Member States shall ensure that the permit-granting procedure for the installation of solar energy equipment with a capacity of 100 kW or less, including for renewables self-consumers and renewable energy communities, shall not exceed one month. The lack of reply by the competent authorities or entities within the established deadline following the submission of a complete application shall result in the permit being considered as granted, provided that the capacity of the solar energy equipment does not exceed the existing capacity of the connection to the distribution grid.

Where the application of the capacity threshold referred to in the first subparagraph leads to a significant administrative burden or to constraints to the operation of the electricity grid, Member States may apply a lower capacity threshold provided that it remains above 10,8 kW.

Article 16e

Permit-granting procedure for the installation of heat pumps

1. Member States shall ensure that the permit-granting procedure for the installation of heat pumps below 50 MW shall not exceed one month. However, in the case of ground source heat pumps, the permit-granting procedure shall not exceed three months.

2. Unless there are justified safety concerns, unless further works are needed for grid connections or unless there is technical incompatibility of the system components, Member States shall ensure that connections to the transmission or distribution grid shall be permitted within two weeks of the notification to the relevant entity for:

(a) heat pumps of up to 12 kW electrical capacity; and

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(b) heat pumps of up to 50 kW electrical capacity installed by renewables self-consumers, provided that the electrical capacity of a renewables self-consumer's renewable electricity generation installation amounts to at least 60 % of the electrical capacity of the heat pump.

3. Member States may exclude certain areas or structures from the application of paragraphs 1 and 2 for the purpose of protecting cultural or historical heritage, national defence interests, or safety reasons.

4. All decisions resulting from the permit-granting procedure referred to in paragraphs 1 and 2 shall be made publicly available in accordance with the applicable law.

Article 16f

Overriding public interest

By 21 February 2024, until climate neutrality is achieved, Member States shall ensure that, in the permit-granting procedure, the planning, construction and operation of renewable energy plants, the connection of such plants to the grid, the related grid itself, and storage assets are presumed as being in the overriding public interest and serving public health and safety when balancing legal interests in individual cases for the purposes of Article 6(4) and Article 16(1), point (c), of Directive 92/43/EEC, Article 4(7) of Directive 2000/60/EC and Article 9(1), point (a), of Directive 2009/147/EC. Member States may, in duly justified and specific circumstances, restrict the application of this Article to certain parts of their territory, to certain types of technology or to projects with certain technical characteristics in accordance with the priorities set out in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. Member States shall inform the Commission of such restrictions, together with the reasons therefor.

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Article 17

Simple-notification procedure for grid connections

1. Member States shall establish a simple-notification procedure for grid connections whereby installations or aggregated production units of renewables self-consumers and demonstration projects, with an electrical capacity of 10,8 kW or less, or equivalent for connections other than three-phase connections, are to be connected to the grid following a notification to the distribution system operator.

The distribution system operator may, within a limited period following the notification, reject the requested grid connection or propose an alternative grid connection point on justified grounds of safety concerns or technical incompatibility of the system components. In the case of a positive decision by the distribution system operator, or in the absence of a decision by the distribution system operator within one month following the notification, the installation or aggregated production unit may be connected.

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2. Member States may allow a simple-notification procedure for installations or aggregated production units with an electrical capacity of above 10,8 kW and up to 50 kW, provided that grid stability, grid reliability and grid safety are maintained.

Article 18

Information and training

1. Member States shall ensure that information on support measures is made available to all relevant actors, such as consumers including low-income, vulnerable consumers, renewables self-consumers, renewable energy communities, builders, installers, architects, suppliers of heating, cooling and electricity equipment and systems, and suppliers of vehicles compatible with the use of renewable energy and of intelligent transport systems.

2. Member States shall ensure that information on the net benefits, cost and energy efficiency of equipment and systems for the use of heating, cooling and electricity from renewable sources is made available either by the supplier of the equipment or system or by the competent authorities.

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3. Member States shall ensure that their certification schemes or equivalent qualification schemes are available for installers and designers of all forms of renewable heating and cooling systems in buildings, industry and agriculture, for installers of solar photovoltaic systems, including energy storage, and for installers of recharging points enabling demand response. Those schemes may take into account existing schemes and structures as appropriate and shall be based on the criteria laid down in Annex IV. Each Member State shall recognise the certification awarded by other Member States in accordance with those criteria.

Member States shall set up a framework to ensure a sufficient number of trained and qualified installers of the technology referred to in the first subparagraph to service the growth of renewable energy required to achieve the targets set out in this Directive.

To achieve such a sufficient number of installers and designers, Member States shall ensure that sufficient training programmes leading to certification or qualification covering renewable heating and cooling technology, solar photovoltaic systems, including energy storage, recharging points enabling demand response, and the latest innovative solutions thereof, are made available provided that they are compatible with their certification schemes or equivalent qualification schemes. Member States shall put in place measures to promote participation in such training programmes, in particular by small and medium-sized enterprises and the self-employed. Member States may put in place voluntary agreements with the relevant technology providers and vendors to train sufficient numbers of installers, which may be based on estimates of sales, in the latest innovative solutions and technology available on the market.

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If Member States identify a substantial gap between available and necessary number of trained and qualified installers, they shall take measures to address that gap.

4. Member States shall make information on certification schemes or equivalent qualification schemes referred to in paragraph 3 available to the public. Member States shall also make available to the public, in a transparent and easily accessible manner, a regularly updated list of installers who are certified or qualified in accordance with paragraph 3.

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5. Member States shall ensure that guidance is made available to all relevant actors, in particular to planners and architects so that they are able properly to consider the optimal combination of energy from renewable sources, of high-efficiency technologies, and of district heating and cooling when planning, designing, building and renovating industrial, commercial or residential areas.

6. Member States, where appropriate with the participation of local and regional authorities, shall develop suitable information, awareness-raising, guidance or training programmes in order to inform citizens of how to exercise their rights as active customers, and of the benefits and practicalities, including technical and financial aspects, of developing and using energy from renewable sources, including by renewables self-consumption or in the framework of renewable energy communities.

Article 19

Guarantees of origin for energy from renewable sources

1. For the purposes of demonstrating to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix and in the energy supplied to consumers under contracts marketed with reference to the consumption of energy from renewable sources, Member States shall ensure that the origin of energy from renewable sources can be guaranteed as such within the meaning of this Directive, in accordance with objective, transparent and non-discriminatory criteria.

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2. To that end, Member States shall ensure that a guarantee of origin is issued in response to a request from a producer of energy from renewable sources, including gaseous renewable fuels of non-biological origin such as hydrogen, unless Member States decide, for the purposes of accounting for the market value of the guarantee of origin, not to issue such a guarantee of origin to a producer that receives financial support from a support scheme. Member States may arrange for guarantees of origin to be issued for energy from non-renewable sources. Issuance of guarantees of origin may be made subject to a minimum capacity limit. A guarantee of origin shall be of the standard size of 1 MWh. Where appropriate, such standard size may be divided to a fraction size, provided that the fraction is a multiple of 1 Wh. No more than one guarantee of origin shall be issued in respect of each unit of energy produced.

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Member States shall ensure that the same unit of energy from renewable sources is taken into account only once.

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Simplified registration processes and reduced registration fees shall be introduced for small installations of less than 50 kW and for renewable energy communities.

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Member States shall ensure that when a producer receives financial support from a support scheme, the market value of the guarantee of origin for the same production is taken into account appropriately in the relevant support scheme.

It shall be presumed that the market value of the guarantee of origin has been taken into account appropriately in any of the following cases:

(a) where the financial support is granted by way of a tendering procedure or a tradable green certificate system;

(b) where the market value of the guarantees of origin is administratively taken into account in the level of financial support; or

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(c) where the guarantees of origin are not issued directly to the producer but to a supplier or consumer who buys the energy either in a competitive setting or in a long-term renewables power purchase agreement.

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In order to take into account the market value of the guarantee of origin, Member States may, *inter alia*, decide to issue a guarantee of origin to the producer and immediately cancel it.

The guarantee of origin shall have no function in terms of a Member State's compliance with Article 3. Transfers of guarantees of origin, separately or together with the physical transfer of energy, shall have no effect on the decision of Member States to use statistical transfers, joint projects or joint support schemes for compliance with Article 3 or on the calculation of the gross final consumption of energy from renewable sources in accordance with Article 7.

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3. For the purposes of paragraph 1, guarantees of origin shall be valid for transactions for 12 months after the production of the relevant energy unit. Member States shall ensure that all guarantees of origin that have not been cancelled expire at the latest 18 months after the production of the energy unit. Member States shall include expired guarantees of origin in the calculation of their residual energy mix.

4. For the purposes of disclosure referred to in paragraphs 8 and 13, Member States shall ensure that energy undertakings cancel guarantees of origin at the latest six months after the end of the validity of the guarantee of origin. Furthermore, by 21 May 2025, Member States shall ensure that the data on their residual energy mix are published on an annual basis.

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5. Member States or designated competent bodies shall supervise the issuance, transfer and cancellation of guarantees of origin. The designated competent bodies shall not have overlapping geographical responsibilities, and shall be independent of production, trade and supply activities.

6. Member States or the designated competent bodies shall put in place appropriate mechanisms to ensure that guarantees of origin are issued, transferred and cancelled electronically and are accurate, reliable and fraud-resistant. Member States and designated competent bodies shall ensure that the requirements they impose comply with the standard CEN - EN 16325.

7. A guarantee of origin shall specify at least:

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(a) the energy source from which the energy was produced and the start and end dates of production, which may be specified:

(i) in the case of renewable gas, including gaseous renewable fuels of non-biological origin, and renewable heating and cooling, at an hourly or sub-hourly interval;

(ii) for renewable electricity, in accordance with the imbalance settlement period as defined in Article 2, point (15), of Regulation (EU) 2019/943;

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(b) whether it relates to:

(i) electricity;

(ii) gas, including hydrogen; or

(iii) heating or cooling;

(c) the identity, location, type and capacity of the installation where the energy was produced;

(d) whether the installation has benefited from investment support and whether the unit of energy has benefited in any other way from a national support scheme, and the type of support scheme;

(e) the date on which the installation became operational; and

(f) the date and country of issue and a unique identification number.

Simplified information may be specified on guarantees of origin from installations of less than 50 kW.

8. Where an electricity supplier is required to demonstrate the share or quantity of energy from renewable sources in its energy mix for the purposes of point (a) of Article 3(9) of Directive 2009/72/EC, it shall do so by using guarantees of origin except:

(a) as regards the share of its energy mix corresponding to non-tracked commercial offers, if any, for which the supplier may use the residual mix; or

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(b) where a Member State decides not to issue guarantees of origin to a producer that receives financial support from a support scheme.

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Where gas is supplied from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, the supplier is required to demonstrate to final consumers the share or quantity of energy from renewable sources in its energy mix for the purposes of Annex I to Directive 2009/73/EC. The supplier shall do so by using guarantees of origin except:

(a) as regards the share of its energy mix corresponding to non-tracked commercial offers, if any, for which the supplier may use the residual energy mix;

(b) where a Member State decides not to issue guarantees of origin to a producer that receives financial support from a support scheme.

When a customer consumes gas from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, as demonstrated in the commercial offer by the supplier, Member States shall ensure that the guarantees of origin that are cancelled correspond to the relevant network characteristics.

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Where Member States have arranged to have guarantees of origin for other types of energy, suppliers shall use for disclosure the same type of guarantees of origin as the energy supplied. Likewise, guarantees of origin created pursuant to Article 14(10) of Directive 2012/27/EU may be used to substantiate any requirement to demonstrate the quantity of electricity produced from high-efficiency cogeneration. For the purposes of paragraph 2 of this Article, where electricity is generated from high-efficiency cogeneration using renewable sources, only one guarantee of origin specifying both characteristics may be issued.

9. Member States shall recognise guarantees of origin issued by other Member States in accordance with this Directive exclusively as evidence of the elements referred to in paragraph 1 and points (a) to (f) of the first subparagraph of paragraph 7. A Member State may refuse to recognise a guarantee of origin only where it has well-founded doubts about its accuracy, reliability or veracity. The Member State shall notify the Commission of such a refusal and its justification.

10. If the Commission finds that a refusal to recognise a guarantee of origin is unfounded, the Commission may adopt a decision requiring the Member State in question to recognise it.

11. Member States shall not recognise guarantees of origins issued by a third country except where the Union has concluded an agreement with that third country on mutual recognition of guarantees of origin issued in the Union and compatible guarantees of origin systems established in that third country, and only where there is direct import or export of energy.

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12. A Member State may, in accordance with Union law, introduce objective, transparent and non-discriminatory criteria for the use of guarantees of origin in accordance with the obligations laid down in Article 3(9) of Directive 2009/72/EC.

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13. By 31 December 2025, the Commission shall adopt a report assessing options to establish a Union-wide green label with a view to promoting the use of renewable energy generated by new installations. Suppliers shall use the information contained in guarantees of origin to demonstrate compliance with the requirements of such a label.

13a. The Commission shall monitor the functioning of the guarantees of origin system and assess by 30 June 2025 the balance of supply and demand of guarantees of origin in the market and, in the case of imbalances, shall identify relevant factors affecting supply and demand.

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Article 20

Access to and operation of the grids

1. Where relevant, Member States shall assess the need to extend existing gas network infrastructure to facilitate the integration of gas from renewable sources.

2. Where relevant, Member States shall require transmission system operators and distribution system operators in their territory to publish technical rules in accordance with Article 8 of Directive 2009/73/EC, in particular regarding network connection rules that include gas quality, gas odoration and gas pressure requirements. Member States shall also require transmission and distribution system operators to publish the connection tariffs to connect gas from renewable sources based on objective, transparent and non-discriminatory criteria.

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3. Subject to the assessment included in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and in accordance with Annex I to that Regulation on the necessity to build new infrastructure for district heating and cooling from renewable sources in order to achieve the overall Union target set in Article 3(1) of this Directive, Member States shall, where relevant, take the necessary steps with a view to developing efficient district heating and cooling infrastructure to promote heating and cooling from renewable sources, such as solar thermal energy, solar photovoltaic energy, renewable electricity driven heat pumps using ambient energy and geothermal energy, other geothermal energy technology, biomass, biogas, bioliquids and waste heat and cold, where possible in combination with thermal energy storage, demand-response systems and power to heat installations.

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Article 20a

Facilitating system integration of renewable electricity

1. Member States shall require transmission system operators and, if the data are available to them, distribution system operators in their territory to make available data on the share of renewable electricity and the greenhouse gas emissions content of the electricity supplied in each bidding zone, as accurately as possible in intervals equal to the market settlement frequency but of no more than one hour, with forecasting where available. Member States shall ensure that distribution system operators have access to the necessary data. If distribution system operators do not have access, pursuant to national law, to all the data needed, they shall apply the existing data reporting system under the European Network of Transmission System Operators for Electricity, in accordance with the provisions of Directive (EU) 2019/944. Member States shall provide incentives for upgrades of smart grids to better monitor grid balance and make available real time data.

If technically available, distribution system operators shall also make available anonymised and aggregated data on the demand response potential and the renewable electricity generated and injected to the grid by self-consumers and renewable energy communities.

2. The data referred to in paragraph 1 shall be made available digitally in a manner that ensures interoperability on the basis of harmonised data formats and standardised data sets so that it can be used in a non-discriminatory manner by electricity market participants, aggregators, consumers and end-users, and that it can be read by electronic communication devices such as smart metering systems, electric vehicle recharging points, heating and cooling systems and building energy management systems.

3. In addition to the requirements laid down in Regulation (EU) 2023/1542, Member States shall ensure that manufacturers of domestic and industrial batteries enable real-time access to basic battery management system information, including battery capacity, state of health, state of charge and power set point, to battery owners and users, as well as to third parties acting, with explicit consent, on the owners' and users' behalf, such as building energy management undertakings and electricity market participants, under non-discriminatory terms, at no cost and in accordance with the data protection rules.

Member States shall adopt measures to require that vehicle manufacturers make available, in real-time, in-vehicle data related to the battery state of health, battery state of charge, battery power set point, battery capacity, and, where appropriate, the location of electric vehicles, to electric vehicle owners and users, as well as to third parties acting on the owners' and users' behalf, such as electricity market participants and electromobility service providers, under non-discriminatory terms and at no cost, in accordance with the data protection rules, and in addition to further requirements with regard to type approval and market surveillance laid down in Regulation (EU) 2018/858 of the European Parliament and of the Council ([1]).

([1]) Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC (OJ L 151, 14.6.2018, p. 1).

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4. In addition to the requirements laid down in Regulation (EU) 2023/1804, Member States or their designated competent authorities shall ensure that new and replaced non–publicly accessible normal power recharging points installed in their territory can support smart recharging functionalities and, where appropriate, the interface with smart metering systems, when deployed by Member States, and bi-directional recharging functionalities in accordance with the requirements of Article 15(3) and (4) of that Regulation.

5. In addition to the requirements laid down in Regulation (EU) 2019/943 and Directive (EU) 2019/944, Member States shall ensure that the national regulatory framework allows small or mobile systems such as domestic batteries and electric vehicles and other small, decentralised energy sources to participate in the electricity markets, including congestion management and the provision of flexibility and balancing services, including through aggregation. To that end, Member States shall, in close cooperation with all market participants and regulatory authorities, establish technical requirements for participation in the electricity markets, on the basis of the technical characteristics of those systems.

Member States shall provide a level playing field and non-discriminatory participation in the electricity markets for small, decentralised energy assets or mobile systems.

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Article 21

Renewables self-consumers

1. Member States shall ensure that consumers are entitled to become renewables self-consumers, subject to this Article.

2. Member States shall ensure that renewables self-consumers, individually or through aggregators, are entitled:

(a) to generate renewable energy, including for their own consumption, store and sell their excess production of renewable electricity, including through renewables power purchase agreements, electricity suppliers and peer-to-peer trading arrangements, without being subject:

(i) in relation to the electricity that they consume from or feed into the grid, to discriminatory or disproportionate procedures and charges, and to network charges that are not cost-reflective;

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(ii) in relation to their self-generated electricity from renewable sources remaining within their premises, to discriminatory or disproportionate procedures, and to any charges or fees;

(b) to install and operate electricity storage systems combined with installations generating renewable electricity for self-consumption without liability for any double charge, including network charges, for stored electricity remaining within their premises;

(c) to maintain their rights and obligations as final consumers;

(d) to receive remuneration, including, where applicable, through support schemes, for the self-generated renewable electricity that they feed into the grid, which reflects the market value of that electricity and which may take into account its long-term value to the grid, the environment and society.

3. Member States may apply non-discriminatory and proportionate charges and fees to renewables self-consumers, in relation to their self-generated renewable electricity remaining within their premises in one or more of the following cases:

(a) if the self-generated renewable electricity is effectively supported via support schemes, only to the extent that the economic viability of the project and the incentive effect of such support are not undermined;

(b) from 1 December 2026, if the overall share of self-consumption installations exceeds 8 % of the total installed electricity capacity of a Member State, and if it is demonstrated, by means of a cost-benefit analysis performed by the national regulatory authority of that Member State, which is conducted by way of an open, transparent and participatory process, that the provision laid down in point (a)(ii) of paragraph 2 either results in a significant disproportionate burden on the long-term financial sustainability of the electric system, or creates an incentive exceeding what is objectively needed to achieve cost-effective deployment of renewable energy, and that such burden or incentive cannot be minimised by taking other reasonable actions; or

(c) if the self-generated renewable electricity is produced in installations with a total installed electrical capacity of more than 30 kW.

4. Member States shall ensure that renewables self-consumers located in the same building, including multi-apartment blocks, are entitled to engage jointly in activities referred to in paragraph 2 and that they are permitted to arrange sharing of renewable energy that is produced on their site or sites between themselves, without prejudice to the network charges and other relevant charges, fees, levies and taxes applicable to each renewables self-consumer. Member States may differentiate between individual renewables self-consumers and jointly acting renewables self-consumers. Any such differentiation shall be proportionate and duly justified.

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5. The renewables self-consumer's installation may be owned by a third party or managed by a third party for installation, operation, including metering and maintenance, provided that the third party remains subject to the renewables self-consumer's instructions. The third party itself shall not be considered to be a renewables self-consumer.

6. Member States shall put in place an enabling framework to promote and facilitate the development of renewables self-consumption based on an assessment of the existing unjustified barriers to, and of the potential of, renewables self-consumption in their territories and energy networks. That enabling framework shall, *inter alia*:

(a) address accessibility of renewables self-consumption to all final customers, including those in low-income or vulnerable households;

(b) address unjustified barriers to the financing of projects in the market and measures to facilitate access to finance;

(c) address other unjustified regulatory barriers to renewables self-consumption, including for tenants;

(d) address incentives to building owners to create opportunities for renewables self-consumption, including for tenants;

(e) grant renewables self-consumers, for self-generated renewable electricity that they feed into the grid, non-discriminatory access to relevant existing support schemes as well as to all electricity market segments;

(f) ensure that renewables self-consumers contribute in an adequate and balanced way to the overall cost sharing of the system when electricity is fed into the grid.

Member States shall include a summary of the policies and measures under the enabling framework and an assessment of their implementation respectively in their integrated national energy and climate plans and progress reports pursuant to Regulation (EU) 2018/1999.

7. This Article shall apply without prejudice to Articles 107 and 108 TFEU.

Article 22

Renewable energy communities

1. Member States shall ensure that final customers, in particular household customers, are entitled to participate in a renewable energy community while maintaining their rights or obligations as final customers, and without being subject to unjustified or discriminatory conditions or procedures that would prevent their participation in a renewable energy community, provided that for private undertakings, their participation does not constitute their primary commercial or professional activity.

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2. Member States shall ensure that renewable energy communities are entitled to:

(a) produce, consume, store and sell renewable energy, including through renewables power purchase agreements;

(b) share, within the renewable energy community, renewable energy that is produced by the production units owned by that renewable energy community, subject to the other requirements laid down in this Article and to maintaining the rights and obligations of the renewable energy community members as customers;

(c) access all suitable energy markets both directly or through aggregation in a non-discriminatory manner.

3. Member States shall carry out an assessment of the existing barriers and potential of development of renewable energy communities in their territories.

4. Member States shall provide an enabling framework to promote and facilitate the development of renewable energy communities. That framework shall ensure, *inter alia*, that:

(a) unjustified regulatory and administrative barriers to renewable energy communities are removed;

(b) renewable energy communities that supply energy or provide aggregation or other commercial energy services are subject to the provisions relevant for such activities;

(c) the relevant distribution system operator cooperates with renewable energy communities to facilitate energy transfers within renewable energy communities;

(d) renewable energy communities are subject to fair, proportionate and transparent procedures, including registration and licensing procedures, and cost-reflective network charges, as well as relevant charges, levies and taxes, ensuring that they contribute, in an adequate, fair and balanced way, to the overall cost sharing of the system in line with a transparent cost-benefit analysis of distributed energy sources developed by the national competent authorities;

(e) renewable energy communities are not subject to discriminatory treatment with regard to their activities, rights and obligations as final customers, producers, suppliers, distribution system operators, or as other market participants;

(f) the participation in the renewable energy communities is accessible to all consumers, including those in low-income or vulnerable households;

(g) tools to facilitate access to finance and information are available;

(h) regulatory and capacity-building support is provided to public authorities in enabling and setting up renewable energy communities, and in helping authorities to participate directly;

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(i) rules to secure the equal and non-discriminatory treatment of consumers that participate in the renewable energy community are in place.

5. The main elements of the enabling framework referred to in paragraph 4, and of its implementation, shall be part of the updates of the Member States' integrated national energy and climate plans and progress reports pursuant to Regulation (EU) 2018/1999.

6. Member States may provide for renewable energy communities to be open to cross-border participation.

7. Without prejudice to Articles 107 and 108 TFEU, Member States shall take into account specificities of renewable energy communities when designing support schemes in order to allow them to compete for support on an equal footing with other market participants.

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Article 22a

Mainstreaming renewable energy in industry

1. Member States shall endeavour to increase the share of renewable sources in the amount of energy sources used for final energy and non-energy purposes in the industry sector by an indicative increase of at least 1,6 percentage points as an annual average calculated for the periods 2021 to 2025 and 2026 to 2030.

Member States may count waste heat and cold towards the average annual increases referred to in the first subparagraph up to a limit of 0,4 percentage points, provided that the waste heat and cold is supplied from efficient district heating and cooling, excluding networks which supply heat to only one building or where all thermal energy is consumed only on-site and where the thermal energy is not sold. If they decide to do so, the average annual increase referred to in the first subparagraph shall increase by half of the waste heat and cold percentage points counted.

Member States shall include the policies and measures planned and taken to achieve such indicative increase in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation.

When electrification is considered to be a cost-effective option, those policies and measures shall promote the renewable-based electrification of industrial processes. Those policies and measures shall endeavour to create conducive market condition for the availability of economically viable and technically feasible renewable energy alternatives to replace fossil fuels used for industrial heating with the aim of reducing the use of fossil fuels used for heating in which the temperature is below 200 °C. When adopting those policies and measures, Member States shall take into account the energy efficiency first principle, effectiveness and international competitiveness and the need to tackle regulatory, administrative and economic barriers.

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Member States shall ensure that the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes shall be at least 42 % of the hydrogen used for final energy and non-energy purposes in industry by 2030, and 60 % by 2035. For the calculation of that percentage, the following rules shall apply:

(a) for the calculation of the denominator, the energy content of hydrogen for final energy and non-energy purposes shall be taken into account, excluding:

(i) hydrogen used as intermediate products for the production of conventional transport fuels and biofuels;

(ii) hydrogen that is produced by decarbonising industrial residual gas and that is used to replace the specific gas from which it is produced;

(iii) hydrogen produced as a by-product or derived from by-products in industrial installations;

(b) for the calculation of the numerator, the energy content of the renewable fuels of non-biological origin consumed in the industry sector for final energy and non-energy purposes shall be taken into account, excluding renewable fuels of non-biological origin used as intermediate products for the production of conventional transport fuels and biofuels;

(c) for the calculation of the numerator and the denominator, the values regarding the energy content of fuels set out in Annex III shall be used.

For the purposes of point (c) of the fifth subparagraph of this paragraph,, in order to determine the energy content of fuels not included in Annex III, the Member States shall use the relevant European standards for the determination of the calorific values of fuels, or where no European standard has been adopted for that purpose, the relevant ISO standards.

2. Member States shall promote voluntary labelling schemes for industrial products that are claimed to be produced with renewable energy and renewable fuels of non-biological origin. Such voluntary labelling schemes shall indicate the percentage of renewable energy used or renewable fuels of non-biological origin used in the raw material acquisition and pre-processing, manufacturing and distribution stage, calculated on the basis of the methodologies laid down either in Commission Recommendation (EU) 2021/2279 ([1]) or in ISO 14067:2018.

([1]) Commission Recommendation (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (OJ L 471, 30.12.2021, p. 1).

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3. Member States shall report the amount of renewable fuels of non-biological origin that they expect to import and export in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and in their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation. On the basis of that reporting, the Commission shall develop a Union strategy for imported and domestic hydrogen with the aim of promoting the European hydrogen market as well as domestic hydrogen production within the Union, supporting the implementation of this Directive and the achievement of the targets laid down herein, while having due regard to security of supply and the Union's strategic autonomy in energy and level playing field on the global hydrogen market. Member States shall indicate in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and in their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation how they intend to contribute to that strategy.

Article 22b

Conditions for reduction of the target for the use of renewable fuels of non-biological origin in the industry sector

1. A Member State may reduce the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes referred to in Article 22a(1), fifth subparagraph, by 20 % in 2030, provided that:

(a) that Member State is on track towards its national contribution to the binding overall Union target set in Article 3(1), first subparagraph, which is at least equivalent to its expected national contribution in accordance with the formula referred to in Annex II to Regulation (EU) 2018/1999; and

(b) the share of hydrogen, or its derivatives, produced from fossil fuels which is consumed in that Member State is not more than 23 % in 2030 and not more than 20 % in 2035.

Where any of those conditions are not fulfilled, the reduction referred to in the first subparagraph shall cease to apply.

2. Where a Member State applies the reduction referred to in paragraph 1, it shall notify the Commission thereof, together with its integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999 and as part of its integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation. The notification shall include information about the updated share of renewable fuels of non-biological origin and all relevant data to demonstrate that conditions set out in paragraph 1, points (a) and (b), of this Article are fulfilled.

The Commission shall monitor the situation in Member States benefitting from a reduction with a view to verifying the ongoing fulfilment of conditions set out in paragraph 1, points (a) and (b).

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Article 23

Mainstreaming renewable energy in heating and cooling

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1. In order to promote the use of renewable energy in the heating and cooling sector, each Member State shall increase the share of renewable energy in that sector by at least 0,8 percentage points as an annual average calculated for the period 2021 to 2025 and by at least 1,1 percentage points as an annual average calculated for the period 2026 to 2030, starting from the share of renewable energy in the heating and cooling sector in 2020, expressed in terms of national share of gross final consumption of energy and calculated in accordance with the methodology set out in Article 7.

Member States may count waste heat and cold towards the average annual increases referred to in the first subparagraph, up to a limit of 0,4 percentage points. If they decide to do so, the average annual increase shall increase by half of the waste heat and cold percentage points counted to an upper limit of 1,0 percentage points for the period 2021 to 2025 and of 1,3 percentage points for the period 2026 to 2030.

Member States shall inform the Commission of their intention to count waste heat and cold and the estimated amount in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. In addition to the minimum percentage points annual increases referred to in the first subparagraph of this paragraph, each Member State shall endeavour to increase the share of renewable energy in its heating and cooling sector by the additional indicative percentage points set out in Annex Ia to this Directive.

Member States may count renewable electricity used for heating and cooling towards the annual average increase set out in the first subparagraph, up to a limit of 0,4 percentage points, provided that the efficiency of the heat and cold generator unit is higher than 100 %. If they decide to do so, the average annual increase shall increase by half of that renewable electricity expressed in percentage points to an upper limit of 1,0 percentage points for the period 2021 to 2025 and of 1,3 percentage points for the period 2026 to 2030.

Member States shall inform the Commission of their intention to count renewable electricity used in heating and cooling from heat and cold generators the efficiency of which is higher than 100 % towards the annual increase set out in first subparagraph of this paragraph. Member States shall include the estimated renewable electricity capacities of heat and cold generator units the efficiency of which is higher than 100 % in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. Member States shall include the amount of renewable electricity used in heating and cooling from heat and cold generator units the efficiency of which is higher than 100 % in their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation.

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1a. For the calculation of the share of renewable electricity used in heating and cooling for the purposes of paragraph 1, Member States shall use the average share of renewable electricity supplied in their territory in the two previous years.

1b. Member States shall carry out an assessment of their potential of energy from renewable sources and of the use of waste heat and cold in the heating and cooling sector including, where appropriate, an analysis of areas suitable for their deployment at low ecological risk and of the potential for small-scale household projects. That assessment shall consider available and economically feasible technology for industrial and domestic uses in order to set out milestones and measures to increase the use of renewable energy in heating and cooling and, where appropriate, the use of waste heat and cold through district heating and cooling with a view to establishing a long-term national strategy to reduce greenhouse gas emissions and air pollution originating from heating and cooling. That assessment shall be in accordance with the energy efficiency first principle and part of the integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999, and shall accompany the comprehensive heating and cooling assessment required by Article 14(1) of Directive 2012/27/EU.

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2. ►M2 For the purposes of paragraph 1 of this Article, when calculating its share of renewable energy in the heating and cooling sector and its average annual increase in accordance with that paragraph, including the additional indicative increase set out in Annex Ia, each Member State: ◄

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(b) where its share of renewable energy in the heating and cooling sector is above 60 %, may count any such share as fulfilling the average annual increase; and

(c) where its share of renewable energy in the heating and cooling sector is above 50 % and up to 60 %, may count any such share as fulfilling half of the average annual increase.

When deciding which measures to adopt for the purposes of deploying energy from renewable sources in the heating and cooling sector, Member States may take into account cost-effectiveness reflecting structural barriers arising from the high share of natural gas or cooling, or from a dispersed settlement structure with low population density.

Where those measures would result in a lower average annual increase than that referred to in paragraph 1 of this Article, Member States shall make it public, for instance by the means of their integrated national energy and climate progress reports pursuant to Article 20 of Regulation (EU) 2018/1999, and provide the Commission with reasons, including of choice of measures as referred to the second subparagraph of this paragraph.

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Member States shall in particular provide information to the owners or tenants of buildings and SMEs on cost-effective measures, and financial instruments, to improve the use of renewable energy in the heating and cooling systems. Member States shall provide the information through accessible and transparent advisory tools.

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3. On the basis of objective and non-discriminatory criteria, Member States may establish and make public a list of measures and may designate and make public the implementing entities, such as fuel suppliers, public or professional bodies, which are to contribute to the average annual increase referred to in paragraph 1.

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4. To achieve the average annual increase referred to in paragraph 1, first subparagraph, Member States shall endeavour to implement at least two of the following measures:

(a) physical incorporation of renewable energy or waste heat and cold in the energy sources and fuels supplied for heating and cooling;

(b) the installation of highly efficient renewable heating and cooling systems in buildings, the connection of buildings to efficient district heating and cooling systems or the use of renewable energy or waste heat and cold in industrial heating and cooling processes;

(c) measures covered by tradable certificates proving compliance with the obligation laid down in paragraph 1, first subparagraph, through support to installation measures under point (b) of this paragraph, carried out by another economic operator such as an independent renewable energy technology installer or an energy service company providing renewable energy installation services;

(d) capacity building for national, regional and local authorities to map local renewable heating and cooling potential and plan, implement and advise on renewable energy projects and infrastructures;

(e) the creation of risk mitigation frameworks to reduce the cost of capital for renewable heat and cooling and waste heat and cold projects, allowing for, inter alia, the bundling of smaller projects as well as linking such projects more holistically with other energy efficiency and building renovation measures;

(f) the promotion of renewables heating and cooling purchase agreements for corporate and collective small consumers;

(g) planned replacement schemes of fossil heating sources, heating systems that are not compatible with renewable sources or fossil phase-out schemes with milestones;

▼M2

(h) requirements at local and regional level concerning renewable heat planning, encompassing cooling;

(i) the promotion of the production of biogas and its injection into the gas grid, instead of its use for electricity production;

(j) measures promoting the integration of thermal energy storage technology in heating and cooling systems;

(k) the promotion of renewable based district heating and cooling networks, in particular by renewable energy communities, including through regulatory measures, financing arrangements and support;

(l) other policy measures, with an equivalent effect, including fiscal measures, support schemes or other financial incentives that contribute to the installation of renewable heating and cooling equipment and the development of energy networks supplying renewable energy for heating and cooling in buildings and industry.

When adopting and implementing those measures, Member States shall ensure their accessibility to all consumers, in particular those in low-income or vulnerable households, who would not otherwise possess sufficient up-front capital to benefit.

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5. Member States may use the structures established under the national energy savings obligations set out in Article 7 of Directive 2012/27/EU to implement and monitor the measures referred to in paragraph 3 of this Article.

6. Where entities are designated under paragraph 3, Member States shall ensure that the contribution by those designated entities is measurable and verifiable and that the designated entities report annually on:

(a) the total amount of energy supplied for heating and cooling;

(b) the total amount of renewable energy supplied for heating and cooling;

(c) the amount of waste heat and cold supplied for heating and cooling;

(d) the share of renewable energy and waste heat and cold in the total amount of energy supplied for heating and cooling; and

(e) the type of renewable energy source.

▼B

Article 24

District heating and cooling

▼M2

1. Member States shall ensure that information on the energy performance and the share of renewable energy in their district heating and cooling systems is provided to final consumers in an easily accessible manner, such as on bills or on the suppliers' websites and on request. The information on the share of renewable energy shall be expressed at least as a percentage of gross final consumption of energy in heating and cooling assigned to the customers of a given district heating and cooling system, including information on how much energy was used to deliver one unit of heating to the customer or end-user.

▼B

2. Member States shall lay down the necessary measures and conditions to allow customers of district heating or cooling systems which are not efficient district heating and cooling systems, or which are not such a system by 31 December 2025 on the basis of a plan approved by the competent authority, to disconnect by terminating or modifying their contract in order to produce heating or cooling from renewable sources themselves.

Where the termination of a contract is linked to physical disconnection, such a termination may be made conditional on compensation for the costs directly incurred as a result of the physical disconnection and for the undepreciated portion of assets needed to provide heat and cold to that customer.

3. Member States may restrict the right to disconnect by terminating or modifying a contract in accordance with paragraph 2 to customers who can demonstrate that the planned alternative supply solution for heating or cooling results in a significantly better energy performance. The energy-performance assessment of the alternative supply solution may be based on the energy performance certificate.

▼M2

4. Member States shall endeavour to increase the share of energy from renewable sources and from waste heat and cold in district heating and cooling by an indicative 2,2 percentage points as an annual average calculated for the period 2021 to 2030, starting from the share of energy from renewable sources and from waste heat and cold in district heating and cooling in 2020, and shall lay down the measures necessary to that end in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. The share of energy from renewable sources shall be expressed in terms of share of gross final consumption of energy in district heating and cooling adjusted to normal average climatic conditions.

Member States may count renewable electricity used for district heating and cooling in the annual average increase set out in the first subparagraph.

▼M2

Member States shall inform the Commission of their intention to count renewable electricity used in district heating and cooling towards the annual increase set out in first subparagraph of this paragraph. Member States shall include the estimated renewable electricity capacities for district heating and cooling in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999. Member States shall include the amount of renewable electricity used in district heating and cooling in their integrated national energy and climate progress reports submitted pursuant to Article 17 of that Regulation.

4a. For the calculation of the share of renewable electricity used in district heating and cooling for the purposes of paragraph 4, Member States shall use the average share of renewable electricity supplied in their territory in the two previous years.

Member States with a share of energy from renewable sources and from waste heat and cold in district heating and cooling above 60 % may count any such share as fulfilling the average annual increase referred to in paragraph 4, first subparagraph. Member States with a share of energy from renewable sources and from waste heat and cold in district heating and cooling above 50 % and up to 60 % may count any such share as fulfilling half of the average annual increase referred to in paragraph 4, first subparagraph.

Member States shall lay down the necessary measures to implement the average annual increase referred to in paragraph 4, first subparagraph, of this Article, in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999.

4b. Member States shall ensure that operators of district heating or cooling systems above 25 MWth capacity are encouraged to connect third party suppliers of energy from renewable sources and from waste heat and cold or are encouraged to offer to connect and purchase heat or cold from renewable sources and from waste heat and cold from third-party suppliers on the basis of non-discriminatory criteria set by the competent authority of the Member State concerned, where such operators need to do one or more of the following:

(a) meet demand from new customers;

(b) replace existing heat or cold generation capacity;

(c) expand existing heat or cold generation capacity.

5. Member States may allow an operator of a district heating or cooling system to refuse to connect and to purchase heat or cold from a third-party supplier in any of the following situations:

(a) the system lacks the necessary capacity due to other supplies of heat or cold from renewable sources or of waste heat and cold;

▼M2

(b) the heat or cold from the third-party supplier does not meet the technical parameters necessary to connect and ensure the reliable and safe operation of the district heating and cooling system;

(c) the operator can demonstrate that providing access would lead to an excessive heat or cold cost increase for final customers compared to the cost of using the main local heat or cold supply with which the renewable source or waste heat and cold would compete;

(d) the operator's system is an efficient district heating and cooling system.

Member States shall ensure that, when an operator of a district heating or cooling system refuses to connect a supplier of heating or cooling pursuant to the first subparagraph, information on the reasons for the refusal, as well as the conditions to be met and measures to be taken in the system in order to enable the connection, is provided by that operator to the competent authority. Member States shall ensure that an appropriate process is in place to remedy unjustified refusals.

6. Member States shall put in place, where necessary, a coordination framework between district heating and cooling system operators and the potential sources of waste heat and cold in the industrial and tertiary sectors to facilitate the use of waste heat and cold. That coordination framework shall ensure dialogue as regards the use of waste heat and cold involving, in particular:

(a) district heating and cooling system operators;

(b) industrial and tertiary sector enterprises generating waste heat and cold that can be economically recovered via district heating and cooling systems, such as data centres, industrial plants, large commercial buildings, energy storage facilities, and public transport;

(c) local authorities responsible for planning and approving energy infrastructures;

(d) scientific experts working on the latest state of the art of district heating and cooling systems; and

(e) renewable energy communities involved in heating and cooling.

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7. The right to disconnect by terminating or modifying a contract in accordance with paragraph 2 may be exercised by individual customers, by joint undertakings formed by customers or by parties acting on behalf of customers. For multi-apartment blocks, such disconnection may be exercised only at a whole building level in accordance with the applicable housing law.

▼M2

8. Member States shall establish a framework under which electricity distribution system operators will assess, at least every four years, in cooperation with the operators of district heating and cooling systems in their respective areas, the potential for district heating and cooling systems to provide balancing and other system services, including demand response and thermal storage of excess electricity from renewable sources, and whether the use of the identified potential would be more resource- and cost-efficient than alternative solutions.

Member States shall ensure that electricity transmission and distribution system operators take due account of the results of the assessment required under the first subparagraph in grid planning, grid investment and infrastructure development in their respective territories.

Member States shall facilitate coordination between operators of district heating and cooling systems and electricity transmission and distribution system operators to ensure that balancing, storage and other flexibility services, such as demand response, provided by district heating and district cooling system operators, can participate in their electricity markets.

Member States may extend the assessment and coordination requirements under the first and third subparagraphs to gas transmission and distribution system operators, including hydrogen networks and other energy networks.

9. Member States shall ensure that the rights of consumers and the rules for operating district heating and cooling systems in accordance with this Article are clearly defined, publicly available and enforced by the competent authority.

10. A Member State shall not be required to apply paragraphs 2 to 9 where at least one of the following conditions is met:

(a) its share of district heating and cooling was less than or equal to 2 % of the gross final consumption of energy in heating and cooling on 24 December 2018;

(b) its share of district heating and cooling is increased above 2 % of the gross final consumption of energy in heating and cooling on 24 December 2018 by developing new efficient district heating and cooling on the basis of its integrated national energy and climate plan submitted pursuant to Articles 3 and 14 of, and in accordance with, Regulation (EU) 2018/1999 and the assessment referred to in Article 23(1b) of this Directive;

(c) 90 % of the gross final consumption of energy in district heating and cooling systems takes place in efficient district heating and cooling systems.

Article 25

Increase of renewable energy and reduction of greenhouse gas intensity in the transport sector

1. Each Member State shall set an obligation on fuel suppliers to ensure that:

▼M2

(a) the amount of renewable fuels and renewable electricity supplied to the transport sector leads to a:

(i) share of renewable energy within the final consumption of energy in the transport sector of at least 29 % by 2030; or

(ii) greenhouse gas intensity reduction of at least 14,5 % by 2030, compared to the baseline set out in Article 27(1), point (b), in accordance with an indicative trajectory set by the Member State;

(b) the combined share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX and of renewable fuels of non-biological origin in the energy supplied to the transport sector is at least 1 % in 2025 and 5,5 % in 2030, of which a share of at least 1 percentage point is from renewable fuels of non-biological origin in 2030.

Member States are encouraged to set differentiated targets for advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX and renewable fuels of non-biological origin at national level in order to fulfil the obligation set out in the first subparagraph, point (b), of this paragraph, in a way that the development of both fuels is promoted and expanded.

Member States with maritime ports shall endeavour to ensure that as of 2030 the share of renewable fuels of non-biological origin in the total amount of energy supplied to the maritime transport sector is at least 1,2 %.

Member States shall, in their integrated national energy and climate progress reports submitted pursuant to Article 17 of Regulation (EU) 2018/1999, report on the share of renewable energy within the final consumption of energy in the transport sector, including in the maritime transport sector, as well as on their greenhouse gas intensity reduction.

If the list of feedstock set out in Part A of Annex IX is amended in accordance with Article 28(6), Member States may increase their minimum share of advanced biofuels and biogas produced from that feedstock in the energy supplied to the transport sector accordingly.

2. For the calculation of the targets referred to in paragraph 1, first subparagraph, point (a), and the shares referred to in paragraph 1, first subparagraph, point (b), Member States:

(a) shall take into account renewable fuels of non-biological origin also when they are used as intermediate products for the production of:

(i) conventional transport fuels; or

(ii) biofuels, provided that the greenhouse gas emissions reduction achieved by the use of renewable fuels of non-biological origin is not counted in the calculation of the greenhouse gas emissions savings of the biofuels;

▼M2

(b) may take into account biogas that is injected into the national gas transmission and distribution infrastructure.

3. For the calculation of the targets set in paragraph 1, first subparagraph, point (a), Member States may take into account recycled carbon fuels.

When designing the obligation on fuel suppliers, Member States may:

(a) exempt fuel suppliers supplying electricity or renewable fuels of non-biological origin from the requirement to comply with the minimum share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX with respect to those fuels;

(b) set the obligation by means of measures targeting volumes, energy content or greenhouse gas emissions;

(c) distinguish between different energy carriers;

(d) distinguish between the maritime transport sector and other sectors.

4. Member States shall establish a mechanism allowing fuel suppliers in their territory to exchange credits for supplying renewable energy to the transport sector. Economic operators that supply renewable electricity to electric vehicles through public recharging points shall receive credits, irrespectively of whether the economic operators are subject to the obligation set by the Member State on fuel suppliers, and may sell those credits to fuel suppliers, which shall be allowed to use the credits to fulfil the obligation set out in paragraph 1, first subparagraph. Member States may include private recharging points in that mechanism provided it can be demonstrated that renewable electricity supplied to those private recharging points is provided solely to electric vehicles.

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Article 26

Specific rules for biofuels, bioliquids and biomass fuels produced from food and feed crops

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1. For the calculation of a Member State's gross final consumption of energy from renewable sources referred to in Article 7 and of the minimum share of renewable energy and the greenhouse gas intensity reduction target referred to in Article 25(1), first subparagraph, point (a), the share of biofuels and bioliquids, as well as of biomass fuels consumed in transport, where produced from food and feed crops, shall be no more than one percentage point higher than the share of such fuels in the final consumption of energy in the transport sector in 2020 in that Member State, with a maximum of 7 % of final consumption of energy in the transport sector in that Member State.

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Where that share is below 1 % in a Member State, it may be increased to a maximum of 2 % of the final consumption of energy in the road and rail transport sectors.

Member States may set a lower limit and may distinguish, for the purposes of Article 29(1), between different biofuels, bioliquids and biomass fuels produced from food and feed crops, taking into account best available evidence on indirect land-use change impact. Member States may, for example, set a lower limit for the share of biofuels, bioliquids and biomass fuels produced from oil crops.

▼M2

Where the share of biofuels and bioliquids, as well as of biomass fuels consumed in transport, produced from food and feed crops in a Member State is limited to a share lower than 7 % or a Member State decides to limit the share further, that Member State may reduce the minimum share of renewable energy or the greenhouse gas intensity reduction target referred to in Article 25(1), first subparagraph, point (a), accordingly, in view of the contribution those fuels would have made in terms of the minimum share of renewable energy or greenhouse gas emissions savings. For the purpose of the greenhouse gas intensity reduction target, Member States shall consider those fuels save 50 % greenhouse gas emissions.

2. For the calculation of a Member State's gross final consumption of energy from renewable sources referred to in Article 7 and the minimum share of renewable energy and the greenhouse gas intensity reduction target referred to in Article 25(1), first subparagraph, point (a), the share of high indirect land-use change-risk biofuels, bioliquids or biomass fuels produced from food and feed crops for which a significant expansion of the production area into land with high-carbon stock is observed shall not exceed the level of consumption of such fuels in that Member State in 2019, unless they are certified to be low indirect land-use change-risk biofuels, bioliquids or biomass fuels pursuant to this paragraph.

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From 31 December 2023 until 31 December 2030 at the latest, that limit shall gradually decrease to 0 %.

By 1 February 2019, the Commission shall submit to the European Parliament and to the Council a report on the status of worldwide production expansion of the relevant food and feed crops.

By 1 February 2019, the Commission shall adopt a delegated act in accordance with Article 35 to supplement this Directive by setting out the criteria for certification of low indirect land-use change-risk biofuels, bioliquids and biomass fuels and for determining the high indirect land-use change-risk feedstock for which a significant expansion of the production area into land with high-carbon stock is observed. The report and the accompanying delegated act shall be based on the best available scientific data.

▼M2

By 1 September 2023, the Commission shall review the criteria laid down in the delegated act referred to in the fourth subparagraph of this paragraph on the basis of the best available scientific data and shall adopt delegated acts in accordance with Article 35 in order to amend those criteria, where appropriate, and to supplement this Directive by including a trajectory to gradually decrease the contribution to the overall Union target set in Article 3(1) and to the minimum share of renewable energy and the greenhouse gas intensity reduction target referred to in Article 25(1), first subparagraph, point (a), of high indirect land-use change-risk biofuels, bioliquids and biomass fuels produced from feedstock for which a significant expansion of the production into land with high-carbon stock is observed. That review shall be based on a revised version of the report on feedstock expansion submitted in accordance with the third subparagraph of this paragraph. That report shall, in particular, assess whether the threshold on the maximum share of the average annual expansion of the global production area in high carbon stocks should be reduced on the basis of objective and scientific based criteria and taking into consideration the Union's climate targets and commitments.

Where appropriate, the Commission shall amend the criteria laid down in the delegated act referred to in the fourth subparagraph on the basis of the results of the assessment referred to in the fifth subparagraph. The Commission shall continue to review, every three years after the adoption of the delegated act referred to in the fourth subparagraph, the data underpinning that delegated act. The Commission shall update that delegated act when necessary in light of evolving circumstances and the latest available scientific evidence.

Article 27

Calculation rules in the transport sector and with regard to renewable fuels of non-biological origin regardless of their end use

1. For the calculation of the greenhouse gas intensity reduction referred to in Article 25(1), first subparagraph, point (a)(ii), the following rules shall apply:

(a) the greenhouse gas emissions savings shall be calculated as follows:

(i) for biofuel and biogas, by multiplying the amount of those fuels supplied to all transport modes by their greenhouse gas emissions savings determined in accordance with Article 31;

(ii) for renewable fuels of non-biological origin and recycled carbon fuels, by multiplying the amount of those fuels that is supplied to all transport modes by their greenhouse gas emissions savings determined in accordance with delegated acts adopted pursuant to Article 29a(3);

(iii) for renewable electricity, by multiplying the amount of renewable electricity that is supplied to all transport modes by the fossil fuel comparator EC_F (e) set out in in Annex V;

▼**M2**

(b) the baseline referred to in Article 25(1), first subparagraph, point (a)(ii), shall be calculated until 31 December 2030 by multiplying the amount of energy supplied to the transport sector by the fossil fuel comparator E_F (t) set out in Annex V; from 1 January 2031, the baseline referred to in Article 25(1), first subparagraph, point (a)(ii), shall be the sum of:

(i) the amount of fuels supplied to all transport modes multiplied by the fossil fuel comparator E_F (t) set out in Annex V;

(ii) the amount of electricity supplied to all transport modes multiplied by the fossil fuel comparator EC_F (e) set out in Annex V;

(c) for the calculation of the relevant amounts of energy, the following rules shall apply:

(i) in order to determine the amount of energy supplied to the transport sector, the values regarding the energy content of transport fuels set out in Annex III shall be used;

(ii) in order to determine the energy content of transport fuels not included in Annex III, the Member States shall use the relevant European standards for the determination of the calorific values of fuels, or, where no European standard has been adopted for that purpose, the relevant ISO standards;

(iii) the amount of renewable electricity supplied to the transport sector is determined by multiplying the amount of electricity supplied to that sector by the average share of renewable electricity supplied in the territory of the Member State in the two previous years, unless electricity is obtained from a direct connection to an installation generating renewable electricity and supplied to the transport sector, in which case electricity shall be fully counted as renewable and electricity generated by a solar-electric vehicle and used for the consumption of the vehicle itself may be fully counted as renewable;

(iv) the share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX in the energy content of fuels and electricity supplied to the transport sector shall, except in Cyprus and Malta, be limited to 1,7 %;

(d) the greenhouse gas intensity reduction from the use of renewable energy is determined by dividing the greenhouse gas emissions savings from the use of biofuels, biogas, renewable fuels of non-biological origin and renewable electricity supplied to all transport modes by the baseline; Member States may take into account recycled carbon fuels.

▼M2

Member States may, where justified, increase the limit referred to in the first subparagraph, point (c)(iv), of this paragraph, taking into account the availability of feedstock listed in Part B of Annex IX. Any such increase shall be notified to the Commission, together with the reasons therefor, and shall be subject to approval by the Commission.

2. For the calculation of the minimum shares referred to in Article 25(1), first subparagraph, point (a)(i) and point (b), the following rules shall apply:

(a) for the calculation of the denominator, that is the amount of energy consumed in the transport sector, all fuels and electricity supplied to the transport sector shall be taken into account;

(b) for the calculation of the numerator, that is the amount of energy from renewable sources consumed in the transport sector for the purposes of Article 25(1), first subparagraph, the energy content of all types of energy from renewable sources supplied to all transport modes, including to international marine bunkers, in the territory of each Member State shall be taken into account; Member States may take into account recycled carbon fuels;

(c) the share of biofuels and biogas produced from the feedstock listed in Annex IX and renewable fuels of non-biological origin shall be considered to be twice its energy content;

(d) the share of renewable electricity shall be considered to be four times its energy content when supplied to road vehicles and may be considered to be 1,5 times its energy content when supplied to rail transport;

(e) the share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX supplied in the aviation and maritime transport modes shall be considered to be 1,2 times their energy content and the share of renewable fuels of non-biological origin supplied in the aviation and maritime transport modes shall be considered to be 1,5 times their energy content;

(f) the share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX in the energy content of fuels and electricity supplied to the transport sector shall, except in Cyprus and Malta, be limited to 1,7 %;

(g) in order to determine the amount of energy supplied to the transport sector, the values regarding the energy content of transport fuels set out in Annex III shall be used;

(h) in order to determine the energy content of transport fuels not included in Annex III, the Member States shall use the relevant European standards for the determination of the calorific values of fuels, or, where no European standard has been adopted for that purpose, the relevant ISO standards;

▼M2

(i) the amount of renewable electricity supplied to the transport sector shall be determined by multiplying the amount of electricity supplied to that sector by the average share of renewable electricity supplied in the territory of the Member State in the two previous years, unless electricity is obtained from a direct connection to an installation generating renewable electricity and supplied to the transport sector, in which case that electricity shall be fully counted as renewable and electricity generated by a solar-electric vehicle and used for the consumption of the vehicle itself may be fully counted as renewable.

Member States may, where justified, increase the limit referred to in the first subparagraph, point (f), of this paragraph, taking into account the availability of feedstock listed in Part B of Annex IX. Any such increase shall be notified to the Commission, together with the reason therefor, and shall be subject to approval by the Commission.

3. The Commission is empowered to adopt delegated acts in accordance with Article 35 to amend this Directive by adapting the limit on the share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX on the basis of an assessment of the availability of feedstock. The limit shall be at least 1,7 %. If the Commission adopts such a delegated act, the limit set out in it shall also apply to Member States that have obtained an approval from the Commission to increase the limit, in accordance with paragraph 1, second subparagraph, or paragraph 2, second subparagraph,) of this Article, after a five-years transitional period, without prejudice to the right of the Member State to apply that new limit earlier. Member States may apply for a new approval from the Commission for an increase from the limit laid down in the delegated act in accordance with paragraph 1, second subparagraph, or paragraph 2, second subparagraph, of this Article.

4. The Commission is empowered to adopt delegated acts in accordance with Article 35 to amend this Directive by adapting transport fuels and their energy content as set out in Annex III in accordance with scientific and technical progress.

5. For the purpose of the calculations referred to in paragraph 1, first subparagraph, point (b), and in paragraph 2, first subparagraph, point (a), the amount of energy supplied to the maritime transport sector shall, as a proportion of that Member State's gross final consumption of energy, be considered to be no more than 13 %. For Cyprus and Malta, the amount of energy consumed in the maritime transport sector shall, as a proportion of those Member States' gross final consumption of energy, be considered to be no more than 5 %. This paragraph shall apply until 31 December 2030.

6. Where electricity is used for the production of renewable fuels of non-biological origin, either directly or for the production of intermediate products, the average share of electricity from renewable sources in the country of production, as measured two years before the year in question, shall be used to determine the share of renewable energy.

▼M2

However, electricity obtained from a direct connection to an installation generating renewable electricity may be fully counted as renewable where it is used for the production of renewable fuels of non-biological origin, provided that the installation:

(a) comes into operation after, or at the same time as, the installation producing the renewable fuels of non-biological origin; and

(b) is not connected to the grid, or is connected to the grid but evidence can be provided that the electricity concerned has been supplied without taking electricity from the grid.

Electricity that has been taken from the grid may be fully counted as renewable provided that it is produced exclusively from renewable sources and the renewable properties and other appropriate criteria have been demonstrated, ensuring that the renewable properties of that electricity are counted only once and only in one end-use sector.

By 31 December 2021, the Commission shall adopt a delegated act in accordance with Article 35 to supplement this Directive by establishing a Union methodology setting out detailed rules by which economic operators are to comply with the requirements laid down in the second and third subparagraphs of this paragraph.

By 1 July 2028, the Commission shall submit a report to the European Parliament and the Council assessing the impact of the Union methodology set out in accordance with the fourth subparagraph, including the impact of additionality and temporal and geographical correlation on production costs, greenhouse gas emissions savings, and the energy system.

That Commission report shall, in particular, assess the impact on the availability and affordability of renewable fuels of non-biological origin for industry and transport sectors and on the ability of the Union to achieve its targets for renewable fuels of non-biological origin taking into account the Union strategy for imported and domestic hydrogen in accordance with Article 22a, while minimising the increase in greenhouse gas emissions in the electricity sector and the overall energy system. Where the report concludes that the requirements fall short of ensuring sufficient availability and affordability of renewable fuels of non-biological origin for industry and transport sectors and do not substantially contribute to greenhouse gas emissions savings, energy system integration and the achievement of the Union targets for renewable fuels of non-biological origin set for 2030, the Commission shall review the Union methodology and shall, where appropriate, adopt a delegated act in accordance with Article 35 to amend that methodology, providing the necessary adjustments to the criteria laid down in the second and third subparagraphs of this paragraph in order to facilitate the ramp-up of the hydrogen industry.

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Article 28

Other provisions on renewable energy in the transport sector

1. With a view to minimising the risk of single consignments being claimed more than once in the Union, Member States and the Commission shall strengthen cooperation among national systems and between national systems and voluntary schemes and verifiers established pursuant to Article 30, including, where appropriate, the exchange of data. Where the competent authority of one Member State suspects or detects a fraud, it shall, where appropriate, inform the other Member States.

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5. By 30 June 2024, the Commission shall adopt delegated acts in accordance with Article 35 to supplement this Directive by specifying the methodology to determine the share of biofuel, and biogas for transport, resulting from biomass being processed with fossil fuels in a common process.

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6. By 25 June 2019 and every two years thereafter, the Commission shall review the list of feedstock set out in Parts A and B of Annex IX with a view to adding feedstock in accordance with the principles set out in the third subparagraph.

The Commission is empowered to adopt delegated acts in accordance with Article 35 to amend the list of feedstock set out in Parts A and B of Annex IX by adding, but not removing, feedstock. Feedstock that can be processed only with advanced technologies shall be added to Part A of Annex IX. Feedstock that can be processed into biofuels, or biogas for transport, with mature technologies shall be added to Part B of Annex IX.

Such delegated acts shall be based on an analysis of the potential of the raw material as feedstock for the production of biofuels and biogas for transport, taking into account all of the following:

(a) the principles of the circular economy and of the waste hierarchy established in Directive 2008/98/EC;

(b) the Union sustainability criteria laid down in Article 29(2) to (7);

(c) the need to avoid significant distortive effects on markets for (by-)products, wastes or residues;

(d) the potential for delivering substantial greenhouse gas emissions savings compared to fossil fuels based on a life-cycle assessment of emissions;

(e) the need to avoid negative impacts on the environment and biodiversity;

(f) the need to avoid creating an additional demand for land.

▼M2

7. By 31 December 2025, in the context of the biennial assessment of progress made pursuant to Regulation (EU) 2018/1999, the Commission shall assess whether the obligation relating to advanced biofuels and biogas produced from feedstock listed in Part A of Annex IX to this Directive laid down in Article 25(1), first subparagraph, point (b), of this Directive effectively stimulates innovation and ensures greenhouse gas emissions savings in the transport sector. The Commission shall analyse in that assessment whether the application of this Article effectively avoids the double-counting of renewable energy.

The Commission shall, if appropriate, submit a proposal to amend the obligation relating to advanced biofuels and biogas produced from feedstock listed in Part A of Annex IX laid down in Article 25(1), first subparagraph, point (b).

▼B

Article 29

Sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels

1. Energy from biofuels, bioliquids and biomass fuels shall be taken into account for the purposes referred to in points (a), (b) and (c) of this subparagraph only if they fulfil the sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10:

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(a) contributing towards the renewable energy shares of Member States and the targets set in Article 3(1), Article 15a(1), Article 22a(1), Article 23(1), Article 24(4), and Article 25(1);

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(b) measuring compliance with renewable energy obligations, including the obligation laid down in Article 25;

(c) eligibility for financial support for the consumption of biofuels, bioliquids and biomass fuels.

▼M2

However, biofuels, bioliquids and biomass fuels produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues, are required to fulfil only the greenhouse gas emissions saving criteria laid down in paragraph 10 in order to be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of this paragraph. In the case of the use of mixed wastes, Member States may require operators to apply mixed waste sorting systems that aim to remove fossil materials. This subparagraph shall also apply to waste and residues that are first processed into a product before being further processed into biofuels, bioliquids and biomass fuels.

▼B

Electricity, heating and cooling produced from municipal solid waste shall not be subject to the greenhouse gas emissions saving criteria laid down in paragraph 10.

▼M2

Biomass fuels shall fulfil the sustainability and greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 if used:

(a) in the case of solid biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 7,5 MW;

(b) in the case of gaseous biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 2 MW;

(c) in the case of installations producing gaseous biomass fuels with the following average biomethane flow rate:

(i) above 200 m^3 methane equivalent/h measured at standard conditions of temperature and pressure, namely 0 °C and 1 bar atmospheric pressure;

(ii) if biogas is composed of a mixture of methane and non-combustible other gas, for the methane flow rate, the threshold set out in point (i), recalculated proportionally to the volumetric share of methane in the mixture.

Member States may apply the sustainability and greenhouse gas emissions saving criteria to installations with lower total rated thermal input or biomethane flow rate.

▼B

The sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 shall apply irrespective of the geographical origin of the biomass.

2. Biofuels, bioliquids and biomass fuels produced from waste and residues derived not from forestry but from agricultural land shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 only where operators or national authorities have monitoring or management plans in place in order to address the impacts on soil quality and soil carbon. Information about how those impacts are monitored and managed shall be reported pursuant to Article 30(3).

▼M2

3. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with a high biodiversity value, namely land that had one of the following statuses in or after January 2008, irrespective of whether the land continues to have that status:

(a) 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;

▼M2

(b) highly biodiverse forest and other wooded land which is species-rich and not degraded, and has been identified as being 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;

(c) areas designated:

(i) by law or by the relevant competent authority for nature protection purposes, unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes; or

(ii) 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, subject to their recognition in accordance with Article 30(4), first subparagraph, unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes;

(d) highly biodiverse grassland spanning more than one hectare that is:

(i) natural, namely grassland that would remain grassland in the absence of human intervention and that maintains the natural species composition and ecological characteristics and processes; or

(ii) non-natural, namely grassland that would cease to be grassland in the absence of human intervention and that is species-rich and not degraded and has been identified as being highly biodiverse by the relevant competent authority, unless evidence is provided that the harvesting of the raw material is necessary to preserve its status as highly biodiverse grassland; or

(e) heathland.

Where the conditions set out in paragraph 6, points (a)(vi) and (vii), are not met, the first subparagraph of this paragraph, with the exception of point (c), also applies to biofuels, bioliquids and biomass fuels produced from forest biomass.

The Commission may adopt implementing acts further specifying the criteria by which to determine which grassland is to be covered by the first subparagraph, point (d), of this paragraph. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

▼B

4. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with high-carbon stock, namely land that had one of the following statuses in January 2008 and no longer has that status:

(a) wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year;

▼B

(b) continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds *in situ*;

(c) 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 area before and after conversion is such that, when the methodology laid down in Part C of Annex V is applied, the conditions laid down in paragraph 10 of this Article would be fulfilled.

This paragraph shall not apply if, at the time the raw material was obtained, the land had the same status as it had in January 2008.

▼M2

Where the conditions set out in paragraph 6, points (a)(vi) and (vii), are not met, the first subparagraph of this paragraph, with the exception of points (b) and (c), and the second subparagraph of this paragraph also apply to biofuels, bioliquids and biomass fuels produced from forest biomass.

5. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in paragraph 1, first subparagraph, points (a), (b) and (c), 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. Where the conditions set out in paragraph 6, points (a)(vi) and (vii), are not met, this paragraph also applies to biofuels, bioliquids and biomass fuels produced from forest biomass.

▼B

6. Biofuels, bioliquids and biomass fuels produced from forest biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall meet the following criteria to minimise the risk of using forest biomass derived from unsustainable production:

(a) the country in which forest biomass was harvested has national or sub-national laws applicable in the area of harvest as well as monitoring and enforcement systems in place ensuring:

(i) the legality of harvesting operations;

(ii) forest regeneration of harvested areas;

▼M2

(iii) that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands, grassland, heathland and peatlands, are protected with the aim of preserving biodiversity and preventing habitat destruction;

▼M2

(iv) that harvesting is carried out considering maintenance of soil quality and biodiversity in accordance with sustainable forest management principles, with the aim of preventing any adverse impact, in a way that avoids harvesting of stumps and roots, degradation of primary forests, and of old growth forests as defined in the country where the forest is located, or their conversion into plantation forests, and harvesting on vulnerable soils, that harvesting is carried out in compliance with maximum thresholds for large clear-cuts as defined in the country where the forest is located and with locally and ecologically appropriate retention thresholds for deadwood extraction and that harvesting is carried out in compliance with requirements to use logging systems that minimise any adverse impact on soil quality, including soil compaction, and on biodiversity features and habitats;

▼B

(v) that harvesting maintains or improves the long-term production capacity of the forest;

▼M2

(vi) that forests in which the forest biomass is harvested do not stem from the lands that have the statuses referred to in paragraph 3, points (a), (b), (d) and (e), paragraph 4, point (a), and paragraph 5, respectively under the same conditions of determination of the status of land specified in those paragraphs; and

(vii) that installations producing biofuels, bioliquids and biomass fuels from forest biomass, issue a statement of assurance, underpinned by company-level internal processes, for the purpose of the audits conducted pursuant to Article 30(3), that the forest biomass is not sourced from the lands referred to in point (vi) of this subparagraph.

▼B

(b) when evidence referred to in point (a) of this paragraph is not available, the biofuels, bioliquids and biomass fuels produced from forest biomass shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 if management systems are in place at forest sourcing area level ensuring:

(i) the legality of harvesting operations;

(ii) forest regeneration of harvested areas;

▼M2

(iii) that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands, grassland, heathland and peatlands, are protected with the aim of preserving biodiversity and preventing habitat destruction, unless evidence is provided that the harvesting of that raw material does not interfere with those nature protection purposes;

▼M2

(iv) that harvesting is carried out considering maintenance of soil quality and biodiversity, in accordance with sustainable forest management principles, with the aim of preventing any adverse impact, in a way that avoids harvesting of stumps and roots, degradation of primary forests, and of old growth forests as defined in the country where the forest is located, or their conversion into plantation forests, and harvesting on vulnerable soils, that harvesting is carried out in compliance with maximum thresholds for large clear-cuts as defined in the country where the forest is located, and with locally and ecologically appropriate retention thresholds for deadwood extraction and that harvesting is carried out in compliance with requirements to use logging systems that minimise any adverse impact on soil quality, including soil compaction, and on biodiversity features and habitats; and

▼B

(v) that harvesting maintains or improves the long-term production capacity of the forest.

7. Biofuels, bioliquids and biomass fuels produced from forest biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall meet the following land-use, land-use change and forestry (LULUCF) criteria:

▼C1

(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 accounted towards 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

(b) where evidence referred to in point (a) of this paragraph is not available, the biofuels, bioliquids and biomass fuels produced from forest biomass shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 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.

▼M2

7a. The production of biofuels, bioliquids and biomass fuels from domestic forest biomass shall be consistent with Member States' commitments and targets laid down in Article 4 of Regulation (EU) 2018/841 of the European Parliament and of the Council [1] and with the policies and measures described by the Member States in their integrated national energy and climate plans submitted pursuant to Articles 3 and 14 of Regulation (EU) 2018/1999.

7b. As part of their final updated integrated national energy and climate plan to be submitted by 30 June 2024 pursuant to Article 14(2) of Regulation (EU) 2018/1999, Member States shall include all of the following:

(a) an assessment of the domestic supply of forest biomass available for energy purposes in 2021-2030 in accordance with the criteria laid down in this Article;

(b) an assessment of the compatibility of the projected use of forest biomass for the production of energy with the Member States' targets and budgets for 2026 to 2030 laid down in Article 4 of Regulation (EU) 2018/841; and

(c) a description of the national measures and policies ensuring compatibility with those targets and budgets.

Member States shall report to the Commission on the measures and policies referred in the first subparagraph, point (c), of this paragraph as part of their integrated national energy and climate progress reports submitted pursuant to Article 17 of Regulation (EU) 2018/1999.

▼B

8. By 31 January 2021, the Commission shall adopt implementing acts establishing the operational guidance on the evidence for demonstrating compliance with the criteria laid down in paragraphs 6 and 7 of this Article. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

9. By 31 December 2026, the Commission shall assess whether the criteria laid down in paragraphs 6 and 7 effectively minimise the risk of using forest biomass derived from unsustainable production and address LULUCF criteria, on the basis of the available data.

The Commission shall, if appropriate, submit a legislative proposal to amend the criteria laid down in paragraphs 6 and 7 for the period after 2030.

10. The greenhouse gas emission savings from the use of biofuels, bioliquids and biomass fuels taken into account for the purposes referred to in paragraph 1 shall be:

[1] 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).

▼B

(a) at least 50 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations in operation on or before 5 October 2015;

(b) at least 60 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 6 October 2015 until 31 December 2020;

(c) at least 65 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 1 January 2021;

▼M2

(d) for electricity, heating and cooling production from biomass fuels used in installations that started operating after 20 November 2023, at least 80 %;

(e) for electricity, heating and cooling production from biomass fuels used in installations with a total rated thermal input equal to or exceeding 10 MW that started operating between 1 January 2021 and 20 November 2023, at least 70 % until 31 December 2029, and at least 80 % from 1 January 2030;

(f) for electricity, heating and cooling production from gaseous biomass fuels used in installations with a total rated thermal input equal to or lower than 10 MW that started operating between 1 January 2021 and 20 November 2023, at least 70 % before they have been operating for 15 years, and at least 80 % after they have been in operation for 15 years;

(g) for electricity, heating and cooling production from biomass fuels used in installations with a total rated thermal input equal to or exceeding 10 MW that started operating before 1 January 2021, at least 80 % after they have been operating for 15 years, at the earliest from 1 January 2026 and at the latest from 31 December 2029;

(h) for electricity, heating and cooling production from gaseous biomass fuels used in installations with a total rated thermal input equal to or lower than 10 MW that started operating before 1 January 2021, at least 80 % after they have been operating for 15 years and at the earliest from 1 January 2026.

▼B

An installation shall be considered to be in operation once the physical production of biofuels, biogas consumed in the transport sector and bioliquids, and the physical production of heating and cooling and electricity from biomass fuels has started.

The greenhouse gas emission savings from the use of biofuels, biogas consumed in the transport sector, bioliquids and biomass fuels used in installations producing heating, cooling and electricity shall be calculated in accordance with Article 31(1).

▼B

11. Electricity from biomass fuels shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 only if it meets one or more of the following requirements:

(a) it is produced in installations with a total rated thermal input below 50 MW;

(b) for installations with a total rated thermal input from 50 to 100 MW, it is produced applying high-efficiency cogeneration technology, or, for electricity-only installations, meeting an energy efficiency level associated with the best available techniques (BAT-AEELs) as defined in Commission Implementing Decision (EU) 2017/1442 ([1]);

(c) for installations with a total rated thermal input above 100 MW, it is produced applying high-efficiency cogeneration technology, or, for electricity-only installations, achieving an net-electrical efficiency of at least 36 %;

(d) it is produced applying Biomass CO_2 Capture and Storage.

For the purposes of points (a), (b) and (c) of the first subparagraph of paragraph 1 of this Article, electricity-only-installations shall be taken into account only if they do not use fossil fuels as a main fuel and only if there is no cost-effective potential for the application of high-efficiency cogeneration technology according to the assessment in accordance with Article 14 of Directive 2012/27/EU.

For the purposes of points (a) and (b) of the first subparagraph of paragraph 1 of this Article, this paragraph shall apply only to installations starting operation or converted to the use of biomass fuels after 25 December 2021. For the purposes of point (c) of the first subparagraph of paragraph 1 of this Article, this paragraph shall be without prejudice to support granted under support schemes in accordance with Article 4 approved by 25 December 2021.

Member States may apply higher energy efficiency requirements than those referred in the first subparagraph to installations with lower rated thermal input.

The first subparagraph shall not apply to electricity from installations which are the object of a specific notification by a Member State to the Commission based on the duly substantiated existence of risks for the security of supply of electricity. Upon assessment of the notification, the Commission shall adopt a decision taking into account the elements included therein.

([1]) Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants (OJ L 212, 17.8.2017, p. 1).

▼B

12. For the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 of this Article, and without prejudice to Articles 25 and 26, Member States shall not refuse to take into account, on other sustainability grounds, biofuels and bioliquids obtained in compliance with this Article. This paragraph shall be without prejudice to public support granted under support schemes approved before 24 December 2018.

13. For the purposes referred to in point (c) of the first subparagraph of paragraph 1 of this Article, Member States may derogate, for a limited period of time, from the criteria laid down in paragraphs 2 to 7 and 10 and 11 of this Article by adopting different criteria for:

▼M2

(a) installations located in an outermost region as referred to in Article 349 TFEU to the extent that such facilities produce electricity or heating or cooling from biomass fuels and bioliquids or produce biofuels; and

(b) biomass fuels and bioliquids used in the installations referred to in point (a) of this subparagraph and biofuels produced in those installations, irrespective of the place of origin of that biomass, provided that such criteria are objectively justified on the grounds that their aim is to ensure, for that outermost region, access to safe and secure energy and a smooth phase-in of the criteria laid down in paragraphs 2 to 7 and 10 and 11 of this Article and thereby incentivise the transition from fossil fuels to sustainable biofuels, bioliquids and biomass fuels.

▼B

The different criteria referred to in this paragraph shall be subject to a specific notification by the relevant Member State to the Commission.

14. For the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1, Member States may establish additional sustainability criteria for biomass fuels.

By 31 December 2026, the Commission shall assess the impact of such additional criteria on the internal market, accompanied, if necessary, by a proposal to ensure harmonisation thereof.

▼M2

15. Until 31 December 2030, energy from biofuels, bioliquids and biomass fuels may also be taken into account for the purposes referred to in paragraph 1, first subparagraph, points (a), (b) and (c), of this Article, where:

(a) support was granted before 20 November 2023, in accordance with the sustainability and greenhouse gas emissions saving criteria set out in Article 29 in its version in force on 29 September 2020; and

(b) support was granted in the form of a long-term support for which a fixed amount has been determined at the start of the support period and provided that a correction mechanism to ensure the absence of overcompensation is in place.

▼M2

Article 29a

Greenhouse gas emissions saving criteria for renewable fuels of non-biological origin and recycled carbon fuels

1. Energy from renewable fuels of non-biological origin shall be counted towards Member States' shares of renewable energy and the targets referred to in Articles 3(1), 15a(1), 22a(1), 23(1), 24(4) and 25(1) only if the greenhouse gas emissions savings from the use of those fuels are at least 70 %.

2. Energy from recycled carbon fuels may be counted towards the targets referred to in Article 25(1), first subparagraph, point (a), only if the greenhouse gas emissions savings from the use of those fuels are at least 70 %.

3. The Commission is empowered to adopt delegated acts in accordance with Article 35 to supplement this Directive by specifying the methodology for assessing greenhouse gas emissions savings from renewable fuels of non-biological origin and from recycled carbon fuels. The methodology shall ensure that credit for avoided emissions is not given for CO_2 from fossil sources the capture of which has already received an emission credit under other provisions of law. The methodology shall cover the life-cycle greenhouse gas emissions and consider indirect emissions resulting from the diversion of rigid inputs such as wastes used for the production of recycled carbon fuels.

▼B

Article 30

Verification of compliance with the sustainability and greenhouse gas emissions saving criteria

▼M2

1. Where renewable fuels and recycled carbon fuels are to be counted towards the targets referred to in Article 3(1), Article 15a(1), Article 22a(1), Article 23(1), Article 24(4) and Article 25(1), Member States shall require economic operators to show, by means of mandatory independent and transparent audits, in accordance with the implementing act adopted pursuant to paragraph 8 of this Article, that the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) and Article 29a(1) and (2) for renewable fuels and recycled-carbon fuels have been fulfilled. To that end, they shall require economic operators to use a mass balance system which:

▼B

(a) allows consignments of raw material or fuels with differing sustainability and greenhouse gas emissions saving characteristics to be mixed for instance in a container, processing or logistical facility, transmission and distribution infrastructure or site;

(b) allows consignments of raw material with differing energy content to be mixed for the purposes of further processing, provided that the size of consignments is adjusted according to their energy content;

▼B

(c) requires information about the sustainability and greenhouse gas emissions saving characteristics and sizes of the consignments referred to in point (a) to remain assigned to the mixture; and

(d) provides for the sum of all consignments withdrawn from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture and requires that this balance be achieved over an appropriate period of time.

The mass balance system shall ensure that each consignment is counted only once in point (a), (b) or (c) of the first subparagraph of Article 7(1) for the purposes of calculating the gross final consumption of energy from renewable sources and shall include information on whether support has been provided for the production of that consignment, and if so, on the type of support scheme.

▼M2

2. Where a consignment is processed, information on the sustainability and greenhouse gas emissions saving characteristics of the consignment shall be adjusted and assigned to the output in accordance with the following rules:

(a) when the processing of a consignment of raw material yields only one output that is intended for the production of biofuels, bioliquids or biomass fuels, renewable fuels of non-biological origin, or recycled carbon fuels, the size of the consignment and the related quantities of sustainability and greenhouse gas emissions saving characteristics shall be adjusted applying a conversion factor representing the ratio between the mass of the output that is intended for such production and the mass of the raw material entering the process;

(b) when the processing of a consignment of raw material yields more than one output that is intended for the production of biofuels, bioliquids or biomass fuels, renewable fuels of non-biological origin, or recycled carbon fuels, for each output a separate conversion factor shall be applied and a separate mass balance shall be used.

▼B

3. ►M2 Member States shall take measures to ensure that economic operators submit reliable information regarding the compliance with the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) and Article 29a(1) and (2), and that economic operators make available to the relevant Member State, upon request, the data used to develop that information. Member States shall require economic operators to arrange for an adequate standard of independent auditing of the information submitted, and to provide evidence that this has been done. In order to comply with Article 29(3), points (a), (b), (d) and (e), Article 29(4), point (a), Article 29(5), Article 29(6), point (a), and Article 29(7), point (a), the first or second party auditing may be used up to the first gathering point of the forest biomass. The auditing shall verify that the systems used by economic operators are accurate, reliable and protected against fraud, including verification ensuring that materials are not intentionally modified or discarded so that the consignment or part thereof could become a waste or residue. The auditing shall also evaluate the frequency and methodology of sampling and the robustness of the data.

▼B

The obligations laid down in this paragraph shall apply regardless of whether renewable fuels and recycled carbon fuels are produced within or are imported into the Union. Information about the geographic origin and feedstock type of biofuels, bioliquids and biomass fuels per fuel supplier shall be made available to consumers in an up-to-date, easily accessible, and user-friendly manner on the websites of operators, suppliers or the relevant competent authorities and shall be updated on an annual basis. ◄

Member States shall submit to the Commission, in aggregated form, the information referred to in the first subparagraph of this paragraph. The Commission shall publish that information on the e-reporting platform referred to in Article 28 of Regulation (EU) 2018/1999 in summary form preserving the confidentiality of commercially sensitive information.

▼M2

4. The Commission may decide that voluntary national or international schemes setting standards for the production of renewable fuels and recycled carbon fuels, provide accurate data on greenhouse gas emissions savings for the purposes of Article 29(10) and Article 29a(1) and (2), demonstrate compliance with Article 27(6) and Article 31a(5), or demonstrate that consignments of biofuels, bioliquids and biomass fuels comply with the sustainability criteria laid down in Article 29(2) to (7). When demonstrating that the criteria laid down in Article 29(6) and (7) are met, the operators may provide the required evidence directly at sourcing area level. The Commission may recognise areas 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 for the purposes of Article 29(3), first subparagraph, point (c)(ii).

▼B

The Commission may decide that those schemes contain accurate information on measures taken for soil, water and air protection, for the restoration of degraded land, for the avoidance of excessive water consumption in areas where water is scarce, and for certification of biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

5. The Commission shall adopt decisions under paragraph 4 of this Article by means of implementing acts. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3). Such decisions shall be valid for a period of no more than five years.

The Commission shall require that each voluntary scheme on which a decision has been adopted under paragraph 4 submit annually by 30 April a report to the Commission covering each of the points ►C1 set out in Annex XI to Regulation (EU) 2018/1999. ◄ The report shall cover the preceding calendar year. The requirement to submit a report shall apply only to voluntary schemes that have operated for at least 12 months.

The Commission shall make the reports drawn up by the voluntary schemes available, in an aggregated form or in full if appropriate, on the e-reporting platform referred to in Article 28 of Regulation (EU) 2018/1999.

▼M2

6. Member States may set up national schemes where compliance with the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) and Article 29a(1) and (2), in accordance with the methodology developed under Article 29a(3), is verified throughout the entire chain of custody involving competent authorities. Those schemes may also be used to verify the accuracy and completeness of the information included by economic operators in the Union database, to demonstrate compliance with Article 27(6) and for the certification of biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

A Member State may notify such a national scheme to the Commission. The Commission shall give priority to the assessment of such a scheme in order to facilitate mutual bilateral and multilateral recognition of those schemes. The Commission may decide, by means of implementing acts, whether such a notified national scheme complies with the conditions laid down in this Directive. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

Where the Commission decides that the national scheme complies with conditions laid down in this Directive, other schemes recognised by the Commission in accordance with this Article shall not refuse mutual recognition with that Member State's national scheme as regards verification of compliance with the criteria for which it has been recognised by the Commission.

For installations producing electricity, heating and cooling with a total rated thermal input between 7,5 and 20 MW, Member States may establish simplified national verification schemes to ensure the fulfilment of the sustainability and greenhouse gas emissions saving criteria set out in Article 29(2) to (7) and (10). For the same installations, the implementing acts provided for in paragraph 8 of this Article shall set out the uniform conditions for simplified voluntary verification schemes to ensure the fulfilment of the sustainability and greenhouse gas emissions saving criteria set out in Article 29(2) to (7) and (10).

▼B

7. The Commission shall adopt decisions under paragraph 4 of this Article only if the scheme in question meets adequate standards of reliability, transparency and independent auditing and provides adequate assurances that no materials have been intentionally modified or discarded so that the consignment or part thereof would fall under Annex IX. In the case of schemes to measure greenhouse gas emissions savings, such schemes shall also comply with the methodological requirements set out in Annex V or VI. Lists of areas of high biodiversity value as referred to in point (c)(ii) of the first subparagraph of Article 29(3) shall meet adequate standards of objectivity and coherence with internationally recognised standards and provide for appropriate appeal procedures.

▼B

The voluntary schemes referred to in paragraph 4 shall, at least annually, publish a list of their certification bodies used for independent auditing, indicating for each certification body by which entity or national public authority it was recognised and which entity or national public authority is monitoring it.

8. In order to ensure that compliance with the sustainability and greenhouse gas emissions saving criteria as well as with the provisions on low or high direct and indirect land-use change-risk biofuels, bioliquids and biomass fuels is verified in an efficient and harmonised manner and in particular to prevent fraud, the Commission shall adopt implementing acts specifying detailed implementing rules, including adequate standards of reliability, transparency and independent auditing and require all voluntary schemes to apply those standards. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

In those implementing acts, the Commission shall pay particular attention to the need to minimise administrative burden. The implementing acts shall set a time frame by which voluntary schemes are required to implement the standards. The Commission may repeal decisions recognising voluntary schemes pursuant to paragraph 4 in the event that those schemes fail to implement such standards in the time frame provided for. Where a Member State raises concerns that a voluntary scheme does not operate in accordance with the standards of reliability, transparency and independent auditing that constitute the basis for decisions under paragraph 4, the Commission shall investigate the matter and take appropriate action.

▼M2

9. Where an economic operator provides evidence or data obtained in accordance with a scheme that has been the subject of a decision pursuant to paragraph 4 or 6, a Member State shall not require the economic operator to provide further evidence of compliance with the elements covered by the scheme for which the scheme has been recognised by the Commission.

▼B

Competent authorities of the Member States shall supervise the operation of certification bodies that are conducting independent auditing under a voluntary scheme. Certification bodies shall submit, upon the request of competent authorities, all relevant information necessary to supervise the operation, including the exact date, time and location of audits. Where Member States find issues of non-conformity, they shall inform the voluntary scheme without delay.

▼M2

10. At the request of a Member State, which may be based on the request of an economic operator, the Commission shall, on the basis of all available evidence, examine whether the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) and Article 29a(1) and (2) in relation to a source of renewable fuels and recycled carbon fuels have been met.

▼M2

Within six months of receipt of such a request, the Commission shall, by means of implementing acts, decide whether the Member State concerned may either:

(a) take into account the renewable fuels and recycled carbon fuels from that source for the purposes referred to in points (a), (b) and (c) of the first subparagraph of Article 29(1); or

(b) by way of derogation from paragraph 9, require suppliers of the source of renewable fuels and recycled carbon fuels to provide further evidence of compliance with those sustainability and greenhouse gas emissions saving criteria and those greenhouse gas emissions savings thresholds.

The implementing acts referred to in the second subparagraph of this paragraph shall be adopted in accordance with the examination procedure referred to in Article 34(3).

▼B

Article 31

Calculation of the greenhouse gas impact of biofuels, bioliquids and biomass fuels

1. For the purposes of Article 29(10), the greenhouse gas emissions saving from the use of biofuel, bioliquids and biomass fuels shall be calculated in one of the following ways:

(a) where a default value for greenhouse gas emissions saving for the production pathway is laid down in Part A or B of Annex V for biofuels and bioliquids and in Part A of Annex VI for biomass fuels where the e_l value for those biofuels or bioliquids calculated in accordance with point 7 of Part C of Annex V and for those biomass fuels calculated in accordance with point 7 of Part B of Annex VI is equal to or less than zero, by using that default value;

(b) by using an actual value calculated in accordance with the methodology laid down in Part C of Annex V for biofuels and bioliquids and in Part B of Annex VI for biomass fuels;

(c) by using a value calculated as the sum of the factors of the formulas referred to in point 1 of Part C of Annex V, where disaggregated default values in Part D or E of Annex V may be used for some factors, and actual values, calculated in accordance with the methodology laid down in Part C of Annex V, are used for all other factors;

(d) by using a value calculated as the sum of the factors of the formulas referred to in point 1 of Part B of Annex VI, where disaggregated default values in Part C of Annex VI may be used for some factors, and actual values, calculated in accordance with the methodology laid down in Part B of Annex VI, are used for all other factors.

▼B

2. Member States may submit to the Commission reports including information on the typical greenhouse gas emissions from the cultivation of agricultural raw materials of the areas on their territory classified as level 2 in the nomenclature of territorial units for statistics (NUTS) or as a more disaggregated NUTS level in accordance with Regulation (EC) No 1059/2003 of the European Parliament and of the Council ([1]). Those reports shall be accompanied by a description of the method and data sources used to calculate the level of emissions. That method shall take into account soil characteristics, climate and expected raw material yields.

3. In the case of territories outside the Union, reports equivalent to those referred to in paragraph 2 and drawn up by competent bodies may be submitted to the Commission.

4. The Commission may, by means of implementing acts, decide that the reports referred to in paragraphs 2 and 3 of this Article contain accurate data for the purposes of measuring the greenhouse gas emissions associated with the cultivation of agriculture biomass feedstock produced in the areas included in such reports for the purposes of Article 29(10). Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

Those data may, pursuant to such decisions, be used instead of the disaggregated default values for cultivation laid down in Part D or E of Annex V for biofuels and bioliquids and in Part C of Annex VI for biomass fuels.

5. The Commission shall review Annexes V and VI with a view, where justified, to adding or revising values for biofuel, bioliquid and biomass fuel production pathways. Those reviews shall also consider modifying the methodology laid down in Part C of Annex V and in Part B of Annex VI.

The Commission is empowered to adopt delegated acts pursuant to Article 35 to amend, where appropriate, Annexes V and VI by adding or revising the default values or modifying the methodology.

In the case of an adaptation of, or addition to, the list of default values in Annexes V and VI:

(a) where the contribution of a factor to overall emissions is small, where there is limited variation, or where the cost or difficulty of establishing actual values is high, the default values shall be typical of normal production processes;

(b) in all other cases, the default values shall be conservative compared to normal production processes.

([1]) Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS) (OJ L 154, 21.6.2003, p. 1).

▼B

6. Where necessary in order to ensure the uniform application of Part C of Annex V and Part B of Annex VI, the Commission may adopt implementing acts setting out detailed technical specifications including definitions, conversion factors, the calculation of annual cultivation emissions or emission savings caused by changes above and below-ground carbon stocks on already cultivated land, the calculation of emission savings from CO_2 capture, CO_2 replacement and CO_2 geological storage. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).

▼M2

Article 31a

Union database

1. By 21 November 2024, the Commission shall ensure that a Union database is set up to enable the tracing of liquid and gaseous renewable fuels and recycled carbon fuels (the ‘Union database’).

2. Member States shall require the relevant economic operators to enter in a timely manner accurate data into the Union database on the transactions made and the sustainability characteristics of the fuels subject to those transactions, including their life-cycle greenhouse gas emissions, starting from their point of production to the moment they are placed on the market in the Union. For the purpose of entering data into the Union database, the interconnected gas system shall be considered to be a single mass balance system. Data on the injection and withdrawal of renewable gaseous fuels shall be provided in the Union database. Data on whether support has been provided for the production of a specific consignment of fuel, and if so, on the type of support scheme, shall also be entered into the Union database. Those data may be entered into the Union database via national databases.

Where appropriate for the purpose of improving the traceability of data along the entire supply chain, the Commission is empowered to adopt delegated acts in accordance with Article 35 to supplement this Directive by further extending the scope of the data to be included in the Union database to cover relevant data from the point of production or collection of the raw material used for the fuel production.

Member States shall require fuel suppliers to enter the data necessary to verify compliance with the requirements laid down in Article 25(1), first subparagraph, into the Union database.

Notwithstanding the first, second and third subparagraphs, for gaseous fuels injected into the Union’s interconnected gas infrastructure, economic operators shall, in the event that the Member State decides to complement a mass balance system by a system of guarantees of origin, enter into the Union database data on the transactions made and on the sustainability characteristics and other relevant data, such as greenhouse gas emissions of the fuels up to the injection point to the interconnected gas infrastructure.

3. Member States shall have access to the Union database for the purposes of monitoring and data verification.

▼M2

4. Where guarantees of origin have been issued for the production of a consignment of renewable gas, Member States shall ensure that those guarantees of origin are transferred to the Union database at the moment when a consignment of renewable gas is registered in the Union database and are cancelled after the consignment of renewable gas is withdrawn from the Union's interconnected gas infrastructure. Such guarantees of origin, once transferred, shall not be tradable outside the Union database.

5. Member States shall ensure in their national legal framework that the accuracy and completeness of the data entered by economic operators into the database is verified, for instance by using certification bodies in the framework of voluntary or national schemes recognised by the Commission pursuant to Article 30(4), (5) and (6) and which may be complemented by a system of guarantees of origin.

Such voluntary or national schemes may use third-party data systems as intermediaries to collect the data, provided that such use has been notified to the Commission.

Each Member State may use an already existing national database aligned to and linked with the Union database via an interface, or establish a national database, which can be used by economic operators as a tool for collecting and declaring data and for entering and transferring those data into the Union database, provided that:

(a) the national database complies with the Union database including in terms of the timeliness of data transmission, the typology of data sets transferred, and the protocols for data quality and data verification;

(b) Member States ensure that the data entered into the national database are instantly transferred to the Union database.

Member States may establish national databases in accordance with national law or practice, such as to take into account stricter national requirements, as regards sustainability criteria. Such national databases shall not hinder the overall traceability of sustainable consignments of raw materials or fuels to be entered into the Union database in accordance with this Directive.

The verification of the quality of the data entered into the Union database by means of national databases, the sustainability characteristics of the fuels related to those data, and the final approval of transactions shall be carried out through the Union database alone. The accuracy and completeness of those data shall be verified in accordance with Commission Implementing Regulation (EU) 2022/996 ([1]). They may be checked by certification bodies.

([1]) Commission Implementing Regulation (EU) 2022/996 of 14 June 2022 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria (OJ L 168, 27.6.2022, p. 1).

▼M2

Member States shall notify the detailed features of their national database to the Commission. Following that notification, the Commission shall assess whether the national database complies with the requirements laid down in the third subparagraph. If that is not the case, the Commission may require Member States to take appropriate steps to ensure compliance with those requirements.

6. Aggregated data from the Union database shall be made publicly available, with due regard to the protection of commercially sensitive information, and shall be kept up-to-date. The Commission shall publish and make publicly available annual reports about the data contained in the Union database, including the quantities, the geographical origin and feedstock type of fuels.

▼B

Article 32

Implementing acts

The implementing acts referred to in the second subparagraph of Article 29(3), Article 29(8), the first subparagraph of Article 30(5), the second subparagraph of Article 30(6), the first subparagraph of Article 30(8), the first subparagraph of Article 31(4) and Article 31(6) of this Directive, shall take full account of the provisions relating to greenhouse gas emissions reductions in accordance with Article 7a of Directive 98/70/EC of the European Parliament and of the Council ([1]).

Article 33

Monitoring by the Commission

1. The Commission shall monitor the origin of biofuels, bioliquids and biomass fuels consumed in the Union and the impact of their production, including the impact as a result of displacement, on land use in the Union and in the main third countries of supply. Such monitoring shall be based on Member States' integrated national energy and climate plans and corresponding progress reports pursuant to Articles 3, 17 and 20 of Regulation (EU) 2018/1999, and those of relevant third countries, intergovernmental organisations, scientific studies and any other relevant pieces of information. The Commission shall also monitor the commodity price changes associated with the use of biomass for energy and any associated positive and negative effects on food security.

2. The Commission shall maintain a dialogue and exchange information with third countries and biofuel, bioliquid and biomass fuel producers, consumer organisations and civil society concerning the general implementation of the measures in this Directive relating to biofuels, bioliquids and biomass fuels. It shall, within that framework, pay particular attention to the impact that biofuel, bioliquid and biomass fuel production may have on food prices.

([1]) Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (OJ L 350, 28.12.1998, p. 58).

▼M2

3. By 31 December 2027, the Commission shall submit, if appropriate, a legislative proposal on the regulatory framework for the promotion of energy from renewable sources for the period after 2030.

▼B

That proposal shall take into account the experience of the implementation of this Directive, including its sustainability and greenhouse gas emissions saving criteria, and technological developments in energy from renewable sources.

▼M2

When preparing the legislative proposal referred to in the first subparagraph of this paragraph the Commission shall take into account, where appropriate:

(a) the advice of the European Scientific Advisory Board on Climate Change established under Article 10a of Regulation (EC) No 401/2009 of the European Parliament and of the Council [1];

(b) the projected indicative Union greenhouse gas budget as set out in Article 4(4) of Regulation (EU) 2021/1119 of the European Parliament and of the Council [2];

(c) the integrated national energy and climate plans submitted by Member States by 30 June 2024 pursuant to Article 14(2) of Regulation (EU) 2018/1999;

(d) the experience gained by the implementation of this Directive, including its sustainability and greenhouse gas emissions saving criteria; and

(e) technological developments in energy from renewable sources.

3a. The Commission shall assess the application of the obligations laid down in Article 29(7a) and (7b) and their impact on ensuring the sustainability of biofuels, bioliquids and biomass fuels.

▼B

4. In 2032, the Commission shall publish a report reviewing the application of this Directive.

Article 34

Committee procedure

1. The Commission shall be assisted by the Energy Union Committee established by Article 44 of Regulation (EU) 2018/1999.

[1] Regulation (EC) No 401/2009 of the European Parliament and of the Council of 23 April 2009 on the European Environment Agency and the European Environment Information and Observation Network (OJ L 126, 21.5.2009, p. 13).

[2] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1)

▼B

2. Notwithstanding paragraph 1, for matters relating to the sustainability of biofuels, bioliquids and biomass fuels, the Commission shall be assisted by the Committee on the Sustainability of Biofuels, Bioliquids and Biomass fuels. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011.

3. Where reference is made to this paragraph, Article 5 of Regulation (EU) No 182/2011 shall apply.

Where the Committee delivers no opinion, the Commission shall not adopt the draft implementing act and the third subparagraph of Article 5(4) of Regulation (EU) No 182/2011 shall apply.

Article 35

Exercise of the delegation

1. The power to adopt delegated acts is conferred on the Commission subject to the conditions laid down in this Article.

▼M2

2. The power to adopt delegated acts referred to in Article 8(3), second subparagraph,, Article 26(2), fourth subparagraph, Article 26(2) fifth subparagraph, Article 27(3), Article 27(4), Article 27(6), fourth subparagraph, Article 28(5), Article 28(6), second subparagraph, Article 29a(3), Article 31(5), second subparagraph, and Article 31a(2), second subparagraph, shall be conferred on the Commission for a period of five years from 20 November 2023. The Commission shall draw up a report in respect of the delegation of power not later than nine months before the end of the five-year period. The delegation of power shall be tacitly extended for periods of an identical duration, unless the European Parliament or the Council opposes such extension not later than three months before the end of each period.

▼C2

3. The power to adopt delegated acts referred to in the fifth subparagraph of Article 7(3) shall be conferred on the Commission until 31 December 2021.

▼M2

4. The delegation of power referred to in Article 7(3), fifth subparagraph, Article 8(3), second subparagraph, Article 26(2), fourth subparagraph, Article 26(2) fifth subparagraph, Article 27(3), article 27(4), Article 27(6), fourth subparagraph, Article 28(5), Article 28(6), second subparagraph, Article 29a(3), Article 31(5), and Article 31a(2), second subparagraph, may be revoked at any time by the European Parliament or by the Council. A decision to revoke shall put an end to the delegation of the power specified in that decision. It shall take effect the day following the publication of the decision in the *Official Journal of the European Union* or at a later date specified therein. It shall not affect the validity of any delegated acts already in force.

▼B

5. Before adopting a delegated act, the Commission shall consult experts designated by each Member State in accordance with the principles laid down in the Interinstitutional Agreement of 13 April 2016 on Better Law-Making.

▼B

6. As soon as it adopts a delegated act, the Commission shall notify it simultaneously to the European Parliament and to the Council.

▼M2

7. A delegated act adopted pursuant to Article 7(3), fifth subparagraph, Article 8(3), second subparagraph, Article 26(2), fourth subparagraph, Article 26(2) fifth subparagraph, Article 27(3), Article 27(4), Article 27(6), fourth subparagraph, Article 28(5), Article 28(6), second subparagraph, Article 29a(3), Article 31(5), or Article 31a(2), second subparagraph, shall enter into force only if no objection has been expressed either by the European Parliament or the Council within a period of two months of notification of that act to the European Parliament and to the Council or if, before the expiry of that period, the European Parliament and the Council have both informed the Commission that they will not object. That period shall be extended by two months at the initiative of the European Parliament or of the Council.

▼B

Article 36

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with Articles 2 to 13, 15 to 31 and 37 and Annexes II, III and V to IX, by 30 June 2021. They shall immediately communicate the text of those measures to the Commission.

When Member States adopt those measures, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. They shall also include a statement that references in existing laws, regulations and administrative provisions to the Directive repealed by this Directive shall be construed as references to this Directive. Member States shall determine how such reference is to be made and how that statement is to be formulated.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

3. This Directive shall not affect the application of the derogations pursuant to Union law on the internal market for electricity.

Article 37

Repeal

Directive 2009/28/EC, as amended by the Directives listed in Part A of Annex X, is repealed with effect from 1 July 2021, without prejudice to the obligations of the Member States relating to the time-limits for the transposition into national law of the Directives set out in Part B of Annex X and without prejudice to the obligations of Member States in 2020 as laid down in Article 3(1) and set out in Part A of Annex I to Directive 2009/28/EC.

References to the repealed Directive shall be construed as references to this Directive and shall be read in accordance with the correlation table set out in Annex XI.

▼B

Article 38

Entry into force

This Directive shall enter into force on the third day following that of its publication in the *Official Journal of the European Union*.

Article 39

Addressees

This Directive is addressed to the Member States.

▼B

ANNEX I

NATIONAL OVERALL TARGETS FOR THE SHARE OF ENERGY FROM RENEWABLE SOURCES IN GROSS FINAL CONSUMPTION OF ENERGY IN 2020 [1]

A. National overall targets

	Share of energy from renewable sources in gross final consumption of energy, 2005 (S_{2005})	Target for share of energy from renewable sources in gross final consumption of energy, 2020 (S_{2020})
Belgium	2,2 %	13 %
Bulgaria	9,4 %	16 %
Czech Republic	6,1 %	13 %
Denmark	17,0 %	30 %
Germany	5,8 %	18 %
Estonia	18,0 %	25 %
Ireland	3,1 %	16 %
Greece	6,9 %	18 %
Spain	8,7 %	20 %
France	10,3 %	23 %
Croatia	12,6 %	20 %
Italy	5,2 %	17 %
Cyprus	2,9 %	13 %
Latvia	32,6 %	40 %
Lithuania	15,0 %	23 %
Luxembourg	0,9 %	11 %
Hungary	4,3 %	13 %
Malta	0,0 %	10 %
Netherlands	2,4 %	14 %
Austria	23,3 %	34 %
Poland	7,2 %	15 %
Portugal	20,5 %	31 %
Romania	17,8 %	24 %
Slovenia	16,0 %	25 %
Slovak Republic	6,7 %	14 %
Finland	28,5 %	38 %
Sweden	39,8 %	49 %

▼M2

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[1] In order to be able to achieve the national objectives set out in this Annex, it is underlined that the State aid guidelines for environmental protection recognise the continued need for national mechanisms of support for the promotion of energy from renewable sources.

▼M2

ANNEX IA

NATIONAL HEATING AND COOLING SHARES OF ENERGY FROM RENEWABLE SOURCES IN GROSS FINAL CONSUMPTION OF ENERGY FOR 2020-2030

	Additional top-ups to Article 23(1) (in percentage points) for the period 2021-2025 (*)	Additional top-ups to Article 23(1) (in percentage points) for the period 2026-2030 (**)	Resulting shares including top-ups without waste heat and cold (in percentage points)
Belgium	1,0	0,7	1,8
Bulgaria	0,7	0,4	1,5
Czechia	0,8	0,5	1,6
Denmark	1,2	1,1	1,6
Germany	1,0	0,7	1,8
Estonia	1,3	1,2	1,7
Ireland	2,3	2,0	3,1
Greece	1,3	1,0	2,1
Spain	0,9	0,6	1,7
France	1,3	1,0	2,1
Croatia	0,8	0,5	1,6
Italy	1,1	0,8	1,9
Cyprus	0,8	0,5	1,6
Latvia	0,7	0,6	1,1
Lithuania	1,7	1,6	2,1
Luxembourg	2,3	2,0	3,1
Hungary	0,9	0,6	1,7
Malta	0,8	0,5	1,6
Netherlands	1,1	0,8	1,9
Austria	1,0	0,7	1,8
Poland	0,8	0,5	1,6
Portugal	0,7	0,4	1,5
Romania	0,8	0,5	1,6
Slovenia	0,8	0,5	1,6
Slovakia	0,8	0,5	1,6
Finland	0,6	0,5	1,0
Sweden	0,7	0,7	0,7

(*) The flexibilities of Article 23(2), points (b) and (c), where they were taken into account when calculating the top-ups and resulting shares.

(**) The flexibilities of Article 23(2), points (b) and (c), where they were taken into account when calculating the top-ups and resulting shares.

▼B

ANNEX II

NORMALISATION RULE FOR ACCOUNTING FOR ELECTRICITY GENERATED FROM HYDROPOWER AND WIND POWER

The following rule shall be applied for the purposes of accounting for electricity generated from hydropower in a given Member State:

►C1 $Q_{N(norm)} = C_N \times \left[\sum_{i=N-14}^{N} \frac{Q_i}{C_i}\right]/15$ ◄ where:

N	=	reference year;
$Q_{N(norm)}$	=	normalised electricity generated by all hydropower plants of the Member State in year N, for accounting purposes;
Q_i	=	the quantity of electricity actually generated in year i by all hydropower plants of the Member State measured in GWh, excluding production from pumped storage units using water that has previously been pumped uphill;
C_i	=	the total installed capacity, net of pumped storage, of all hydropower plants of the Member State at the end of year i, measured in MW.

The following rule shall be applied for the purposes of accounting for electricity generated from onshore wind power in a given Member State:

►C1 $Q_{N(norm)} = \frac{C_N + C_{N-1}}{2} \times \frac{\sum_{i=N-n}^{N} Q_i}{\sum_{j=N-n}^{N} \frac{C_j + C_{j-1}}{2}}$ ◄ where:

N	=	reference year;
$Q_{N(norm)}$	=	normalised electricity generated by all onshore wind power plants of the Member State in year N, for accounting purposes;
Q_i	=	the quantity of electricity actually generated in year i by all onshore wind power plants of the Member State measured in GWh;
C_j	=	the total installed capacity of all the onshore wind power plants of the Member State at the end of year j, measured in MW;
n	=	4 or the number of years preceding year N for which capacity and production data are available for the Member State in question, whichever is lower.

The following rule shall be applied for the purposes of accounting for electricity generated from offshore wind power in a given Member State:

►C1 $Q_{N(norm)} = \frac{C_N + C_{N-1}}{2} \times \frac{\sum_{i=N-n}^{N} Q_i}{\sum_{j=N-n}^{N} \frac{C_j + C_{j-1}}{2}}$ ◄ where:

N	=	reference year;
$Q_{N(norm)}$	=	normalised electricity generated by all offshore wind power plants of the Member State in year N, for accounting purposes;

▼B

Q_i	=	the quantity of electricity actually generated in year i by all offshore wind power plants of the Member State measured in GWh;
C_j	=	the total installed capacity of all the offshore wind power plants of the Member State at the end of year j, measured in MW;
n	=	4 or the number of years preceding year N for which capacity and production data are available for the Member State in question, whichever is lower.

▼M2

ANNEX III

ENERGY CONTENT OF FUELS

Fuel	Energy content by weight (lower calorific value, MJ/kg)	Energy content by volume (lower calorific value, MJ/l)
FUELS FROM BIOMASS AND/OR BIOMASS PROCESSING OPERATIONS		
Bio-Propane	46	24
Pure vegetable oil (oil produced from oil plants through pressing, extraction or comparable procedures, crude or refined but chemically unmodified)	37	34
Biodiesel – fatty acid methyl ester (methyl-ester produced from oil of biomass origin)	37	33
Biodiesel – fatty acid ethyl ester (ethyl-ester produced from oil of biomass origin)	38	34
Biogas that can be purified to natural gas quality	50	—
Hydrotreated (thermochemically treated with hydrogen) oil of biomass origin, to be used for replacement of diesel	44	34
Hydrotreated (thermochemically treated with hydrogen) oil of biomass origin, to be used for replacement of petrol	45	30
Hydrotreated (thermochemically treated with hydrogen) oil of biomass origin, to be used for replacement of jet fuel	44	34
Hydrotreated oil (thermochemically treated with hydrogen) of biomass origin, to be used for replacement of liquefied petroleum gas	46	24
Co-processed oil (processed in a refinery simultaneously with fossil fuel) of biomass or pyrolysed biomass origin to be used for replacement of diesel	43	36
Co-processed oil (processed in a refinery simultaneously with fossil fuel) of biomass or pyrolysed biomass origin, to be used to replace petrol	44	32
Co-processed oil (processed in a refinery simultaneously with fossil fuel) of biomass or pyrolysed biomass origin, to be used to replace jet fuel	43	33
Co-processed oil (processed in a refinery simultaneously with fossil fuel) of biomass or pyrolysed biomass origin, to be used to replace liquefied petroleum gas	46	23

▼M2

Fuel	Energy content by weight (lower calorific value, MJ/kg)	Energy content by volume (lower calorific value, MJ/l)
RENEWABLE FUELS THAT CAN BE PRODUCED FROM VARIOUS RENEWABLE SOURCES, INCLUDING BIOMASS		
Methanol from renewable sources	20	16
Ethanol from renewable sources	27	21
Propanol from renewable sources	31	25
Butanol from renewable sources	33	27
Fischer-Tropsch diesel (a synthetic hydrocarbon or mixture of synthetic hydrocarbons to be used for replacement of diesel)	44	34
Fischer-Tropsch petrol (a synthetic hydrocarbon or mixture of synthetic hydrocarbons produced from biomass, to be used for replacement of petrol)	44	33
Fischer-Tropsch jet fuel (a synthetic hydrocarbon or mixture of synthetic hydrocarbons produced from biomass, to be used for replacement of jet fuel)	44	33
Fischer-Tropsch liquefied petroleum gas (a synthetic hydrocarbon or mixture of synthetic hydrocarbons, to be used for replacement of liquefied petroleum gas	46	24
DME (dimethylether)	28	19
Hydrogen from renewable sources	120	—
ETBE (ethyl-tertio-butyl-ether produced on the basis of ethanol)	36 (of which 33 % from renewable sources)	27 (of which 33 % from renewable sources)
MTBE (methyl-tertio-butyl-ether produced on the basis of methanol)	35 (of which 22 % from renewable sources)	26 (of which 22 % from renewable sources)
TAEE (tertiary-amyl-ethyl-ether produced on the basis of ethanol)	38 (of which 29 % from renewable sources)	29 (of which 29 % from renewable sources)
TAME (tertiary-amyl-methyl-ether produced on the basis of methanol)	36 (of which 18 % from renewable sources)	28 (of which 18 % from renewable sources)
THxEE (tertiary-hexyl-ethyl-ether produced on the basis of ethanol)	38 (of which 25 % from renewable sources)	30 (of which 25 % from renewable sources)
THxME (tertiary-hexyl-methyl-ether produced on the basis of methanol)	38 of which 14 % from renewable sources)	30 (of which 14 % from renewable sources)
NON-RENEWABLE FUELS		
Petrol	43	32
Diesel	43	36
Jet fuel	43	34
Hydrogen from non-renewable sources	120	—

▼B

ANNEX IV

▼M2

TRAINING AND CERTIFICATION OF INSTALLERS AND DESIGNERS OF RENEWABLE ENERGY INSTALLATIONS

The certification or equivalent qualification schemes and training programmes referred to in Article 18(3) shall be based on the following criteria:

1. The certification or equivalent qualification process shall be transparent and clearly defined by the Member States or by the administrative body that they appoint.

1a. The certificates issued by certification bodies shall be clearly defined and easy to identify for workers and professionals seeking certification.

1b. The certification process shall enable installers to acquire the necessary theoretical and practical knowledge and guarantee the existence of skills needed to put in place high quality installations that operate reliably.

2. Installers of systems using biomass, heat pump, shallow geothermal, solar photovoltaic and solar thermal energy, including energy storage, and recharging points shall be certified by an accredited training programme or training provider or equivalent qualification schemes.

3. The accreditation of the training programme or provider shall be effected by Member States or by the administrative body that they appoint. The accrediting body shall ensure that the training, including upskilling and reskilling programmes, offered by the training provider are inclusive and have continuity and regional or national coverage.

The training provider shall have adequate technical facilities to provide practical training, including sufficient laboratory equipment or corresponding facilities to provide practical training.

The training provider shall offer, in addition to the basic training, shorter refresher and upskilling courses organised in training modules allowing installers and designers to add new competences, widen and diversify their skills across several types of technology and their combinations. The training provider shall ensure adaptation of training to new renewable energy technology in the context of buildings, industry and agriculture. Training providers shall recognise acquired relevant skills.

The training programmes and modules shall be designed to enable life-long learning in renewable energy installations and be compatible with vocational training for first time job seekers and adults seeking reskilling or new employment.

The training programmes shall be designed in order to facilitate acquiring qualifications covering different types of technology and solutions and avoid limited specialisation in a specific brand or technology. The training provider may be the manufacturer of the equipment or system, institutes or associations.

▼B

4. The training leading to certification or qualification of an installer shall include theoretical and practical parts. At the end of the training, the installer must have the skills required to install the relevant equipment and systems to meet the performance and reliability needs of the customer, incorporate quality craftsmanship, and comply with all applicable codes and standards, including energy and eco-labelling.

▼M2

5. The training course shall end with an examination leading to a certificate or qualification. The examination shall include a practical assessment of successfully installing biomass boilers or stoves, heat pumps, shallow geothermal installations, solar photovoltaic or solar thermal installations, including energy storage, or recharging points, enabling demand response.

▼B

6. The certification schemes or equivalent qualification schemes referred to in Article 18(3) shall take due account of the following guidelines:

(a) Accredited training programmes should be offered to installers with work experience, who have undergone, or are undergoing, the following types of training:

(i) in the case of biomass boiler and stove installers: training as a plumber, pipe fitter, heating engineer or technician of sanitary and heating or cooling equipment as a prerequisite;

(ii) in the case of heat pump installers: training as a plumber or refrigeration engineer and have basic electrical and plumbing skills (cutting pipe, soldering pipe joints, gluing pipe joints, lagging, sealing fittings, testing for leaks and installation of heating or cooling systems) as a prerequisite;

(iii) in the case of a solar photovoltaic or solar thermal installer: training as a plumber or electrician and have plumbing, electrical and roofing skills, including knowledge of soldering pipe joints, gluing pipe joints, sealing fittings, testing for plumbing leaks, ability to connect wiring, familiar with basic roof materials, flashing and sealing methods as a prerequisite; or

(iv) a vocational training scheme to provide an installer with adequate skills corresponding to a three years education in the skills referred to in point (a), (b) or (c), including both classroom and workplace learning.

(b) The theoretical part of the biomass stove and boiler installer training should give an overview of the market situation of biomass and cover ecological aspects, biomass fuels, logistics, fire protection, related subsidies, combustion techniques, firing systems, optimal hydraulic solutions, cost and profitability comparison as well as the design, installation and maintenance of biomass boilers and stoves. The training should also provide good knowledge of any European standards for technology and biomass fuels, such as pellets, and biomass related national and Union law.

▼M2

(c) The theoretical part of the heat pump installer training should give an overview of the market situation for heat pumps and cover geothermal energy sources and ground source temperatures of different regions, soil and rock identification for thermal conductivity, regulations on using geothermal energy sources, feasibility of using heat pumps in buildings and determining the most suitable heat pump system, and knowledge about their technical requirements, safety, air filtering, connection with the heat source and system layout, and integration with energy storage solutions, including in combination with solar installations. The training should also provide good knowledge of any European standards for heat pumps, and of relevant national and Union law. The installer should demonstrate the following key competences:

▼B

(i) a basic understanding of the physical and operation principles of a heat pump, including characteristics of the heat pump circle: context between low temperatures of the heat sink, high temperatures of the heat source, and the efficiency of the system, determination of the coefficient of performance and seasonal performance factor (SPF);

(ii) an understanding of the components and their function within a heat pump circle, including the compressor, expansion valve, evaporator, condenser, fixtures and fittings, lubricating oil, refrigerant, superheating and sub-cooling and cooling possibilities with heat pumps; and

▼M2

(iii) the ability to choose and size the components in typical installation situations, including determining the typical values of the heat load of different buildings and for hot water production based on energy consumption, determining the capacity of the heat pump on the heat load for hot water production, on the storage mass of the building and on interruptible current supply; determine energy storage solutions, including via the buffer tank component and its volume and integration of a second heating system;

(iv) an understanding of feasibility and design studies;

(v) an understanding of drilling, in the case of geothermal heat pumps.

(d) The theoretical part of the solar photovoltaic and solar thermal installer training should give an overview of the market situation of solar products and cost and profitability comparisons, and cover ecological aspects, components, characteristics and dimensioning of solar systems, selection of accurate systems and dimensioning of components, determination of the demand for heat, options for integrating energy storage solutions, fire protection, related subsidies, as well as the design, installation and maintenance of solar photovoltaic and solar thermal installations. The training should also provide good knowledge of any European standards for technology, and certification such as Solar Keymark, and related national and Union law. The installer should demonstrate the following key competences:

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(i) the ability to work safely using the required tools and equipment and implementing safety codes and standards and to identify plumbing, electrical and other hazards associated with solar installations;

▼M2

(ii) the ability to identify systems and their components specific to active and passive systems, including the mechanical design, and to determine the location of the components, the system layout and the configuration, and options for the integration of energy storage solutions, including through combination with recharging stations;

▼B

(iii) the ability to determine the required installation area, orientation and tilt for the solar photovoltaic and solar water heater, taking account of shading, solar access, structural integrity, the appropriateness of the installation for the building or the climate and to identify different installation methods suitable for roof types and the balance of system equipment required for the installation; and

▼B

(iv) for solar photovoltaic systems in particular, the ability to adapt the electrical design, including determining design currents, selecting appropriate conductor types and ratings for each electrical circuit, determining appropriate size, ratings and locations for all associated equipment and subsystems and selecting an appropriate interconnection point.

(e) The installer certification should be time restricted, so that a refresher seminar or event would be necessary for continued certification.

▼B

ANNEX V

RULES FOR CALCULATING THE GREENHOUSE GAS IMPACT OF BIOFUELS, BIOLIQUIDS AND THEIR FOSSIL FUEL COMPARATORS

A. TYPICAL AND DEFAULT VALUES FOR BIOFUELS IF PRODUCED WITH NO NET CARBON EMISSIONS FROM LAND-USE CHANGE

Biofuel production pathway	Greenhouse gas emissions saving – typical value	Greenhouse gas emissions saving – default value
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	67 %	59 %
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	77 %	73 %
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	73 %	68 %
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	79 %	76 %
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	58 %	47 %
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	71 %	64 %
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	48 %	40 %
corn (maize) ethanol, (natural gas as process fuel in CHP plant (*))	55 %	48 %
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	40 %	28 %
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	69 %	68 %
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	47 %	38 %
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	53 %	46 %
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	37 %	24 %
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	67 %	67 %

▼B

Biofuel production pathway	Greenhouse gas emissions saving – typical value	Greenhouse gas emissions saving – default value
sugar cane ethanol	70 %	70 %
the part from renewable sources of ethyl-tertio-butyl-ether (ETBE)	Equal to that of the ethanol production pathway used	
the part from renewable sources of tertiary-amyl-ethyl-ether (TAEE)	Equal to that of the ethanol production pathway used	
rape seed biodiesel	52 %	47 %
sunflower biodiesel	57 %	52 %
soybean biodiesel	55 %	50 %
▼C1 palm oil biodiesel (open effluent pond)	33 %	20 %
▼B palm oil biodiesel (process with methane capture at oil mill)	51 %	45 %
waste cooking oil biodiesel	88 %	84 %
animal fats from rendering biodiesel (**)	84 %	78 %
hydrotreated vegetable oil from rape seed	51 %	47 %
hydrotreated vegetable oil from sunflower	58 %	54 %
hydrotreated vegetable oil from soybean	55 %	51 %
hydrotreated vegetable oil from palm oil (open effluent pond)	34 %	22 %
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	53 %	49 %
hydrotreated oil from waste cooking oil	87 %	83 %
hydrotreated oil from animal fats from rendering (**)	83 %	77 %
pure vegetable oil from rape seed	59 %	57 %
pure vegetable oil from sunflower	65 %	64 %
pure vegetable oil from soybean	63 %	61 %
pure vegetable oil from palm oil (open effluent pond)	40 %	30 %
pure vegetable oil from palm oil (process with methane capture at oil mill)	59 %	57 %
pure oil from waste cooking oil	98 %	98 %

(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP.

(**) Applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009 of the European Parliament and of the Council [1], for which emissions related to hygenisation as part of the rendering are not considered.

[1] Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation) (OJ L 300, 14.11.2009, p. 1).

▼B

B. ESTIMATED TYPICAL AND DEFAULT VALUES FOR FUTURE BIOFUELS THAT WERE NOT ON THE MARKET OR WERE ON THE MARKET ONLY IN NEGLIGIBLE QUANTITIES IN 2016, IF PRODUCED WITH NO NET CARBON EMISSIONS FROM LAND-USE CHANGE

Biofuel production pathway	Greenhouse gas emissions saving - typical value	Greenhouse gas emissions saving - default value
wheat straw ethanol	85 %	83 %
▼C1 waste wood Fischer-Tropsch diesel in free-standing plant	83 %	83 %
▼B farmed wood Fischer-Tropsch diesel in free-standing plant	82 %	82 %
▼C1 waste wood Fischer-Tropsch petrol in free-standing plant	83 %	83 %
▼B farmed wood Fischer-Tropsch petrol in free-standing plant	82 %	82 %
▼C1 waste wood dimethylether (DME) in free-standing plant	84 %	84 %
▼B farmed wood dimethylether (DME) in free-standing plant	83 %	83 %
▼C1 waste wood methanol in free-standing plant	84 %	84 %
▼B farmed wood methanol in free-standing plant	83 %	83 %
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	89 %	89 %
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	89 %	89 %
dimethylether (DME) from black-liquor gasification integrated with pulp mill	89 %	89 %
Methanol from black-liquor gasification integrated with pulp mill	89 %	89 %
the part from renewable sources of methyl-tertio-butyl-ether (MTBE)	Equal to that of the methanol production pathway used	

C. METHODOLOGY

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 as:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr},$$

where

E	=	total emissions from the use of the fuel;
e_{ec}	=	emissions from the extraction or cultivation of raw materials;

▼B

e_l	=	annualised emissions from carbon stock changes caused by land-use change;
e_p	=	emissions from processing;
e_{td}	=	emissions from transport and distribution;
e_u	=	emissions from the fuel in use;
e_{sca}	=	emission savings from soil carbon accumulation via improved agricultural management;
e_{ccs}	=	emission savings from CO_2 capture and geological storage; and
e_{ccr}	=	emission savings from CO_2 capture and replacement.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

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

(i) For energy installations delivering only heat:

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

(ii) For energy installations delivering only electricity:

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

where

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

E = Total greenhouse gas emissions of the bioliquid before end-conversion.

η_{el} = The electrical efficiency, defined as the annual electricity produced divided by the annual bioliquid input based on its energy content.

η_h = The heat efficiency, defined as the annual useful heat output divided by the annual bioliquid input based on its energy content.

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

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

▼B

(iv) For the useful heat coming from energy installations delivering 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 commodity.

E = Total greenhouse gas emissions of the bioliquid before end-conversion.

η_{el} = The electrical efficiency, defined as the annual electricity produced divided by the annual fuel input based on its energy content.

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

C_{el} = Fraction of exergy in the electricity, and/or mechanical energy, set to 100 % ($C_{el} = 1$).

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

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

T_0 = Temperature of surroundings, set at 273,15 kelvin (equal to 0 °C)

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423,15 kelvin), C_h can alternatively be defined as follows:

C_h = Carnot efficiency in heat at 150 °C (423,15 kelvin), which is: 0,3546

For the purposes of that calculation, the following definitions apply:

(a) ‘cogeneration’ means the simultaneous generation in one process of thermal energy and electricity and/or mechanical energy;

(b) ‘useful heat’ means heat generated to satisfy an economical justifiable demand for heat, for heating and cooling purposes;

(c) ‘economically justifiable demand’ means the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at 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 terms of grams of CO_2 equivalent per MJ of fuel, g CO_2eq/MJ.

(b) greenhouse gas emissions from bioliquids, EC, in terms of grams of CO_2 equivalent per MJ of final energy commodity (heat or electricity), g CO_2eq/MJ.

▼B

When heating and cooling are co-generated with electricity, emissions shall be allocated between heat and electricity (as under 1(b)), irrespective if the heat is used for actual heating purposes or for cooling ([1]).

Where the greenhouse gas emissions from the extraction or cultivation of raw materials e_{ec} are expressed in unit g CO_2eq/dry-ton of feedstock, the conversion to grams of CO_2 equivalent per MJ of fuel, g CO_2eq/MJ, shall be calculated as follows ([2]):

$$e_{ec}fuel_a\left[\frac{gCO_2eq}{MJ\ fuel}\right]_{ec} = \frac{e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{dry}}\right]}{LHV_a\left[\frac{MJfeedstock}{tdry\ feedstock}\right]} \times Fuel\ feedstock\ factor_a \times Allocation\ factor\ fuel_a$$

where

$$Allocation\ factor\ fuel_a = \left[\frac{Energy\ in\ fuel}{Energy\ fuel + Energy\ in\ co-products}\right]$$

$$Fuel\ feedstock\ factor_a = \left[Ratio\ of\ MJ\ feedstock\ required\ to\ make\ 1\ MJ\ fuel\right]$$

Emissions per dry-ton feedstock shall be calculated as follows:

$$e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{moist}}\right]}{\left(1 - moisture\ content\right)}$$

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 heat and cooling, and electricity being generated from bioliquids:

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

   where

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

([1]) Heat or waste heat is used to generate cooling (chilled air or water) through absorption ***chillers***. Therefore, it is appropriate to calculate only the emissions associated to the heat produced per MJ of heat, irrespectively if the end-use of the heat is actual heating or cooling via absorption chillers.

([2]) The formula for calculating greenhouse gas emissions from the extraction or cultivation of raw materials e_{ec} describes cases where feedstock is converted into biofuels in one step. For more complex supply chains, adjustments are needed for calculating greenhouse gas emissions from the extraction or cultivation of raw materials e_{ec} for intermediate products.

▼B

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

4. The greenhouse gases taken into account for the purposes of point 1 shall be CO_2, N_2O and CH_4. For the purposes of calculating CO_2 equivalence, those gases shall be valued as follows:

CO_2	:	1
N_2O	:	298
CH_4	:	25

5. Emissions from the extraction or cultivation of raw materials, e_{ec}, shall include emissions from the extraction or cultivation process itself; from the collection, drying and storage of raw materials; from waste and leakages; and from the production of chemicals or products used in extraction or cultivation. Capture of CO_2 in the cultivation of raw materials shall be excluded. Estimates of emissions from agriculture biomass cultivation may be derived from the use of regional averages for cultivation emissions included in the reports referred to in Article 31(4) or the information on the disaggregated default values for cultivation emissions included in this Annex, as an alternative to using actual values. In the absence of relevant information in those reports it is allowed to calculate averages based on local farming practises based for instance on data of a group of farms, as an alternative to using actual values.

▼M2

6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, e_{sca}, such as shifting to reduced or zero-tillage, improved crops and 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 to negatively affect biodiversity. Further, solid and verifiable evidence shall be provided that the soil carbon has increased or that it is reasonable to expect to have increased over the period in which the raw materials concerned were cultivated while taking into account the emissions where such practices lead to increased fertiliser and herbicide use ([1]).

▼B

7. Annualised emissions from carbon stock changes caused by land-use change, e_l, shall be calculated by dividing total emissions equally over 20 years. For the calculation of those emissions, the following rule shall be applied:

$$e_l = (CS_R - CS_A) \times 3{,}664 \times 1/20 \times 1/P - e_B, ([2])$$

where

([1]) Measurements of soil carbon can constitute such evidence, e.g. by a first measurement in advance of the cultivation and subsequent ones at regular intervals several years apart. In such a case, before the second measurement is available, increase in soil carbon would be estimated on the basis of representative experiments or soil models. From the second measurement onwards, the measurements would constitute the basis for determining the existence of an increase in soil carbon and its magnitude.

([2]) 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 equal to 3,664.

▼B

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)). 'Cropland' ([1]) and 'perennial cropland' ([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 was obtained, whichever was the later;
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 the carbon stock accumulates over more than one year, the value attributed to CS_A shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever the earlier;
P	=	the productivity of the crop (measured as biofuel or bioliquid energy per unit area per year) and
e_B	=	bonus of 29 g CO_2eq/MJ biofuel or bioliquid if 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 be attributed if evidence is provided that the land:

(a) was not in use for agriculture or any other activity in January 2008; and

(b) is severely degraded land, including such land that was formerly in agricultural use.

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 a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured.

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

([1]) Cropland as defined by 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.

▼B

10. The Commission shall review, by 31 December 2020, guidelines for the calculation of land carbon stocks ([1]) drawing on 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 ([2]). The Commission guidelines shall serve as the basis for the calculation of land carbon stocks for the purposes of this Directive.

11. Emissions from processing, e_p, shall include emissions from the processing itself; from waste and leakages; and from the production of chemicals or products used in processing including the CO_2 emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process.

    In accounting for the consumption of electricity not produced within the fuel production plant, the greenhouse gas emissions 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 region. By way of derogation from this rule, producers may use an average value for an individual electricity production plant for electricity produced by that plant, if that plant is not connected to the electricity grid.

    Emissions from processing shall include emissions from drying of interim products and materials where relevant.

12. Emissions from transport and distribution, e_{td}, shall include emissions from the transport of raw and semi-finished materials and from the storage and distribution of finished materials. Emissions from transport and distribution to be taken into account under point 5 shall not be covered by this point.

13. Emissions of the fuel in use, e_u, shall be taken to be zero for biofuels and bioliquids.

    Emissions of non-CO_2 greenhouse gases (N_2O and CH_4) of the fuel in use shall be included in the e_u factor for bioliquids.

14. Emission savings from CO_2 capture and geological storage, e_{ccs}, that have not already been accounted for in e_p, shall be limited to emissions avoided through the capture and storage of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel if stored in compliance with Directive 2009/31/EC of the European Parliament and of the Council ([3]).

▼M2

15. Emissions savings from CO_2 capture and replacement, e_{ccr}, shall be related directly to the production of the biofuels or bioliquids to which they are attributed, and shall be limited to 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 in the production of commercial products and services before 1 January 2036.

([1]) Commission Decision 2010/335/EU of 10 June 2010 on 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).

([2]) 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).

([3]) 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).

▼M2

16. Where a cogeneration unit – providing heat and/or electricity to a fuel production process for which emissions are being 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 (which reflects the usefulness (utility) of the heat). The useful part of the heat is found 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 = Temperature, measured in absolute temperature (kelvin) of the useful heat at point of delivery.

T_0 = Temperature of surroundings, set at 273,15 kelvin (equal to 0 °C)

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423,15 kelvin), C_h can alternatively be defined as follows:

C_h = Carnot efficiency in heat at 150 °C (423,15 kelvin), which is: 0,3546

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

For the purposes of that calculation, the following definitions apply:

(a) ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy;

(b) ‘useful heat’ shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes;

(c) ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions.

17. Where a fuel production process produces, in combination, the fuel for which emissions are being calculated and one or more other products (co-products), greenhouse gas emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content (determined by lower heating value in the case of co-products other than electricity and heat). The greenhouse gas intensity of excess useful heat or excess electricity is the same as the greenhouse gas intensity of heat or electricity delivered to the fuel production process and is determined from calculating the greenhouse intensity of all inputs and emissions, including the feedstock and CH_4 and N_2O emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the fuel production process. In the case of cogeneration of electricity and heat, the calculation is performed following point 16.

▼M2

18. For the purposes of the calculations referred to in point 17, the emissions to be divided shall be $e_{ec} + e_l + e_{sca}$ + those fractions of e_p, e_{td}, e_{ccs} and e_{ccr} that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions. In the case of biofuels and bioliquids, all co-products that do not fall under the scope of point 17 shall be taken into account for the purposes of that calculation.

Co-products that have a negative energy content shall be considered to have an energy content of zero for the purposes of the calculation.

As a general rule, wastes and residues including all wastes and residues included in Annex IX shall be considered to have zero life-cycle greenhouse gas emissions up to the process of collection of those materials irrespectively of whether they are processed to interim products before being transformed into the final product.

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

▼B

19. For biofuels, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $E_{F(t)}$ shall be 94 g CO_2eq/MJ.

For bioliquids used for the production of electricity, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $EC_{F(e)}$ shall be 183 g CO_2eq/MJ.

For bioliquids used for the production of useful heat, as well as for the production of heating and/or cooling, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $EC_{F(h\&c)}$ shall be 80 g CO_2eq/MJ.

D. DISAGGREGATED DEFAULT VALUES FOR BIOFUELS AND BIOLIQUIDS

Disaggregated default values for cultivation: 'e_{ec}' as defined in Part C of this Annex, including soil N_2O emissions

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol	9,6	9,6
corn (maize) ethanol	25,5	25,5
other cereals excluding corn (maize) ethanol	27,0	27,0
sugar cane ethanol	17,1	17,1

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	32,0	32,0
sunflower biodiesel	26,1	26,1
soybean biodiesel	21,2	21,2
▼C1 palm oil biodiesel	26,0	26,0
▼B waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel (**)	0	0
hydrotreated vegetable oil from rape seed	33,4	33,4
hydrotreated vegetable oil from sunflower	26,9	26,9
hydrotreated vegetable oil from soybean	22,1	22,1
▼C1 hydrotreated vegetable oil from palm oil	27,3	27,3
▼B hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (**)	0	0
pure vegetable oil from rape seed	33,4	33,4
pure vegetable oil from sunflower	27,2	27,2
pure vegetable oil from soybean	22,2	22,2
pure vegetable oil from palm oil	27,1	27,1
pure oil from waste cooking oil	0	0

(**) Applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Disaggregated default values for cultivation: 'e_{ec}' – for soil N_2O emissions only (these are already included in the disaggregated values for cultivation emissions in the 'e_{ec}' table)

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol	4,9	4,9
corn (maize) ethanol	13,7	13,7
other cereals excluding corn (maize) ethanol	14,1	14,1
sugar cane ethanol	2,1	2,1
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
rape seed biodiesel	17,6	17,6
sunflower biodiesel	12,2	12,2
soybean biodiesel	13,4	13,4
palm oil biodiesel	16,5	16,5
waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel (**)	0	0
hydrotreated vegetable oil from rape seed	18,0	18,0
hydrotreated vegetable oil from sunflower	12,5	12,5
hydrotreated vegetable oil from soybean	13,7	13,7
hydrotreated vegetable oil from palm oil	16,9	16,9
hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (**)	0	0
pure vegetable oil from rape seed	17,6	17,6
pure vegetable oil from sunflower	12,2	12,2
pure vegetable oil from soybean	13,4	13,4
pure vegetable oil from palm oil	16,5	16,5
pure oil from waste cooking oil	0	0

(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Disaggregated default values for processing: 'e_p' as defined in Part C of this Annex

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	18,8	26,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	9,7	13,6
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	13,2	18,5
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	7,6	10,6
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	27,4	38,3

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	15,7	22,0
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	20,8	29,1
corn (maize) ethanol, (natural gas as process fuel in CHP plant (*))	14,8	20,8
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	28,6	40,1
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	1,8	2,6
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	21,0	29,3
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	15,1	21,1
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	30,3	42,5
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	1,5	2,2
sugar cane ethanol	1,3	1,8
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	11,7	16,3
sunflower biodiesel	11,8	16,5
soybean biodiesel	12,1	16,9
palm oil biodiesel (open effluent pond)	30,4	42,6
palm oil biodiesel (process with methane capture at oil mill)	13,2	18,5
waste cooking oil biodiesel	9,3	13,0
animal fats from rendering biodiesel (**)	13,6	19,1
hydrotreated vegetable oil from rape seed	10,7	15,0

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
hydrotreated vegetable oil from sunflower	10,5	14,7
hydrotreated vegetable oil from soybean	10,9	15,2
hydrotreated vegetable oil from palm oil (open effluent pond)	27,8	38,9
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	9,7	13,6
hydrotreated oil from waste cooking oil	10,2	14,3
hydrotreated oil from animal fats from rendering (**)	14,5	20,3
pure vegetable oil from rape seed	3,7	5,2
pure vegetable oil from sunflower	3,8	5,4
pure vegetable oil from soybean	4,2	5,9
pure vegetable oil from palm oil (open effluent pond)	22,6	31,7
pure vegetable oil from palm oil (process with methane capture at oil mill)	4,7	6,5
pure oil from waste cooking oil	0,6	0,8

(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP.
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Disaggregated default values for oil extraction only (these are already included in the disaggregated values for processing emissions in the 'e_p' table)

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
rape seed biodiesel	3,0	4,2
sunflower biodiesel	2,9	4,0
soybean biodiesel	3,2	4,4
palm oil biodiesel (open effluent pond)	20,9	29,2
palm oil biodiesel (process with methane capture at oil mill)	3,7	5,1
waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel (**)	4,3	6,1
hydrotreated vegetable oil from rape seed	3,1	4,4
hydrotreated vegetable oil from sunflower	3,0	4,1

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
hydrotreated vegetable oil from soybean	3,3	4,6
hydrotreated vegetable oil from palm oil (open effluent pond)	21,9	30,7
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	3,8	5,4
hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (**)	4,3	6,0
pure vegetable oil from rape seed	3,1	4,4
pure vegetable oil from sunflower	3,0	4,2
pure vegetable oil from soybean	3,4	4,7
pure vegetable oil from palm oil (open effluent pond)	21,8	30,5
pure vegetable oil from palm oil (process with methane capture at oil mill)	3,8	5,3
pure oil from waste cooking oil	0	0

(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Disaggregated default values for transport and distribution: 'e_{td}' as defined in Part C of this Annex

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	2,3	2,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	2,3	2,3
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	2,3	2,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	2,3	2,3
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	2,3	2,3
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	2,3	2,3
corn (maize) ethanol (natural gas as process fuel in CHP plant (*))	2,2	2,2

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	2,2	2,2
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	2,2	2,2
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	2,2	2,2
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	2,2	2,2
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	2,2	2,2
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	2,2	2,2
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	2,2	2,2
sugar cane ethanol	9,7	9,7
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	1,8	1,8
sunflower biodiesel	2,1	2,1
soybean biodiesel	8,9	8,9
palm oil biodiesel (open effluent pond)	6,9	6,9
palm oil biodiesel (process with methane capture at oil mill)	6,9	6,9
waste cooking oil biodiesel	1,9	1,9

▼C1

animal fats from rendering biodiesel (**)	1,6	1,6

▼B

hydrotreated vegetable oil from rape seed	1,7	1,7
hydrotreated vegetable oil from sunflower	2,0	2,0
hydrotreated vegetable oil from soybean	9,2	9,2
hydrotreated vegetable oil from palm oil (open effluent pond)	7,0	7,0
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	7,0	7,0

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
hydrotreated oil from waste cooking oil	1,7	1,7
hydrotreated oil from animal fats from rendering (**)	1,5	1,5
pure vegetable oil from rape seed	1,4	1,4
pure vegetable oil from sunflower	1,7	1,7
pure vegetable oil from soybean	8,8	8,8
pure vegetable oil from palm oil (open effluent pond)	6,7	6,7
pure vegetable oil from palm oil (process with methane capture at oil mill)	6,7	6,7
pure oil from waste cooking oil	1,4	1,4

(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP.
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Disaggregated default values for transport and distribution of final fuel only. These are already included in the table of 'transport and distribution emissions e_{td}' as defined in Part C of this Annex, but the following values are useful if an economic operator wishes to declare actual transport emissions for crops or oil transport only).

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	1,6	1,6
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	1,6	1,6
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	1,6	1,6
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	1,6	1,6
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	1,6	1,6
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	1,6	1,6

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
corn (maize) ethanol (natural gas as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	1,6	1,6
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	1,6	1,6
sugar cane ethanol	6,0	6,0
the part of ethyl-tertio-butyl-ether (ETBE) from renewable ethanol	Will be considered to be equal to that of the ethanol production pathway used	
the part of tertiary-amyl-ethyl-ether (TAEE) from renewable ethanol	Will be considered to be equal to that of the ethanol production pathway used	
rape seed biodiesel	1,3	1,3
sunflower biodiesel	1,3	1,3
soybean biodiesel	1,3	1,3
palm oil biodiesel (open effluent pond)	1,3	1,3
palm oil biodiesel (process with methane capture at oil mill)	1,3	1,3
waste cooking oil biodiesel	1,3	1,3
animal fats from rendering biodiesel (**)	1,3	1,3
hydrotreated vegetable oil from rape seed	1,2	1,2
hydrotreated vegetable oil from sunflower	1,2	1,2

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
hydrotreated vegetable oil from soybean	1,2	1,2
hydrotreated vegetable oil from palm oil (open effluent pond)	1,2	1,2
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	1,2	1,2
hydrotreated oil from waste cooking oil	1,2	1,2
hydrotreated oil from animal fats from rendering (**)	1,2	1,2
pure vegetable oil from rape seed	0,8	0,8
pure vegetable oil from sunflower	0,8	0,8
pure vegetable oil from soybean	0,8	0,8
pure vegetable oil from palm oil (open effluent pond)	0,8	0,8
pure vegetable oil from palm oil (process with methane capture at oil mill)	0,8	0,8
pure oil from waste cooking oil	0,8	0,8

(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP.
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Total for cultivation, processing, transport and distribution

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	30,7	38,2
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	21,6	25,5
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	25,1	30,4
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	19,5	22,5
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	39,3	50,2

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)	Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	27,6	33,9
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	48,5	56,8
corn (maize) ethanol, (natural gas as process fuel in CHP plant (*))	42,5	48,5
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	56,3	67,8
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	29,5	30,3
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	50,2	58,5
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	44,3	50,3
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	59,5	71,7
▼C1 other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	30,7	31,4
sugar cane ethanol	28,1	28,6
▼B the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	45,5	50,1
sunflower biodiesel	40,0	44,7
soybean biodiesel	42,2	47,0
▼C1 palm oil biodiesel (open effluent pond)	63,3	75,5
palm oil biodiesel (process with methane capture at oil mill)	46,1	51,4
▼B waste cooking oil biodiesel	11,2	14,9
▼C1 animals fats from rendering biodiesel (**)	15,2	20,7

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
hydrotreated vegetable oil from rape seed	45,8	50,1
hydrotreated vegetable oil from sunflower	39,4	43,6
hydrotreated vegetable oil from soybean	42,2	46,5
▼C1 hydrotreated vegetable oil from palm oil (open effluent pond)	62,1	73,2
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	44,0	47,9
▼B hydrotreated oil from waste cooking oil	11,9	16,0
hydrotreated oil from animal fats from rendering (**)	16,0	21,8
pure vegetable oil from rape seed	38,5	40,0
pure vegetable oil from sunflower	32,7	34,3
pure vegetable oil from soybean	35,2	36,9
▼C1 pure vegetable oil from palm oil (open effluent pond)	56,4	65,5
pure vegetable oil from palm oil (process with methane capture at oil mill)	38,5	40,3
▼B pure oil from waste cooking oil	2,0	2,2

(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP.
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

E. ESTIMATED DISAGGREGATED DEFAULT VALUES FOR FUTURE BIOFUELS AND BIOLIQUIDS THAT WERE NOT ON THE MARKET OR WERE ONLY ON THE MARKET IN NEGLIGIBLE QUANTITIES IN 2016

Disaggregated default values for cultivation: 'e_{ec}' as defined in Part C of this Annex, including N_2O emissions (including chipping of waste or farmed wood)

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	1,8	1,8
waste wood Fischer-Tropsch diesel in free-standing plant	3,3	3,3
farmed wood Fischer-Tropsch diesel in free-standing plant	8,2	8,2
▼C1 waste wood Fischer-Tropsch petrol in free-standing plant	3,3	3,3
farmed wood Fischer-Tropsch petrol in free-standing plant	8,2	8,2

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
waste wood dimethylether (DME) in free-standing plant	3,1	3,1
farmed wood dimethylether (DME) in free-standing plant	7,6	7,6
waste wood methanol in free-standing plant	3,1	3,1
farmed wood methanol in free-standing plant	7,6	7,6
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	2,5	2,5
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	2,5	2,5
dimethylether (DME) from black-liquor gasification integrated with pulp mill	2,5	2,5
Methanol from black-liquor gasification integrated with pulp mill	2,5	2,5
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for soil N_2O emissions (included in disaggregated default values for cultivation emissions in the 'e_{ec}' table)

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	0	0
waste wood Fischer-Tropsch diesel in free-standing plant	0	0
farmed wood Fischer-Tropsch diesel in free-standing plant	4,4	4,4
waste wood Fischer-Tropsch petrol in free-standing plant	0	0
farmed wood Fischer-Tropsch petrol in free-standing plant	4,4	4,4
waste wood dimethylether (DME) in free-standing plant	0	0
farmed wood dimethylether (DME) in free-standing plant	4,1	4,1
waste wood methanol in free-standing plant	0	0
farmed wood methanol in free-standing plant	4,1	4,1

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	0	0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	0	0
dimethylether (DME) from black-liquor gasification integrated with pulp mill	0	0
Methanol from black-liquor gasification integrated with pulp mill	0	0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for processing: 'e_p' as defined in Part C of this Annex

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	4,8	6,8
waste wood Fischer-Tropsch diesel in free-standing plant	0,1	0,1
farmed wood Fischer-Tropsch diesel in free-standing plant	0,1	0,1
waste wood Fischer-Tropsch petrol in free-standing plant	0,1	0,1
farmed wood Fischer-Tropsch petrol in free-standing plant	0,1	0,1
waste wood dimethylether (DME) in free-standing plant	0	0
farmed wood dimethylether (DME) in free-standing plant	0	0
waste wood methanol in free-standing plant	0	0
farmed wood methanol in free-standing plant	0	0
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	0	0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	0	0

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
dimethylether (DME) from black-liquor gasification integrated with pulp mill	0	0
methanol from black-liquor gasification integrated with pulp mill	0	0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for transport and distribution: 'e_{td}' as defined in Part C of this Annex

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	7,1	7,1
▼C1 waste wood Fischer-Tropsch diesel in free-standing plant	12,2	12,2
▼B farmed wood Fischer-Tropsch diesel in free-standing plant	8,4	8,4
▼C1 waste wood Fischer-Tropsch petrol in free-standing plant	12,2	12,2
▼B farmed wood Fischer-Tropsch petrol in free-standing plant	8,4	8,4
▼C1 waste wood dimethylether (DME) in free-standing plant	12,1	12,1
▼B farmed wood dimethylether (DME) in free-standing plant	8,6	8,6
▼C1 waste wood methanol in free-standing plant	12,1	12,1
▼B farmed wood methanol in free-standing plant	8,6	8,6
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	7,7	7,7
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	7,9	7,9
dimethylether (DME) from black-liquor gasification integrated with pulp mill	7,7	7,7
methanol from black-liquor gasification integrated with pulp mill	7,9	7,9
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

▼B

Disaggregated default values for transport and distribution of final fuel only. These are already included in the table of 'transport and distribution emissions e_{td}' as defined in Part C of this Annex, but the following values are useful if an economic operator wishes to declare actual transport emissions for feedstock transport only).

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	1,6	1,6
waste wood Fischer-Tropsch diesel in free-standing plant	1,2	1,2
farmed wood Fischer-Tropsch diesel in free-standing plant	1,2	1,2
waste wood Fischer-Tropsch petrol in free-standing plant	1,2	1,2
farmed wood Fischer-Tropsch petrol in free-standing plant	1,2	1,2
waste wood dimethylether (DME) in free-standing plant	2,0	2,0
farmed wood dimethylether (DME) in free-standing plant	2,0	2,0
waste wood methanol in free-standing plant	2,0	2,0
farmed wood methanol in free-standing plant	2,0	2,0
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	2,0	2,0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	2,0	2,0
dimethylether (DME) from black-liquor gasification integrated with pulp mill	2,0	2,0
methanol from black-liquor gasification integrated with pulp mill	2,0	2,0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Total for cultivation, processing, transport and distribution

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
wheat straw ethanol	13,7	15,7

▼C1

waste wood Fischer-Tropsch diesel in free-standing plant	15,6	15,6

▼B

Biofuel and bioliquid production pathway	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)	Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)
farmed wood Fischer-Tropsch diesel in free-standing plant	16,7	16,7
▼C1 waste wood Fischer-Tropsch petrol in free-standing plant	15,6	15,6
▼B farmed wood Fischer-Tropsch petrol in free-standing plant	16,7	16,7
▼C1 waste wood dimethylether (DME) in free-standing plant	15,2	15,2
▼B farmed wood dimethylether (DME) in free-standing plant	16,2	16,2
▼C1 waste wood methanol in free-standing plant	15,2	15,2
▼B farmed wood methanol in free-standing plant	16,2	16,2
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	10,2	10,2
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	10,4	10,4
dimethylether (DME) from black-liquor gasification integrated with pulp mill	10,2	10,2
methanol from black-liquor gasification integrated with pulp mill	10,4	10,4
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

▼B

ANNEX VI

RULES FOR CALCULATING THE GREENHOUSE GAS IMPACT OF BIOMASS FUELS AND THEIR FOSSIL FUEL COMPARATORS

A. Typical and default values of greenhouse gas emissions savings for biomass fuels if produced with no net-carbon emissions from land-use change

WOODCHIPS					
Biomass fuel production system	Transport distance	Greenhouse gas emissions savings –typical value		Greenhouse gas emissions savings – default value	
		Heat	Electricity	Heat	Electricity
Woodchips from forest residues	1 to 500 km	93 %	89 %	91 %	87 %
	500 to 2 500 km	89 %	84 %	87 %	81 %
	2 500 to 10 000 km	82 %	73 %	78 %	67 %
	Above 10 000 km	67 %	51 %	60 %	41 %
Woodchips from short rotation coppice (Eucalyptus)	2 500 to 10 000 km	77 %	65 %	73 %	60 %
Woodchips from short rotation coppice (Poplar – Fertilised)	1 to 500 km	89 %	83 %	87 %	81 %
	500 to 2 500 km	85 %	78 %	84 %	76 %
	2 500 to 10 000 km	78 %	67 %	74 %	62 %
	Above 10 000 km	63 %	45 %	57 %	35 %
Woodchips from short rotation coppice (Poplar – No fertilisation)	1 to 500 km	91 %	87 %	90 %	85 %
	500 to 2 500 km	88 %	82 %	86 %	79 %
	2 500 to 10 000 km	80 %	70 %	77 %	65 %
	Above 10 000 km	65 %	48 %	59 %	39 %
Woodchips from stemwood	1 to 500 km	93 %	89 %	92 %	88 %
	500 to 2 500 km	90 %	85 %	88 %	82 %
	2 500 to 10 000 km	82 %	73 %	79 %	68 %
	Above 10 000 km	67 %	51 %	61 %	42 %
Woodchips from industry residues	1 to 500 km	94 %	92 %	93 %	90 %
	500 to 2 500 km	91 %	87 %	90 %	85 %
	2 500 to 10 000 km	83 %	75 %	80 %	71 %
	Above 10 000 km	69 %	54 %	63 %	44 %

▼B

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 forest residues	Case 1	1 to 500 km	58 %	37 %	49 %	24 %
		500 to 2 500 km	58 %	37 %	49 %	25 %
		2 500 to 10 000 km	55 %	34 %	47 %	21 %
		Above 10 000 km	50 %	26 %	40 %	11 %
	Case 2a	1 to 500 km	77 %	66 %	72 %	59 %
		500 to 2 500 km	77 %	66 %	72 %	59 %
		2 500 to 10 000 km	75 %	62 %	70 %	55 %
		Above 10 000 km	69 %	54 %	63 %	45 %
	Case 3a	1 to 500 km	92 %	88 %	90 %	85 %
		500 to 2 500 km	92 %	88 %	90 %	86 %
		2 500 to 10 000 km	90 %	85 %	88 %	81 %
		Above 10 000 km	84 %	76 %	81 %	72 %
Wood briquettes or pellets from short rotation coppice (Eucalyptus)	Case 1	2 500 to 10 000 km	52 %	28 %	43 %	15 %
	Case 2a	2 500 to 10 000 km	70 %	56 %	66 %	49 %
	Case 3a	2 500 to 10 000 km	85 %	78 %	83 %	75 %
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised)	Case 1	1 to 500 km	54 %	32 %	46 %	20 %
		500 to 10 000 km	52 %	29 %	44 %	16 %
		Above 10 000 km	47 %	21 %	37 %	7 %
	Case 2a	1 to 500 km	73 %	60 %	69 %	54 %
		500 to 10 000 km	71 %	57 %	67 %	50 %
		Above 10 000 km	66 %	49 %	60 %	41 %
	Case 3a	1 to 500 km	88 %	82 %	87 %	81 %
		500 to 10 000 km	86 %	79 %	84 %	77 %
		Above 10 000 km	80 %	71 %	78 %	67 %

▼B

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 short rotation coppice (Poplar – No fertilisation)	Case 1	1 to 500 km	56 %	35 %	48 %	23 %
		500 to 10 000 km	54 %	32 %	46 %	20 %
		Above 10 000 km	49 %	24 %	40 %	10 %
	Case 2a	1 to 500 km	76 %	64 %	72 %	58 %
		500 to 10 000 km	74 %	61 %	69 %	54 %
		Above 10 000 km	68 %	53 %	63 %	45 %
	Case 3a	1 to 500 km	91 %	86 %	90 %	85 %
		500 to 10 000 km	89 %	83 %	87 %	81 %
		Above 10 000 km	83 %	75 %	81 %	71 %
Stemwood	Case 1	1 to 500 km	57 %	37 %	49 %	24 %
		500 to 2 500 km	58 %	37 %	49 %	25 %
		2 500 to 10 000 km	55 %	34 %	47 %	21 %
		Above 10 000 km	50 %	26 %	40 %	11 %
	Case 2a	1 to 500 km	77 %	66 %	73 %	60 %
		500 to 2 500 km	77 %	66 %	73 %	60 %
		2 500 to 10 000 km	75 %	63 %	70 %	56 %
		Above 10 000 km	70 %	55 %	64 %	46 %
	Case 3a	1 to 500 km	92 %	88 %	91 %	86 %
		500 to 2 500 km	92 %	88 %	91 %	87 %
		2 500 to 10 000 km	90 %	85 %	88 %	83 %
		Above 10 000 km	84 %	77 %	82 %	73 %

▼B

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 wood industry residues	Case 1	1 to 500 km	75 %	62 %	69 %	55 %
		500 to 2 500 km	75 %	62 %	70 %	55 %
		2 500 to 10 000 km	72 %	59 %	67 %	51 %
		Above 10 000 km	67 %	51 %	61 %	42 %
	Case 2a	1 to 500 km	87 %	80 %	84 %	76 %
		500 to 2 500 km	87 %	80 %	84 %	77 %
		2 500 to 10 000 km	85 %	77 %	82 %	73 %
		Above 10 000 km	79 %	69 %	75 %	63 %
	Case 3a	1 to 500 km	95 %	93 %	94 %	91 %
		500 to 2 500 km	95 %	93 %	94 %	92 %
		2 500 to 10 000 km	93 %	90 %	92 %	88 %
		Above 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. Electricity for the pellet mill is supplied from the grid;
Case 2a refers to processes in which a woodchips boiler, fed with pre-dried chips, is used to provide process heat. Electricity for the pellet mill is supplied from the grid;
Case 3a refers to processes in which a CHP, fed with pre-dried woodchips, is used to provide electricity and heat to the pellet mill.

AGRICULTURE 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 density < 0,2 t/m^3 (*)	1 to 500 km	95 %	92 %	93 %	90 %
	500 to 2 500 km	89 %	83 %	86 %	80 %
	2 500 to 10 000 km	77 %	66 %	73 %	60 %
	Above 10 000 km	57 %	36 %	48 %	23 %
Agricultural Residues with density > 0,2 t/m^3 (**)	1 to 500 km	95 %	92 %	93 %	90 %
	500 to 2 500 km	93 %	89 %	92 %	87 %
	2 500 to 10 000 km	88 %	82 %	85 %	78 %
	Above 10 000 km	78 %	68 %	74 %	61 %

▼B

AGRICULTURE PATHWAYS

Biomass fuel production system	Transport distance	Greenhouse gas emissions savings – typical value		Greenhouse gas emissions savings – default value	
		Heat	Electricity	Heat	Electricity
Straw pellets	1 to 500 km	88 %	82 %	85 %	78 %
	500 to 10 000 km	86 %	79 %	83 %	74 %
	Above 10 000 km	80 %	70 %	76 %	64 %
Bagasse briquettes	500 to 10 000 km	93 %	89 %	91 %	87 %
	Above 10 000 km	87 %	81 %	85 %	77 %
Palm Kernel Meal	Above 10 000 km	20 %	-18 %	11 %	-33 %
Palm Kernel Meal (no CH_4 emissions from oil mill)	Above 10 000 km	46 %	20 %	42 %	14 %

(*) This group of materials includes agricultural residues with a low bulk density and it comprises materials such as straw bales, oat hulls, rice husks and sugar cane bagasse bales (not exhaustive list).

(**) The group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soybean hulls, palm kernel shells (not exhaustive list).

BIOGAS FOR ELECTRICITY (*)

Biogas production system		Technological option	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Wet manure ([1])	Case 1	Open digestate ([2])	146 %	94 %
		Close digestate ([3])	246 %	240 %
	Case 2	Open digestate	136 %	85 %
		Close digestate	227 %	219 %
	Case 3	Open digestate	142 %	86 %
		Close digestate	243 %	235 %
Maize whole plant ([4])	Case 1	Open digestate	36 %	21 %
		Close digestate	59 %	53 %
	Case 2	Open digestate	34 %	18 %
		Close digestate	55 %	47 %
	Case 3	Open digestate	28 %	10 %
		Close digestate	52 %	43 %

([1]) The values for biogas production from manure include negative emissions for emissions saved from raw manure management. The value of e_{sca} considered is equal to – 45 g CO_2eq/MJ manure used in anaerobic digestion.

([2]) Open storage of digestate accounts for additional emissions of CH_4 and N_2O. The magnitude of those emissions changes with ambient conditions, substrate types and the digestion efficiency.

([3]) Close storage means that the digestate resulting from the digestion process is stored in a gas-tight tank and that the additional biogas released during storage is considered to be recovered for production of additional electricity or biomethane. No greenhouse gas emissions are included in that process.

([4]) Maize whole plant means maize harvested as fodder and ensiled for preservation.

▼B

BIOGAS FOR ELECTRICITY (*)

Biogas production system		Technological option	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Biowaste	Case 1	Open digestate	47 %	26 %
		Close digestate	84 %	78 %
	Case 2	Open digestate	43 %	21 %
		Close digestate	77 %	68 %
	Case 3	Open digestate	38 %	14 %
		Close digestate	76 %	66 %

(*) 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 – MIXTURES OF MANURE AND MAIZE

Biogas production system		Technological option	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Manure – Maize 80 % - 20 %	Case 1	Open digestate	72 %	45 %
		Close digestate	120 %	114 %
	Case 2	Open digestate	67 %	40 %
		Close digestate	111 %	103 %
	Case 3	Open digestate	65 %	35 %
		Close digestate	114 %	106 %
Manure – Maize 70 % - 30 %	Case 1	Open digestate	60 %	37 %
		Close digestate	100 %	94 %
	Case 2	Open digestate	57 %	32 %
		Close digestate	93 %	85 %
	Case 3	Open digestate	53 %	27 %
		Close digestate	94 %	85 %

▼B

BIOGAS FOR ELECTRICITY – MIXTURES OF MANURE AND MAIZE

Biogas production system		Technological option	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Manure – Maize 60 % - 40 %	Case 1	Open digestate	53 %	32 %
		Close digestate	88 %	82 %
	Case 2	Open digestate	50 %	28 %
		Close digestate	82 %	73 %
	Case 3	Open digestate	46 %	22 %
		Close digestate	81 %	72 %

BIOMETHANE FOR TRANSPORT (*)

Biomethane production system	Technological options	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Wet manure	Open digestate, no off-gas combustion	117 %	72 %
	Open digestate, off-gas combustion	133 %	94 %
	Close digestate, no off-gas combustion	190 %	179 %
	Close digestate, off-gas combustion	206 %	202 %
Maize whole plant	Open digestate, no off-gas combustion	35 %	17 %
	Open digestate, off-gas combustion	51 %	39 %
	Close digestate, no off-gas combustion	52 %	41 %
	Close digestate, off-gas combustion	68 %	63 %
Biowaste	Open digestate, no off-gas combustion	43 %	20 %
	Open digestate, off-gas combustion	59 %	42 %
	Close digestate, no off-gas combustion	70 %	58 %
	Close digestate, off-gas combustion	86 %	80 %

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

▼B

BIOMETHANE – MIXTURES OF MANURE AND MAIZE (*)

Biomethane production system	Technological options	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Manure – Maize 80 % - 20 %	Open digestate, no off-gas combustion (1)	62 %	35 %
	Open digestate, off-gas combustion (2)	78 %	57 %
	Close digestate, no off-gas combustion	97 %	86 %
	Close digestate, off-gas combustion	113 %	108 %
Manure – Maize 70 % - 30 %	Open digestate, no off-gas combustion	53 %	29 %
	Open digestate, off-gas combustion	69 %	51 %
	Close digestate, no off-gas combustion	83 %	71 %
	Close digestate, off-gas combustion	99 %	94 %
Manure – Maize 60 % - 40 %	Open digestate, no off-gas combustion	48 %	25 %
	Open digestate, off-gas combustion	64 %	48 %
	Close digestate, no off-gas combustion	74 %	62 %
	Close digestate, off-gas combustion	90 %	84 %

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

B. METHODOLOGY

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

(a) Greenhouse gas emissions from the production and use of biomass fuels before conversion into electricity, heating and cooling, shall be calculated as:

$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr}$,

Where

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

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

(1) This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0,03 MJ CH_4/MJ biomethane for the emission of methane in the off-gases.

(2) This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off-gas is combusted, if any).

▼B

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

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use;

e_{sca} = emission savings from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission savings from CO_2 capture and geological storage; and

e_{ccr} = emission savings from CO_2 capture and replacement.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

(b) In the case of co-digestion of different substrates in a biogas plant for the production of biogas or biomethane, the typical and default values of greenhouse gas emissions shall be calculated as:

▼C1

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

▼B

where

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

S_n = Share of feedstock n in energy content

E_n = Emission in g CO_2/MJ for pathway n as provided in Part D of this Annex (*)

▼C1

$$S_n = \frac{P_n \cdot W_n}{\sum_1^n P_n \cdot W_n}$$

▼B

where

P_n = energy yield [MJ] per kilogram of wet input of feedstock 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 digester of substrate n [tonne of fresh matter]

AM_n = Average annual moisture of substrate n [kg water/kg fresh matter]

SM_n = Standard moisture for substrate n (***).

▼B

(*) For animal manure used as substrate, a bonus of 45 g CO_2eq/MJ manure (– 54 kg CO_2eq/t fresh matter) is added for improved agricultural and manure management.

(**) The following values of P_n shall be used for calculating typical and default values:

P(Maize): 4,16 [$MJ_{biogas}/kg_{wet\ maize\ @\ 65\ \%\ moisture}$]

P(Manure): 0,50 [$MJ_{biogas}/kg_{wet\ manure\ @\ 90\ \%\ moisture}$]

P(Biowaste) 3,41 [$MJ_{biogas}/kg_{wet\ biowaste\ @\ 76\ \%\ moisture}$]

(***) The following values of the standard moisture for substrate SM_n shall be used:

SM(Maize): 0,65 [kg water/kg fresh matter]

SM(Manure): 0,90 [kg water/kg fresh matter]

SM(Biowaste): 0,76 [kg water/kg fresh matter]

(c) In the case of co-digestion of n substrates in a biogas plant for the production of electricity or biomethane, actual greenhouse gas emissions of biogas and biomethane are calculated as follows:

$$E = \sum_{1}^{n} S_n \cdot (e_{ec,n} + e_{td,feedstock,n} + e_{l,n} - e_{sca,n}) + e_p + e_{td,product} + e_u - e_{ccs} - e_{ccr}$$

where

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

S_n = Share of feedstock n, in fraction of input to the digester;

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

$e_{td,feedstock,n}$ = emissions from transport of feedstock n to the digester;

$e_{l,n}$ = annualised emissions from carbon stock changes caused by land-use change, for feedstock n;

e_{sca} = emission savings from improved agricultural management of feedstock n (*);

e_p = emissions from processing;

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

e_u = emissions from the fuel in use, that is greenhouse gases emitted during combustion;

e_{ccs} = emission savings from CO_2 capture and geological storage; and

e_{ccr} = emission savings from CO_2 capture and replacement.

▼B

(*) For e_{sca} a bonus of 45 g CO_2eq/MJ manure shall be attributed for improved agricultural and manure management in the case animal manure is used as a substrate for the production of biogas and biomethane.

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

(i) For energy installations delivering only heat:

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

(ii) For energy installations delivering only electricity:

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

where

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

E = Total greenhouse gas emissions of the fuel before end-conversion.

η_{el} = The electrical efficiency, defined as the annual electricity produced divided by the annual fuel input, based on its energy content.

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

(iii) For the electricity or mechanical energy coming from energy installations delivering 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 the useful heat coming from energy installations delivering 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 commodity.

E = Total greenhouse gas emissions of the fuel before end-conversion.

η_{el} = The electrical efficiency, defined as the annual electricity produced divided by the annual energy input, based on its energy content.

▼B

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

C_{el} = Fraction of exergy in the electricity, and/or mechanical energy, set to 100 % (C_{el} = 1).

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

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

T_0 = Temperature of surroundings, set at 273,15 kelvin (equal to 0 °C).

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423,15 kelvin), C_h can alternatively be defined as follows:

C_h = Carnot efficiency in heat at 150 °C (423,15 kelvin), which is: 0,3546

For the purposes of that calculation, the following definitions apply:

(i) ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electricity and/or mechanical energy;

(ii) ‘useful heat’ shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes;

(iii) ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions.

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

(a) greenhouse gas emissions from biomass fuels, E, shall be expressed in terms of grams of CO_2 equivalent per MJ of biomass fuel, g CO_2eq/MJ;

(b) greenhouse gas emissions from heating or electricity, produced from biomass fuels, EC, shall be expressed in terms of grams of CO_2 equivalent per MJ of final energy commodity (heat or electricity), g CO_2eq/MJ.

▼B

When heating and cooling are co-generated with electricity, emissions shall be allocated between heat and electricity (as under point 1(d)), irrespective if the heat is used for actual heating purposes or for cooling. ([1])

Where the greenhouse gas emissions from the extraction or cultivation of raw materials e_{ec} are expressed in unit g CO_2eq/dry-ton of feedstock, the conversion to grams of CO_2 equivalent per MJ of fuel, g CO_2eq /MJ, shall be calculated as follows ([2]):

$$e_{ec}fuel_a\left[\frac{gCO_2eq}{MJfuel}\right]_{ec} = \frac{e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{dry}}\right]}{LHV_a\left[\frac{MJfeedstock}{tdry\ feedstock}\right]} \cdot Fuel\ feedstock\ factor_a \cdot Allocation\ factor\ fuel_a$$

Where

$$Allocation\ factor\ fuel_a = \left[\frac{Energy\ in\ fuel}{Energy\ fuel + Energy\ in\ co - products}\right]$$

$$Fuel\ feedstock\ factor_a = \left[Ratio\ of\ MJ\ feedstock\ required\ to\ make\ 1\ MJ\ fuel\right]$$

Emissions per dry-ton feedstock shall be calculated as follows:

$$e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{e_{ec}feedstock_a\left[\frac{gCO_2eq}{t_{moist}}\right]}{\left(1 - moisture\ content\right)}$$

3. 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 biomass fuels used as transport fuels; and

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

([1]) Heat or waste heat is used to generate cooling (chilled air or water) through absorption chillers. Therefore, it is appropriate to calculate only the emissions associated to the heat produced, per MJ of heat, irrespectively if the end-use of the heat is actual heating or cooling via absorption chillers.

([2]) The formula for calculating greenhouse gas emissions from the extraction or cultivation of raw materials eec describes cases where feedstock is converted into biofuels in one step. For more complex supply chains, adjustments are needed for calculating greenhouse gas emissions from the extraction or cultivation of raw materials eec for intermediate products.

▼B

(b) greenhouse gas emissions savings from heat and cooling, and electricity being generated from biomass fuels:

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

where

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

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

4. The greenhouse gases taken into account for the purposes of point 1 shall be CO_2, N_2O and CH_4. For the purposes of calculating CO_2 equivalence, those gases shall be valued as follows:

CO_2: 1

N_2O: 298

CH_4: 25

5. Emissions from the extraction, harvesting or cultivation of raw materials, e_{ec}, shall include emissions from the extraction, harvesting or cultivation process itself; from the collection, drying and storage of raw materials; from waste and leakages; and from the production of chemicals or products used in extraction or cultivation. Capture of CO_2 in the cultivation of raw materials shall be excluded. Estimates of emissions from agriculture biomass cultivation may be derived from the regional averages for cultivation emissions included in the reports referred to in Article 31(4) of this Directive or the information on the disaggregated default values for cultivation emissions included in this Annex, as an alternative to using actual values. In the absence of relevant information in those reports it is allowed to calculate averages based on local farming practises based for instance on data of a group of farms, as an alternative to using actual values.

Estimates of emissions from cultivation and harvesting of forestry biomass may be derived from the use of averages for cultivation and harvesting emissions calculated for geographical areas at national level, as an alternative to using actual values.

▼M2

6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, e_{sca}, such as shifting to reduced or zero-tillage, improved crops and crops 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 to negatively affect biodiversity. Further, solid and verifiable evidence shall be provided that the soil carbon has increased or that it is reasonable to expect to have increased over the period in which the raw materials concerned were cultivated while taking into account the emissions where such practices lead to increased fertiliser and herbicide use ([1]).

([1]) Measurements of soil carbon can constitute such evidence, e.g. by a first measurement in advance of the cultivation and subsequent ones at regular intervals several years apart. In such a case, before the second measurement is available, increase in soil carbon would be estimated on the basis of representative experiments or soil models. From the second measurement onwards, the measurements would constitute the basis for determining the existence of an increase in soil carbon and its magnitude.

▼B

7. Annualised emissions from carbon stock changes caused by land-use change, e_l, shall be calculated by dividing total emissions equally over 20 years. For the calculation of those emissions the following rule shall be applied:

$$e_l = (CS_R - CS_A) \times 3{,}664 \times 1/20 \times 1/P - e_B, (^1)$$

where

e_l = annualised greenhouse gas emissions from carbon stock change due to land-use change (measured as mass of CO_2-equivalent per unit biomass fuel energy). 'Cropland' (2) and 'perennial cropland' (3) 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 was obtained, whichever was the later;

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 the carbon stock accumulates over more than one year, the value attributed to CS_A shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever the earlier;

P = the productivity of the crop (measured as biomass fuel energy per unit area per year); and

e_B = bonus of 29 g CO_2eq/MJ biomass fuel if 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 be attributed if evidence is provided that the land:

(a) was not in use for agriculture in January 2008 or any other activity; and

(b) is severely degraded land, including such land that was formerly in agricultural use.

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 a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured.

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

(1) The quotient obtained by dividing the molecular weight of CO2 (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) is equal to 3,664.
(2) Cropland as defined by IPCC.
(3) 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.

▼B

10. In accordance with point 10 of Part C of Annex V to this Directive, Commission Decision 2010/335/EU [1], which provides for guidelines for the calculation of land carbon stocks in relation to this Directive, drawing 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, shall serve as the basis for the calculation of land carbon stocks.

11. Emissions from processing, e_p, shall include emissions from the processing itself; from waste and leakages; and from the production of chemicals or products used in processing, including the CO_2 emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process.

In accounting for the consumption of electricity not produced within the solid or gaseous biomass fuel production plant, the greenhouse gas emissions 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 region. By way of derogation from this rule, producers may use an average value for an individual electricity production plant for electricity produced by that plant, if that plant is not connected to the electricity grid.

Emissions from processing shall include emissions from drying of interim products and materials where relevant.

12. Emissions from transport and distribution, e_{td}, shall include emissions from the transport of raw and semi-finished materials and from the storage and distribution of finished materials. Emissions from transport and distribution to be taken into account under point 5 shall not be covered by this point.

13. Emissions of CO_2 from fuel in use, $e_{u,}$ shall be taken to be zero for biomass fuels. Emissions of non-CO_2 greenhouse gases (CH_4 and N_2O) from the fuel in use shall be included in the e_u factor.

14. Emission savings from CO_2 capture and geological storage, e_{ccs}, that have not already been accounted for in e_p, shall be limited to emissions avoided through the capture and storage of emitted CO_2 directly related to the extraction, transport, processing and distribution of biomass fuel if stored in compliance with Directive 2009/31/EC.

▼M2

15. Emissions savings from CO_2 capture and replacement, e_{ccr}, shall be related directly to the production of biomass fuels to which they are attributed, and shall be limited to 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 in the production of commercial products and services before 1 January 2036.

[1] Commission Decision 2010/335/EU of 10 June 2010 on 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).

▼B

16. Where a cogeneration unit – providing heat and/or electricity to a biomass fuel production process for which emissions are being 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 (which reflects the usefulness (utility) of the heat). The useful part of the heat is found 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 = Temperature, measured in absolute temperature (kelvin) of the useful heat at point of delivery.

T_0 = Temperature of surroundings, set at 273,15 kelvin (equal to 0 °C).

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423,15 kelvin), C_h can alternatively be defined as follows:

C_h = Carnot efficiency in heat at 150 °C (423,15 kelvin), which is: 0,3546

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

For the purposes of that calculation, the following definitions apply:

(a) ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy;

(b) ‘useful heat’ shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes;

(c) ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions.

17. Where a biomass fuel production process produces, in combination, the fuel for which emissions are being calculated and one or more other products (‘co-products’), greenhouse gas emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content (determined by lower heating value in the case of co-products other than electricity and heat). The greenhouse gas intensity of excess useful heat

▼B

or excess electricity is the same as the greenhouse gas intensity of heat or electricity delivered to the biomass fuel production process and is determined from calculating the greenhouse gas intensity of all inputs and emissions, including the feedstock and CH_4 and N_2O emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the biomass fuel production process. In the case of cogeneration of electricity and heat, the calculation is performed following point 16.

▼M2

18. For the purposes of the calculations referred to in point 17, the emissions to be divided shall be $e_{ec} + e_l + e_{sca}$ + those fractions of e_p, e_{td}, e_{ccs} and e_{ccr} that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions.

In the case of biogas and biomethane, all co-products that do not fall under the scope of point 17 shall be taken into account for the purposes of that calculation. Co-products that have a negative energy content shall be considered to have an energy content of zero for the purposes of the calculation.

As a general rule, wastes and residues including all wastes and residues included in Annex IX shall be considered to have zero life-cycle greenhouse gas emissions up to the process of collection of those materials irrespectively of whether they are processed to interim products before being transformed into the final product.

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

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19. For biomass fuels used for the production of electricity, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $EC_{F(el)}$ shall be 183 g CO_2eq/MJ electricity or 212 g CO_2eq/MJ electricity for the outermost regions.

For biomass fuels used for the production of useful heat, as well as for the production of heating and/or cooling, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $EC_{F(h)}$ shall be 80 g CO_2eq/MJ heat.

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

For biomass fuels used as transport fuels, for the purposes of the calculation referred to in point 3, the fossil fuel comparator $E_{F(t)}$ shall be 94 g CO_2eq/MJ.

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C. DISAGGREGATED DEFAULT VALUES FOR BIOMASS FUELS

Wood briquettes or pellets

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)				Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)			
		Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use
Wood chips from forest residues	1 to 500 km	0,0	1,6	3,0	0,4	0,0	1,9	3,6	0,5
	500 to 2 500 km	0,0	1,6	5,2	0,4	0,0	1,9	6,2	0,5
	2 500 to 10 000 km	0,0	1,6	10,5	0,4	0,0	1,9	12,6	0,5
	Above 10 000 km	0,0	1,6	20,5	0,4	0,0	1,9	24,6	0,5
Wood chips from SRC (Eucalyptus)	2 500 to 10 000 km	4,4	0,0	11,0	0,4	4,4	0,0	13,2	0,5
Wood chips from SRC (Poplar – fertilised)	1 to 500 km	3,9	0,0	3,5	0,4	3,9	0,0	4,2	0,5
	500 to 2 500 km	3,9	0,0	5,6	0,4	3,9	0,0	6,8	0,5
	2 500 to 10 000 km	3,9	0,0	11,0	0,4	3,9	0,0	13,2	0,5
	Above 10 000 km	3,9	0,0	21,0	0,4	3,9	0,0	25,2	0,5
Wood chips from SRC (Poplar – Not fertilised)	1 to 500 km	2,2	0,0	3,5	0,4	2,2	0,0	4,2	0,5
	500 to 2 500 km	2,2	0,0	5,6	0,4	2,2	0,0	6,8	0,5
	2 500 to 10 000 km	2,2	0,0	11,0	0,4	2,2	0,0	13,2	0,5
	Above 10 000 km	2,2	0,0	21,0	0,4	2,2	0,0	25,2	0,5

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Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use
Wood chips from stemwood	1 to 500 km	1,1	0,3	3,0	0,4	1,1	0,4	3,6	0,5
	500 to 2 500 km	1,1	0,3	5,2	0,4	1,1	0,4	6,2	0,5
	2 500 to 10 000 km	1,1	0,3	10,5	0,4	1,1	0,4	12,6	0,5
	Above 10 000 km	1,1	0,3	20,5	0,4	1,1	0,4	24,6	0,5
Wood chips from wood industry residues	1 to 500 km	0,0	0,3	3,0	0,4	0,0	0,4	3,6	0,5
	500 to 2 500 km	0,0	0,3	5,2	0,4	0,0	0,4	6,2	0,5
	2 500 to 10 000 km	0,0	0,3	10,5	0,4	0,0	0,4	12,6	0,5
	Above 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_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes or pellets from forest residues (case 1)	1 to 500 km	0,0	25,8	2,9	0,3	0,0	30,9	3,5	0,3
	500 to 2 500 km	0,0	25,8	2,8	0,3	0,0	30,9	3,3	0,3
	2 500 to 10 000 km	0,0	25,8	4,3	0,3	0,0	30,9	5,2	0,3
	Above 10 000 km	0,0	25,8	7,9	0,3	0,0	30,9	9,5	0,3

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Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)				Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes or pellets from forest residues (case 2a)	1 to 500 km	0,0	12,5	3,0	0,3	0,0	15,0	3,6	0,3
	500 to 2 500 km	0,0	12,5	2,9	0,3	0,0	15,0	3,5	0,3
	2 500 to 10 000 km	0,0	12,5	4,4	0,3	0,0	15,0	5,3	0,3
	Above 10 000 km	0,0	12,5	8,1	0,3	0,0	15,0	9,8	0,3
Wood briquettes or pellets from forest residues (case 3a)	1 to 500 km	0,0	2,4	3,0	0,3	0,0	2,8	3,6	0,3
	500 to 2 500 km	0,0	2,4	2,9	0,3	0,0	2,8	3,5	0,3
	2 500 to 10 000 km	0,0	2,4	4,4	0,3	0,0	2,8	5,3	0,3
	Above 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 to 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 to 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 to 10 000 km	5,3	0,3	4,4	0,3	5,3	0,4	5,3	0,3

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Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)				Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes from short rotation coppice (Poplar – Fertilised – case 1)	1 to 500 km	3,4	24,5	2,9	0,3	3,4	29,4	3,5	0,3
	500 to 10 000 km	3,4	24,5	4,3	0,3	3,4	29,4	5,2	0,3
	Above 10 000 km	3,4	24,5	7,9	0,3	3,4	29,4	9,5	0,3
Wood briquettes from short rotation coppice (Poplar – Fertilised – case 2a)	1 to 500 km	4,4	10,6	3,0	0,3	4,4	12,7	3,6	0,3
	500 to 10 000 km	4,4	10,6	4,4	0,3	4,4	12,7	5,3	0,3
	Above 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 3a)	1 to 500 km	4,6	0,3	3,0	0,3	4,6	0,4	3,6	0,3
	500 to 10 000 km	4,6	0,3	4,4	0,3	4,6	0,4	5,3	0,3
	Above 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 fertilisation – case 1)	1 to 500 km	2,0	24,5	2,9	0,3	2,0	29,4	3,5	0,3
	500 to 2 500 km	2,0	24,5	4,3	0,3	2,0	29,4	5,2	0,3
	2 500 to 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 fertilisation – case 2a)	1 to 500 km	2,5	10,6	3,0	0,3	2,5	12,7	3,6	0,3
	500 to 10 000 km	2,5	10,6	4,4	0,3	2,5	12,7	5,3	0,3
	Above 10 000 km	2,5	10,6	8,1	0,3	2,5	12,7	9,8	0,3

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Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)				Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes from short rotation coppice (Poplar – no fertilisation– case 3a)	1 to 500 km	2,6	0,3	3,0	0,3	2,6	0,4	3,6	0,3
	500 to 10 000 km	2,6	0,3	4,4	0,3	2,6	0,4	5,3	0,3
	Above 10 000 km	2,6	0,3	8,2	0,3	2,6	0,4	9,8	0,3
Wood briquettes or pellets from stemwood (case 1)	1 to 500 km	1,1	24,8	2,9	0,3	1,1	29,8	3,5	0,3
	500 to 2 500 km	1,1	24,8	2,8	0,3	1,1	29,8	3,3	0,3
	2 500 to 10 000 km	1,1	24,8	4,3	0,3	1,1	29,8	5,2	0,3
	Above 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 to 500 km	1,4	11,0	3,0	0,3	1,4	13,2	3,6	0,3
	500 to 2 500 km	1,4	11,0	2,9	0,3	1,4	13,2	3,5	0,3
	2 500 to 10 000 km	1,4	11,0	4,4	0,3	1,4	13,2	5,3	0,3
	Above 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 to 500 km	1,4	0,8	3,0	0,3	1,4	0,9	3,6	0,3
	500 to 2 500 km	1,4	0,8	2,9	0,3	1,4	0,9	3,5	0,3
	2 500 to 10 000 km	1,4	0,8	4,4	0,3	1,4	0,9	5,3	0,3
	Above 10 000 km	1,4	0,8	8,2	0,3	1,4	0,9	9,8	0,3

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Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value ($g\ CO_2eq/MJ$)				Greenhouse gas emissions – default value ($g\ CO_2eq/MJ$)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes or pellets from wood industry residues (case 1)	1 to 500 km	0,0	14,3	2,8	0,3	0,0	17,2	3,3	0,3
	500 to 2 500 km	0,0	14,3	2,7	0,3	0,0	17,2	3,2	0,3
	2 500 to 10 000 km	0,0	14,3	4,2	0,3	0,0	17,2	5,0	0,3
	Above 10 000 km	0,0	14,3	7,7	0,3	0,0	17,2	9,2	0,3
Wood briquettes or pellets from wood industry residues (case 2a)	1 to 500 km	0,0	6,0	2,8	0,3	0,0	7,2	3,4	0,3
	500 to 2 500 km	0,0	6,0	2,7	0,3	0,0	7,2	3,3	0,3
	2 500 to 10 000 km	0,0	6,0	4,2	0,3	0,0	7,2	5,1	0,3
	Above 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 to 500 km	0,0	0,2	2,8	0,3	0,0	0,3	3,4	0,3
	500 to 2 500 km	0,0	0,2	2,7	0,3	0,0	0,3	3,3	0,3
	2 500 to 10 000 km	0,0	0,2	4,2	0,3	0,0	0,3	5,1	0,3
	Above 10 000 km	0,0	0,2	7,8	0,3	0,0	0,3	9,3	0,3

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Agriculture pathways

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Agricultural Residues with density < 0,2 t/m^3	1 to 500 km	0,0	0,9	2,6	0,2	0,0	1,1	3,1	0,3
	500 to 2 500 km	0,0	0,9	6,5	0,2	0,0	1,1	7,8	0,3
	2 500 to 10 000 km	0,0	0,9	14,2	0,2	0,0	1,1	17,0	0,3
	Above 10 000 km	0,0	0,9	28,3	0,2	0,0	1,1	34,0	0,3
Agricultural Residues with density > 0,2 t/m^3	1 to 500 km	0,0	0,9	2,6	0,2	0,0	1,1	3,1	0,3
	500 to 2 500 km	0,0	0,9	3,6	0,2	0,0	1,1	4,4	0,3
	2 500 to 10 000 km	0,0	0,9	7,1	0,2	0,0	1,1	8,5	0,3
	Above 10 000 km	0,0	0,9	13,6	0,2	0,0	1,1	16,3	0,3
Straw pellets	1 to 500 km	0,0	5,0	3,0	0,2	0,0	6,0	3,6	0,3
	500 to 10 000 km	0,0	5,0	4,6	0,2	0,0	6,0	5,5	0,3
	Above 10 000 km	0,0	5,0	8,3	0,2	0,0	6,0	10,0	0,3
Bagasse briquettes	500 to 10 000 km	0,0	0,3	4,3	0,4	0,0	0,4	5,2	0,5
	Above 10 000 km	0,0	0,3	8,0	0,4	0,0	0,4	9,5	0,5
Palm Kernel Meal	Above 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 oil mill)	Above 10 000 km	21,6	3,5	11,2	0,2	21,6	4,2	13,5	0,3

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Disaggregated default values for biogas for the production of electricity

Biomass fuel production system		Technology	TYPICAL VALUE [g CO_2eq/MJ]					DEFAULT VALUE [g CO_2eq/MJ]				
			Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits	Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits
Wet manure (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
		Close 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
		Close 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
		Close digestate	0,0	4,6	8,9	0,8	– 108,5	0,0	6,4	12,5	0,8	– 108,5
Maize whole plant (2)	case 1	Open digestate	15,6	13,5	8,9	0,0 (3)	—	15,6	18,9	12,5	0,0	—
		Close digestate	15,2	0,0	8,9	0,0	—	15,2	0,0	12,5	0,0	—

(1) The values for biogas production from manure include negative emissions for emissions saved from raw manure management. The value of e_{sca} considered is equal to – 45 g CO_2eq/MJ manure used in anaerobic digestion.

(2) Maize whole plant means maize harvested as fodder and ensiled for preservation.

(3) Transport of agricultural raw materials to the transformation plant is, according to the methodology provided in the Commission's 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. The value for transport of maize silage accounts for 0,4 g CO_2eq/MJ biogas.

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Biomass fuel production system		Technology	TYPICAL VALUE [g CO_2eq/MJ]					DEFAULT VALUE [g CO_2eq/MJ]				
			Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits	Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits
	case 2	Open digestate	15,6	18,8	8,9	0,0	—	15,6	26,3	12,5	0,0	—
		Close 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	—
		Close 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	—
		Close 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	—
		Close 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	—
		Close digestate	0,0	6,5	8,9	0,5	—	0,0	9,1	12,5	0,5	—

▼B

Disaggregated default values for biomethane

Biomethane production system	Technological option		TYPICAL VALUE [g CO_2eq/MJ]						DEFAULT VALUE [g CO_2eq/MJ]					
			Cultivation	Processing	Upgrading	Transport	Compression at filling station	Manure credits	Cultivation	Processing	Upgrading	Transport	Compression at filling station	Manure credits
Wet manure	Open digestate	no 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
		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
	Close digestate	no 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
		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 whole plant	Open digestate	no off-gas combustion	18,1	20,1	19,5	0,0	3,3	—	18,1	28,1	27,3	0,0	4,6	—
		off-gas combustion	18,1	20,1	4,5	0,0	3,3	—	18,1	28,1	6,3	0,0	4,6	—
	Close digestate	no off-gas combustion	17,6	4,3	19,5	0,0	3,3	—	17,6	6,0	27,3	0,0	4,6	—
		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	no off-gas combustion	0,0	30,6	19,5	0,6	3,3	—	0,0	42,8	27,3	0,6	4,6	—
		off-gas combustion	0,0	30,6	4,5	0,6	3,3	—	0,0	42,8	6,3	0,6	4,6	—
	Close digestate	no off-gas combustion	0,0	5,1	19,5	0,5	3,3	—	0,0	7,2	27,3	0,5	4,6	—
		off-gas combustion	0,0	5,1	4,5	0,5	3,3	—	0,0	7,2	6,3	0,5	4,6	—

▼B

D. TOTAL TYPICAL AND DEFAULT VALUES FOR BIOMASS FUEL PATHWAYS

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Woodchips from forest residues	1 to 500 km	5	6
	500 to 2 500 km	7	9
	2 500 to 10 000 km	12	15
	Above 10 000 km	22	27
Woodchips from short rotation coppice (Eucalyptus)	2 500 to 10 000 km	16	18
Woodchips from short rotation coppice (Poplar – Fertilised)	1 to 500 km	8	9
	500 to 2 500 km	10	11
	2 500 to 10 000 km	15	18
	Above 10 000 km	25	30
Woodchips from short rotation coppice (Poplar – No fertilisation)	1 to 500 km	6	7
	500 to 2 500 km	8	10
	2 500 to 10 000 km	14	16
	Above 10 000 km	24	28
Woodchips from stemwood	1 to 500 km	5	6
	500 to 2 500 km	7	8
	2 500 to 10 000 km	12	15
	Above 10 000 km	22	27
Woodchips from industry residues	1 to 500 km	4	5
	500 to 2 500 km	6	7
	2 500 to 10 000 km	11	13
	Above 10 000 km	21	25
Wood briquettes or pellets from forest residues (case 1)	1 to 500 km	29	35
	500 to 2 500 km	29	35
	2 500 to 10 000 km	30	36
	Above 10 000 km	34	41
Wood briquettes or pellets from forest residues (case 2a)	1 to 500 km	16	19
	500 to 2 500 km	16	19
	2 500 to 10 000 km	17	21
	Above 10 000 km	21	25

▼B

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Wood briquettes or pellets from forest residues (case 3a)	1 to 500 km	6	7
	500 to 2 500 km	6	7
	2 500 to 10 000 km	7	8
	Above 10 000 km	11	13
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 1)	2 500 to 10 000 km	33	39
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 2a)	2 500 to 10 000 km	20	23
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 3a)	2 500 to 10 000 km	10	11
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised – case 1)	1 to 500 km	31	37
	500 to 10 000 km	32	38
	Above 10 000 km	36	43
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised – case 2a)	1 to 500 km	18	21
	500 to 10 000 km	20	23
	Above 10 000 km	23	27
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised – case 3a)	1 to 500 km	8	9
	500 to 10 000 km	10	11
	Above 10 000 km	13	15
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 1)	1 to 500 km	30	35
	500 to 10 000 km	31	37
	Above 10 000 km	35	41
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 2a)	1 to 500 km	16	19
	500 to 10 000 km	18	21
	Above 10 000 km	21	25
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 3a)	1 to 500 km	6	7
	500 to 10 000 km	8	9
	Above 10 000 km	11	13

▼B

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Wood briquettes or pellets from stemwood (case 1)	1 to 500 km	29	35
	500 to 2 500 km	29	34
	2 500 to 10 000 km	30	36
	Above 10 000 km	34	41
Wood briquettes or pellets from stemwood (case 2a)	1 to 500 km	16	18
	500 to 2 500 km	15	18
	2 500 to 10 000 km	17	20
	Above 10 000 km	21	25
Wood briquettes or pellets from stemwood (case 3a)	1 to 500 km	5	6
	500 to 2 500 km	5	6
	2 500 to 10 000 km	7	8
	Above 10 000 km	11	12
Wood briquettes or pellets from wood industry residues (case 1)	1 to 500 km	17	21
	500 to 2 500 km	17	21
	2 500 to 10 000 km	19	23
	Above 10 000 km	22	27
Wood briquettes or pellets from wood industry residues (case 2a)	1 to 500 km	9	11
	500 to 2 500 km	9	11
	2 500 to 10 000 km	10	13
	Above 10 000 km	14	17
Wood briquettes or pellets from wood industry residues (case 3a)	1 to 500 km	3	4
	500 to 2 500 km	3	4
	2 500 to 10 000	5	6
	Above 10 000 km	8	10

▼B

Case 1 refers to processes in which a Natural Gas boiler is used to provide the process heat to the pellet mill. Process electricity is purchased 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. Process electricity is purchased 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.

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Agricultural Residues with density < 0,2 t/m^3 (1)	1 to 500 km	4	4
	500 to 2 500 km	8	9
	2 500 to 10 000 km	15	18
	Above 10 000 km	29	35
Agricultural Residues with density > 0,2 t/m^3 (2)	1 to 500 km	4	4
	500 to 2 500 km	5	6
	2 500 to 10 000 km	8	10
	Above 10 000 km	15	18
Straw pellets	1 to 500 km	8	10
	500 to 10 000 km	10	12
	Above 10 000 km	14	16
Bagasse briquettes	500 to 10 000 km	5	6
	Above 10 000 km	9	10
Palm Kernel Meal	Above 10 000 km	54	61
Palm Kernel Meal (no CH_4 emissions from oil mill)	Above 10 000 km	37	40

(1) This group of materials includes agricultural residues with a low bulk density and it comprises materials such as straw bales, oat hulls, rice husks and sugar cane bagasse bales (not exhaustive list).

(2) The group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soybean hulls, palm kernel shells (not exhaustive list).

▼B

Typical and default values – biogas for electricity

Biogas production system	Technological option		Typical value	Default value
			Greenhouse gas emissions (g CO_2eq/MJ)	Greenhouse gas emissions (g CO_2eq/MJ)
Biogas for electricity from wet manure	Case 1	Open digestate (1)	– 28	3
		Close digestate (2)	– 88	– 84
	Case 2	Open digestate	– 23	10
		Close digestate	– 84	– 78
	Case 3	Open digestate	– 28	9
		Close digestate	– 94	– 89
Biogas for electricity from maize whole plant	Case 1	Open digestate	38	47
		Close digestate	24	28
	Case 2	Open digestate	43	54
		Close digestate	29	35
	Case 3	Open digestate	47	59
		Close digestate	32	38
Biogas for electricity from biowaste	Case 1	Open digestate	31	44
		Close digestate	9	13
	Case 2	Open digestate	37	52
		Close digestate	15	21
	Case 3	Open digestate	41	57
		Close digestate	16	22

(1) Open storage of digestate accounts for additional emissions of methane which change with the weather, the substrate and the digestion efficiency. In these calculations the amounts are taken to be equal to 0,05 MJ CH_4/MJ biogas for manure, 0,035 MJ CH_4/MJ biogas for maize and 0,01 MJ CH_4/MJ biogas for biowaste.

(2) Close storage means that the digestate resulting from the digestion process is stored in a gas tight tank and the additional biogas released during storage is considered to be recovered for production of additional electricity or biomethane.

▼B

Typical and default values for biomethane

Biomethane production system	Technological option	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Biomethane from wet manure	Open digestate, no off-gas combustion (1)	– 20	22
	Open digestate, off-gas combustion (2)	– 35	1
	Close digestate, no off-gas combustion	– 88	– 79
	Close digestate, off-gas combustion	– 103	– 100
Biomethane from maize whole plant	Open digestate, no off-gas combustion	58	73
	Open digestate, off-gas combustion	43	52
	Close digestate, no off-gas combustion	41	51
	Close digestate, off-gas combustion	26	30
Biomethane from biowaste	Open digestate, no off-gas combustion	51	71
	Open digestate, off-gas combustion	36	50
	Close digestate, no off-gas combustion	25	35
	Close digestate, off-gas combustion	10	14

(1) This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0,03 MJ CH_4/MJ biomethane for the emission of methane in the off-gases.

(2) This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off-gas is combusted, if any).

▼B

Typical and default values – biogas for electricity – mixtures of manure and maize: greenhouse gas emissions with shares given on a fresh mass basis

Biogas production system		Technological options	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Manure – Maize 80 % - 20 %	Case 1	Open digestate	17	33
		Close digestate	– 12	– 9
	Case 2	Open digestate	22	40
		Close digestate	– 7	– 2
	Case 3	Open digestate	23	43
		Close digestate	– 9	– 4
Manure – Maize 70 % - 30 %	Case 1	Open digestate	24	37
		Close digestate	0	3
	Case 2	Open digestate	29	45
		Close digestate	4	10
	Case 3	Open digestate	31	48
		Close digestate	4	10
Manure – Maize 60 % - 40 %	Case 1	Open digestate	28	40
		Close digestate	7	11
	Case 2	Open digestate	33	47
		Close digestate	12	18
	Case 3	Open digestate	36	52
		Close digestate	12	18

Comments

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.

▼B

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 maize: greenhouse gas emissions with shares given on a fresh mass basis

Biomethane production system	Technological options	Typical value	Default value
		(g CO_2eq/MJ)	(g CO_2eq/MJ)
Manure – Maize 80 % - 20 %	Open digestate, no off-gas combustion	32	57
	Open digestate, off-gas combustion	17	36
	Close digestate, no off-gas combustion	– 1	9
	Close digestate, off-gas combustion	– 16	– 12
Manure – Maize 70 % - 30 %	Open digestate, no off-gas combustion	41	62
	Open digestate, off-gas combustion	26	41
	Close digestate, no off-gas combustion	13	22
	Close digestate, off-gas combustion	– 2	1
Manure – Maize 60 % - 40 %	Open digestate, no off-gas combustion	46	66
	Open digestate, off-gas combustion	31	45
	Close digestate, no off-gas combustion	22	31
	Close digestate, off-gas combustion	7	10

Where biomethane is used as Compressed Biomethane as a transport fuel, a value of 3,3 g CO_2eq/MJ biomethane needs to be added to the typical values and a value of 4,6 g CO_2eq/MJ biomethane to the default values.

▼**M1**

ANNEX VII

ACCOUNTING OF RENEWABLE ENERGY USED FOR HEATING AND COOLING

PART A: ACCOUNTING OF RENEWABLE ENERGY FROM HEAT PUMPS USED FOR HEATING

The amount of aerothermal, geothermal or hydrothermal energy captured by heat pumps to be considered to be energy from renewable sources for the purposes of this Directive, E_{RES}, shall be calculated in accordance with the following formula:

$$E_{RES} = Q_{usable} * (1 - 1/SPF)$$

where

—	Q_{usable}	=	the estimated total usable heat delivered by heat pumps fulfilling the criteria referred to in ►**M2** Article 7(3) ◄, implemented as follows: Only heat pumps for which SPF > 1,15 * 1/η shall be taken into account,
—	SPF	=	the estimated average seasonal performance factor for those heat pumps,
—	H	=	the ratio between total gross production of electricity and the primary energy consumption for the production of electricity and shall be calculated as an EU average based on Eurostat data.

PART B: ACCOUNTING OF RENEWABLE ENERGY USED FOR COOLING

1. **DEFINITIONS**

When calculating renewable energy used for cooling the following definitions shall apply:

(1) ‘cooling’ means the extraction of heat from an enclosed or indoor space (comfort application) or from a process in order to reduce the space or process temperature to, or maintain it at, a specified temperature (set point); for cooling systems, the extracted heat is rejected into and absorbed by the ambient air, ambient water or the ground, where the environment (air, ground, and water) provides a sink for the heat extracted and thus functions as a cold source;

(2) ‘cooling system’ means an assembly of components consisting of a heat extraction system, one or several cooling devices and a heat rejection system, complemented in the case of active cooling with a cooling medium in the form of fluid that work together to generate a specified heat transfer and, thus, ensures a required temperature;

(a) for space cooling, the cooling system can be either a free cooling system or a cooling system embedding a cooling generator, and for which cooling is one of the primary functions;

(b) for process cooling, the cooling system is embedding a cooling generator, and for which cooling is one of the primary functions;

▼**M1**

(3) ‘free cooling’ means a cooling system using a natural cold source to extract heat from the space or process to be cooled via fluid(s) transportation with pump(s) and/or fan(s) and which does not require the use of a cooling generator;

(4) ‘cooling generator’ means the part of a cooling system that generates a temperature difference allowing heat extraction from the space or process to be cooled, using a vapour compression cycle, a sorption cycle or driven by another thermodynamic cycle, used when the cold source is unavailable or insufficient;

(5) ‘active cooling’ means the removal of heat from a space or process, for which an energy input is needed to meet the cooling demand, used when the natural flow of energy is unavailable or insufficient and can occur with or without a cooling generator;

(6) ‘passive cooling’ means the removal of heat by the natural flow of energy through conduction, convection, radiation or mass transfer without the need for moving a cooling fluid to extract and reject heat or to generate a lower temperature with a cooling generator, including decreasing the need for cooling by building design features such as building insulation, green roof, vegetal wall, shading or increased building mass, by ventilation or by using comfort fans;

(7) ‘ventilation’ means the natural or forced movement of air to introduce ambient air inside a space with the aim to ensure appropriate indoor air quality, including temperature;

(8) ‘comfort fan’ means a product that includes a fan and electric motor assembly to move air and provide summer comfort by increasing the air speed around human body giving a thermal feeling of coolness;

(9) ‘renewable energy quantity for cooling’ means the cooling supply that has been generated with a specified energy efficiency expressed as a Seasonal Performance Factor calculated in primary energy;

(10) ‘heat sink’ or ‘cold source’ means an external natural sink into which the heat extracted from the space or process is transferred; it can be ambient air, ambient water in the form of natural or artificial water bodies and geothermal formations beneath the surface of solid earth;

(11) ‘heat extraction system’ means a device that removes heat from the space or process to be cooled, such as an evaporator in a vapour compression cycle;

(12) ‘cooling device’ means a device designed to perform active cooling;

(13) ‘heat rejection system’ means the device where the final heat transfer from the cooling medium to the heat sink occurs, such as the air-to-refrigerant condenser in an air-cooled vapour compression cycle;

(14) ‘energy input’ means the energy needed to transport the fluid (free cooling), or the energy needed to transport the fluid and to drive the cooling generator (active cooling with a cooling generator);

▼M1

(15) ‘district cooling’ means the distribution of thermal energy in the form of chilled liquids, from central or decentralised sources of production through a network to multiple buildings or sites, for the use of space or process cooling;

(16) ‘primary seasonal performance factor’ means a metric of the primary energy conversion efficiency of the cooling system;

(17) ‘equivalent full load hours’ means the number of hours a cooling system runs with full load to produce the amount of cooling that it actually produces during a year but at varying loads;

(18) ‘Cooling Degree Days’ means the climate values computed with a base of 18 °C used as input to determine equivalent full load hours.

2. **SCOPE**

1. When calculating the amount of renewable energy used for cooling, Member States shall count active cooling, including district cooling, regardless of whether it is free cooling or a cooling generator is used.

2. Member States shall not count:

   (a) passive cooling, although where ventilation air is used as a heat transport medium for cooling, the corresponding cooling supply, which can be supplied either by a cooling generator or by free cooling is part of renewable cooling calculation.

   (b) the following technologies or processes of cooling:

      (i) cooling in means of transportation ([1]);

      (ii) cooling systems whose primary function is to produce or store perishable materials at specified temperatures (refrigeration and freezing);

      (iii) cooling systems with space or process cooling temperature set points lower than 2 °C;

      (iv) cooling systems with space or process cooling temperature set points above 30 °C;

      (v) cooling of waste heat resulting from energy generation, industrial processes and the tertiary sector (waste heat) ([2]).

   (c) energy used for cooling in power generation plants; cement, iron and steel manufacturing; wastewater treatment plants; information technology facilities (such as data centres); power transmission and distribution facilities; and transportation infrastructures.

Member States may exclude more categories of cooling systems from the calculation of the renewable energy used for cooling in order to preserve natural cold sources in specific geographic areas for environmental protection reasons. Examples are the protection of rivers or lakes from the risk of overheating.

([1]) The renewable cooling definition concerns only stationary cooling.
([2]) Waste heat is defined in Article 2(9) of this Directive. Waste heat can be accounted for the purposes of Articles 23 and 24 of this Directive.

▼M1

3. METHODOLOGY FOR ACCOUNTING OF RENEWABLE ENERGY FOR INDIVIDUAL AND DISTRICT COOLING

Only cooling systems operating above the minimum efficiency requirement expressed as primary Seasonal Performance Factor (SPF_p) in section 3.2, second paragraph shall be considered to produce renewable energy.

3.1. Renewable energy quantity for cooling

The renewable energy quantity for cooling (E_{RES-C}) shall be calculated with the following formula:

$$E_{RES-C} = (Q_{C_{Source}} - E_{INPUT}) \times s_{SPF_p} = Q_{C_{Supply}} \times s_{SPF_p}$$

where:

$Q_{C_{Source}}$ is the amount of heat released to the ambient air, ambient water or to the ground by the cooling system ([1]);

E_{INPUT} is the energy consumption of the cooling system, including energy consumption of the auxiliary systems for measured systems, such as district cooling;

$Q_{C_{Supply}}$ is the cooling energy supplied by the cooling system ([2]);

s_{SPF_p} is defined at cooling system level as the share of the cooling supply that can be considered as renewable according to the SPF requirements, expressed as a percentage. The SPF is established without accounting for distribution losses. For district cooling, this means that the SPF is established per cooling generator, or at free cooling system level. For cooling systems where standard SPF can apply, the F(1) and F(2) coefficients according to Commission Regulation (EU) 2016/2281 ([3]) and the linked Commission Communication ([4]) are not used as correction factors.

For 100 % renewable heat driven cooling (absorption and adsorption) the cooling delivered should be considered fully renewable.

The calculation steps needed for $Q_{C_{Supply}}$ and s_{SPF_p} are explained in Sections 3.2 to 3.4.

([1]) The quantity of cold source corresponds to the quantity of heat absorbed by ambient air, ambient water and the ground acting as heat sinks. Ambient air and ambient water correspond to ambient energy as defined in Article 2(2) of this Directive. The ground correspond to geothermal energy as defined in Article 2(3) of this Directive.

([2]) From a thermodynamical point of view, cooling supply corresponds to a portion of the heat released by a cooling system to ambient air, ambient water or to the ground, which function as a heat sink or cold source. Ambient air and ambient water correspond to ambient energy as defined in Article 2(2) of this Directive. The heat sink or cold source function of the ground corresponds to geothermal energy as defined in Article 2(3) of this Directive.

([3]) Commission Regulation (EU) 2016/2281 of 30 November 2016 implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units (OJ L 346, 20.12.2016, p. 1).

([4]) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2017.229.01.0001.01.ENG&toc=OJ:C:2017:229:TOC

▼M1

3.2. **Calculation of the share of Seasonal Performance Factor that qualifies as renewable energy – S_{SPF_p}**

S_{SPF} is the share of cooling supply that can be counted as renewable. The S_{SPF_p} increases with increasing SPF_p values. The SPF_p ([1]) is defined as described in Commission Regulation (EU) 2016/2281 and Commission Regulation (EU) No 206/2012 ([2]), except that the default primary energy factor for electricity has been updated to 2.1 in Directive 2012/27/EU (as amended by Directive (EU) 2018/2002 ([3])) of the European Parliament and of the Council. Boundary conditions from the EN14511 standard shall be used.

The minimum efficiency requirement of the cooling system expressed in primary seasonal performance factor shall be at least 1.4 ($SPFp_{LOW}$). For S_{SPF_p} to be 100 % the minimum efficiency requirement of the cooling system shall be at least 6 ($SPFp_{HIGH}$). For all the other cooling systems the following calculation shall be applied:

$$SSPFp = \frac{SPF_p - SPF_{p\_LOW}}{SPF_{p\_HIGH} - SPF_{p\_LOW}} \%$$

SPFp is the efficiency of the cooling system expressed as primary seasonal performance factor;

$SPFp_{LOW}$ is the minimum seasonal performance factor expressed in primary energy and based upon the efficiency of standard cooling systems (minimum eco-design requirements);

$SPFp_{HIGH}$ is the upper threshold for seasonal performance factor expressed in primary energy and based on best practices for free cooling used in district cooling ([4]).

3.3. **Calculation of renewable energy quantity for cooling using standard and measured SPF_p**

Standard and measured SPF

Standardised SPF values are available for electric vapour compression cooling generators and combustion engine vapour compression cooling generator due to the Ecodesign requirements in Regulation (EU) No 206/2012 and (EU) No 2016/2281. Values are available for these cooling generators up to 2 MW for comfort cooling and up to 1.5 MW for process cooling. For other technologies and capacity scales standard values are not available. As regards district cooling, standard values are not available but measurements are used and available; these allow to compute SPF values at least on a yearly basis.

([1]) In case the real operating conditions of cooling generators lead to SPF values substantially lower than planned in standard conditions because of different installation provisions, Member States may exclude these systems from the scope of the renewable cooling definition (e.g. a water cooled cooling generator using a dry cooler instead of a cooling tower to release heat to ambient air).

([2]) Commission Regulation (EU) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans (OJ L 72, 10.3.2012, p. 7).

([3]) Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (OJ L 328, 21.12.2018, p. 210).

([4]) ENER/C1/2018-493, Renewable cooling under the revised Renewable Energy Directive, TU-Wien, 2021.

▼M1

To calculate the quantity of renewable cooling, standard SPF values may be used where available. Where standard values are not available or measurement is standard practice, measured SPF values shall be used, separated by cooling capacity thresholds. For cooling generators with a cooling capacity below 1.5 MW, standard SPF can be used, while measured SPF shall be used for district cooling, for cooling generators with cooling capacities higher than or equal to 1.5 MW and cooling generators for which standard values are not available.

In addition, for all cooling systems without standard SPF, which includes all free cooling solutions and heat activated cooling generators, a measured SPF shall be established in order to take advantage of the calculation methodology for renewable cooling.

Definition of standard SPF values

SPF values are expressed in terms of primary energy efficiency calculated using primary energy factors following Regulation (EU) 2016/2281 to determine the space cooling efficiency for the different types of cooling generators ([1]). The primary energy factor in Regulation (EU) 2016/2281 shall be calculated as $1/\eta$, where η is the average ratio of total gross production of electricity to the primary energy consumption for electricity production in the whole EU. With the amendment of the default primary energy factor for electricity, called coefficient in point (1) of the Annex to Directive (EU) 2018/2002 amending footnote (3) in Annex IV of Directive 2012/27/EU, the primary energy factor of 2.5 in Regulation (EU) 2016/2281 shall be replaced by 2.1 when calculating the SPF values.

When primary energy carriers, such as heat or gas are used as energy input to drive the cooling generator, the default primary energy factor ($1/\eta$) is 1, reflecting the lack of energy transformation $\eta = 1$.

The standard operating conditions and the other parameters necessary for the determination of the SPF are defined in Regulation (EU) 2016/2281 and Regulation (EU) No 206/2012, depending on the cooling generator category. Boundary conditions are the ones defined in the EN14511 standard.

For reversible cooling generators (reversible heat pumps), which are excluded from the scope of Regulation (EU) 2016/2281 because their heating function is covered by Commission Regulation (EU) No 813/2013 ([2]) with regard to Ecodesign requirements for space heaters and combination heaters, the same SPF calculation that is defined for similar non reversible cooling generators in Regulation (EU) 2016/2281 shall be used.

For instance, for electric vapour compression cooling generators, the SPF_p shall be defined as follows (the index *p* is used to clarify that the SPF is defined in terms of primary energy):

([1]) SPF_p is identical to $\eta_{s,c}$ defined in Regulation (EU) No 2016/2281.

([2]) Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters (OJ L 239, 6.9.2013, p. 136).

▼M1

— For space cooling: $SPF_p = \frac{SEER}{\frac{1}{\eta}} - F(1) - F(2)$

— For process cooling: $SPF_p = \frac{SEPR}{\frac{1}{\eta}} - F(1) - F(2)$

Where:

— SEER and SEPR are seasonal performance factors ([1]) (SEER stands for 'Seasonal Energy Efficiency Ratio', SEPR stands for 'Seasonal Energy Performance Ratio') in final energy defined according to Regulation (EU) 2016/2281 and Regulation (EU) No 206/2012;

— η is the average ratio of total gross production of electricity to the primary energy consumption for electricity production in the EU (η = 0.475 and 1/η = 2.1).

F(1) and F(2) are correction factors according to Regulation (EU) 2016/2281 and the linked Commission Communication. These coefficients do not apply to process cooling in Regulation (EU) 2016/2281 as the SEPR final energy metrics is directly used. In absence of adapted values, the same values used for SEER conversion shall be used for the SEPR conversion.

SPF boundary conditions

For defining the SPF of the cooling generator, the SPF boundary conditions defined in Regulation (EU) No 2281/2016 and in Regulation (EU) No 206/2012 shall be used. In the case of water-to-air and water-to-water cooling generators, the energy input required to make the cold source available is included via the F(2) correction factor. The SPF boundary conditions are shown in Figure 1. These boundary conditions shall apply for all cooling systems, either free cooling systems or systems containing cooling generators.

These boundary conditions are similar to the ones for heat pumps (used in heating mode) in Commission Decision 2013/114/EU ([2]). The difference is that for heat pumps, the electricity consumption corresponding to auxiliary power consumption (thermostat-off mode, standby mode, off mode, crankcase heater) is not taken into account to evaluate the SPF. However, as in the case of cooling both standard SPF values and measured SPF will be used, and given the fact that in the measured SPF auxiliary consumption is taken into account, it is necessary to include auxiliary power consumption in both situations.

For district cooling, distribution cold losses and distribution pump electric consumption between the cooling plant and the customer substation shall not be included in the estimation of the SPF.

([1]) Part 1 of the study ENER/C1/2018-493 on 'Cooling Technologies Overview and Market Share' provides more detailed definitions and equations for these metrics in chapter 1.5 'Energy efficiency metrics of state-of-the-art cooling systems'.

([2]) Commission Decision of 1 March 2013 establishing the guidelines for Member States on calculating renewable energy from heat pumps from different heat pump technologies pursuant to Article 5 of Directive 2009/28/EC of the European Parliament and of the Council (OJ L 62, 6.3.2013, p. 27).

▼M1

In the case of air based cooling systems ensuring also the ventilation function, the cooling supply due to ventilation air flow shall not be accounted. The fan power needed for the ventilation shall also be discounted in proportion of the ratio of the ventilation air flow to the cooling air flow.

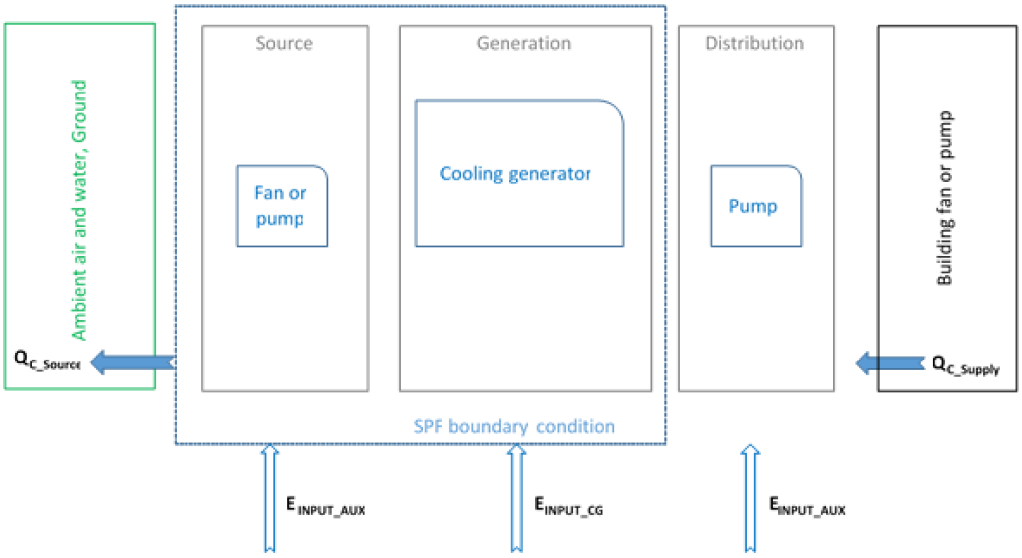

Figure 1 Illustration of SPF boundary conditions for cooling generator using standard SPF and district cooling (and other large cooling systems using measured SPF), where E_{INPUT_AUX} is the energy input to fan and/or pump and E_{INPUT_CG} the energy input to the cooling generator

In the case of air based cooling systems with internal cold recovery, the cooling supply due to the cold recovery shall not be accounted. The fan power needed for the cold recovery performed by the heat exchanger shall be discounted in proportion of the ratio of the pressure losses due to the cold recovery heat exchanger to the total pressure losses of the air based cooling system.

3.4. Calculation using standard values

A simplified method may be used for individual cooling systems of less than 1.5 MW capacity, for which a standard SPF value is available, to estimate the total cooling energy supplied.

Under the simplified method, the cooling energy supplied by the cooling system ($Q_{Csupply}$) is the nominal cooling capacity *(Pc)* multiplied by the number of equivalent full load hours *(EFLH)*. A single Cooling Degree Days (CDD) value may be used for a whole country, or distinct values for different climate zones provided that nominal capacities and SPFs are available for these climate zones.

The following default methods may be used to compute *EFLH*:

— for space cooling in the residential sector: EFLH = 96 + 0.85 * CDD

— for space cooling in the tertiary sector: EFLH = 475 + 0.49 * CDD

— for process cooling: EFLH = τ_s * (7300 + 0.32 * CDD)

▼**M1**

Where:

τ_s is an activity factor to account for the operation time of the specific processes (e.g. all year long τ_s = 1, not on weekends τ_s = 5/7). There is no default value.

3.4.1. *Calculation using measured values*

Systems for which no standard values exist, as well as cooling systems larger than 1.5 MW capacity and district cooling systems**,** shall calculate their renewable cooling based on the following measurements:

Measured energy input: The measured energy input includes all energy sources for the cooling system, including any cooling generator, i.e. electricity, gas, heat etc.. It includes also auxiliary pumps and fans used in the cooling system but not for the distribution of cooling to a building or a process. In case of air-based cooling with ventilation function, only the additional energy input due to cooling shall be included in the energy input of the cooling system.

Measured cooling energy supply: The cooling energy supply shall be measured as the output from the cooling system and subtracted any cold losses in order to estimate the net cooling energy supply to the building or process that is the end-user of the cooling. The cold losses include losses in a district cooling system and in the cooling distribution system in a building or an industrial site. In case of air-based cooling with ventilation function, the cooling energy supply shall be net of the effect of fresh air introduction for ventilation purposes.

The measurements need to be carried out for the specific year to be reported i.e. all energy input and all cooling energy supply for the whole year.

3.4.2. *District cooling: additional requirements*

For district cooling systems the net cooling supply at customer level shall be accounted when defining the net cooling supply, denoted as $Q_{C\_Supply\_net}$ Thermal losses occurring in the distribution network (Q_{c_LOSS}) shall be deducted from the gross cooling supply ($Q_{c\_Supply\_gross}$) as follows:

$$Q_{C\_Supply\_net} = Q_{c\_Supply\_gross-} - Q_{c\_LOSS}$$

3.4.2.1. *Division in subsystems*

District cooling systems can be divided in subsystems, which comprise at least one cooling generator or free cooling system. This requires the measurement of the cooling energy supply and of the energy input for each sub-system as well as the allocation of cold losses per sub-system as follows:

$$Q_{C\_Supply\_net\_i} = Q_{C\_Supply\_gross\_i} x \left(1 - \frac{Q_{C_{LOSS}}}{\left(\sum_{i=1}^{n} Q_{C_{Supply_{gross_i}}}\right)}\right)$$

3.4.2.2. *Auxiliaries*

When dividing a cooling system into subsystems, the auxiliaries (e.g. controls, pumps and fans) of the cooling generator(s) and/or free cooling system(s) shall be included in the same subsystem(s). Auxiliary energy corresponding to cooling distribution inside the building, e.g. secondary pumps and terminal units (e.g. fan coils, fans of air handling units) are not accounted for.

▼M1

For auxiliaries which cannot be allocated to a specific subsystem, for instance district cooling network pumps which deliver the cooling energy supplied by all cooling generators, their primary energy consumption shall be allocated to each cooling subsystem in the proportion of the cooling energy supplied by the cooling generators and/or the free cooling systems of each subsystem, in the same way as with cold losses in the network, as follows

$$E_{INPUT\_AUX\_i} = E_{INPUT\_AUX1\_i} + E_{INPUT\_AUX2} * \frac{Q_{C\_Supply\_net\_i}}{\sum_{i=1}^{n} Q_{C\_Supply\_net\_i}}$$

where:

$E_{INPUT\_AUX1\_i}$ is the auxiliary energy consumption of subsystem 'I';

E_{INPUT_AUX12} is the auxiliary energy consumption of the entire cooling system, which cannot be allocated to a specific cooling subsystem.

3.5. **Calculation of renewable energy quantity for cooling for the overall renewable shares and for the heating and cooling renewable energy shares**

For the calculation of the overall renewable energy shares, the renewable energy quantity for cooling shall be added both to the numerator 'gross final consumption of energy from renewable sources' and to the denominator 'gross final consumption of energy'.

For the calculation of the heating and cooling renewable energy shares the renewable energy quantity for cooling shall be added both to the numerator 'gross final consumption of energy from renewable sources for heating and cooling' and to the denominator 'gross final consumption of energy for heating and cooling'.

3.6. **Guidance on the development of more accurate methodologies and calculations**

It is envisaged and encouraged that Member States do their own estimations for both SPF and EFLH. Any such national/regional approaches should be based on accurate assumptions, representative samples of sufficient size, resulting in a significantly improved estimate of renewable energy compared to that obtained using the methodology set out in this Delegated Act. Such improved methodologies may be based on detailed calculation based on technical data taking into account, among other factors, year of installation, quality of installation, compressor type and machine size, operation mode, distribution system, cascading of generators and the regional climate. Member States that use alternative methodologies and/or values shall submit them to the Commission together with a report describing the method and data used. The Commission will, if necessary, translate the documents and publish them on its transparency platform.

▼B

ANNEX VIII

PART A. PROVISIONAL ESTIMATED INDIRECT LAND-USE CHANGE EMISSIONS FROM BIOFUEL, BIOLIQUID AND BIOMASS FUEL FEEDSTOCK (g CO_2eq/MJ) ([1])

Feedstock group	Mean ([2])	Interpercentile range derived from the sensitivity analysis ([3])
Cereals and other starch-rich crops	12	8 to 16
Sugars	13	4 to 17
Oil crops	55	33 to 66

PART B. BIOFUELS, BIOLIQUIDS AND BIOMASS FUELS FOR WHICH THE ESTIMATED INDIRECT LAND-USE CHANGE EMISSIONS ARE CONSIDERED TO BE ZERO

Biofuels, bioliquids and biomass fuels produced from the following feedstock categories will be considered to have estimated indirect land-use change emissions of zero:

(1) feedstocks which are not listed under part A of this Annex.

(2) feedstocks, the production of which has led to direct land-use change, namely, a change from one of the following IPCC land cover categories: forest land, grassland, wetlands, settlements, or other land, to cropland or perennial cropland ([4]). In such a case a direct land-use change emission value (e_l) should have been calculated in accordance with point 7 of part C of Annex V.

([1]) The mean values reported here represent a weighted average of the individually modelled feedstock values. The magnitude of the values in the Annex is sensitive to the range of assumptions (such as treatment of co-products, yield developments, carbon stocks and displacement of other commodities) used in the economic models developed for their estimation. Although it is therefore not possible to fully characterise the uncertainty range associated with such estimates, a sensitivity analysis conducted on the results based on a random variation of key parameters, a so-called Monte Carlo analysis, was conducted.

([2]) The mean values included here represent a weighted average of the individually modelled feedstock values.

([3]) The range included here reflects 90 % of the results using the fifth and ninety-fifth percentile values resulting from the analysis. The fifth percentile suggests a value below which 5 % of the observations were found (namely, 5 % of total data used showed results below 8, 4, and 33 g CO_2eq/MJ). The ninety-fifth percentile suggests a value below which 95 % of the observations were found (namely, 5 % of total data used showed results above 16, 17, and 66 g CO_2eq/MJ).

([4]) 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.

▼B

ANNEX IX

Part A. Feedstocks ►M2 for the production of biogas for transport and advanced biofuels: ◄

(a) Algae if cultivated on land in ponds or photobioreactors;

(b) Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under point (a) of Article 11(2) of Directive 2008/98/EC;

(c) Biowaste as defined in point (4) of Article 3 of Directive 2008/98/EC from private households subject to separate collection as defined in point (11) of Article 3 of that Directive;

(d) Biomass fraction of industrial waste not fit for use in the food or feed chain, including material from retail and wholesale and the agro-food and fish and aquaculture industry, and excluding feedstocks listed in part B of this Annex;

(e) Straw;

(f) Animal manure and sewage sludge;

(g) Palm oil mill effluent and empty palm fruit bunches;

(h) Tall oil pitch;

(i) Crude glycerine;

(j) Bagasse;

(k) Grape marcs and wine lees;

(l) Nut shells;

(m) Husks;

(n) Cobs cleaned of kernels of corn;

(o) Biomass fraction of wastes and residues from forestry and forest-based industries, namely, bark, branches, pre-commercial thinnings, leaves, needles, tree tops, saw dust, cutter shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil;

(p) Other non-food cellulosic material;

(q) Other ligno-cellulosic material except saw logs and veneer logs.

Part B. Feedstocks ►M2 for the production of biofuels and biogas for transport, the contribution of which towards the targets referred to in Article 25(1), first subparagraph, point (a), shall be limited to: ◄

(a) Used cooking oil;

(b) Animal fats classified as categories 1 and 2 in accordance with Regulation (EC) No 1069/2009.

▼B

ANNEX X

PART A

Repealed Directive with a list of the successive amendments thereto (referred to in Article 37)

Directive 2009/28/EC of the European Parliament and of the Council (OJ L 140, 5.6.2009, p. 16)	
Council Directive 2013/18/EU (OJ L 158, 10.6.2013, p. 230)	
Directive (EU) 2015/1513 of the European Parliament and of the Council (OJ L 239, 15.9.2015, p. 1)	Only Article 2

PART B

Time-limits for transposition into national law

(referred to in Article 36)

Directive	Time-limit for transposition
2009/28/EC	25 June 2009
2013/18/EU	1 July 2013
(EU) 2015/1513	10 September 2017

▼B

ANNEX XI

Correlation table

Directive 2009/28/EC	This Directive
Article 1	Article 1
Article 2, first subparagraph	Article 2, first subparagraph
Article 2, second subparagraph, introductory wording	Article 2, second subparagraph, introductory wording
Article 2, second subparagraph, point (a)	Article 2, second subparagraph, point (1)
Article 2, second subparagraph, point (b)	—
—	Article 2, second subparagraph, point (2)
Article 2, second subparagraph, point (c)	Article 2, second subparagraph, point (3)
Article 2, second subparagraph, point (d)	—
Article 2, second subparagraph, points (e), (f), (g), (h), (i), (j), (k), (l), (m), (n), (o), (p), (q), (r), (s), (t), (u), (v) and (w)	Article 2, second subparagraph, points (24), (4), (19), (32), (33), (12), (5), (6), (45), (46), (47), (23), (39), (41), (42), (43), (36), (44) and (37)
—	Article 2, second subparagraph, points (7), (8), (9), (10), (11), (13), (14), (15), (16), (17), (18), (20), (21), (22), (25), (26), (27), (28), (29), (30), (31), (34), (35), (38) and (40)
Article 3	—
—	Article 3
Article 4	—
—	Article 4
—	Article 5
—	Article 6
Article 5(1)	Article 7(1)
Article 5(2)	—
Article 5(3)	Article 7(2)
Article 5(4), first, second, third and fourth subparagraphs	Article 7(3), first, second, third and fourth subparagraphs
—	Article 7(3), fifth and sixth subparagraphs
—	Article 7(4)
Article 5(5),	Article 27(1), first subparagraph, point (c)
Article 5(6) and (7)	Article 7(5) and (6)
Article 6(1)	Article 8(1)
—	Article 8(2) and (3)
Article 6(2) and (3)	Article 8(4) and (5)
Article 7(1), (2), (3), (4) and (5)	Article 9(1), (2), (3), (4) and (5)
—	Article 9(6)
Article 8	Article 10

▼B

Directive 2009/28/EC	This Directive
Article 9(1)	Article 11(1)
Article 9(2), first subparagraph, points (a), (b) and (c)	Article 11(2), first subparagraph, points (a), (b) and (c)
—	Article 11(2), first subparagraph, point (d)
Article 10	Article 12
Article 11(1), (2) and (3)	Article 13(1), (2) and (3)
—	Article 13(4)
Article 12	Article 14
Article 13(1), first subparagraph	Article 15(1), first subparagraph
Article 13(1), second subparagraph	Article 15(1), second subparagraph
Article 13(1), second subparagraph, points (a) and (b)	—
Article 13(1), second subparagraph, points (c), (d), (e) and (f)	Article 15(1), second subparagraph, points (a), (b), (c) and (d)
Article 13(2), (3), (4) and (5)	Article 15(2), (3), (4) and (5)
Article 13(6), first subparagraph	Article 15(6), first subparagraph
Article 13(6), second, third, fourth and fifth subparagraphs	—
—	Article 15, (7) and (8)
—	Article 16
—	Article 17
Article 14	Article 18
Article 15(1)	Article 19(1)
Article 15(2), first, second and third subparagraphs	Article 19(2) first, second and third subparagraphs
—	Article 19(2), fourth and fifth subparagraphs
Article 15(2), fourth subparagraph	Article 19(2), sixth subparagraph
Article 15(3)	—
—	Article 19(3) and (4)
Article 15(4) and (5)	Article 19(5) and (6)
Article 15(6), first subparagraph, point (a)	Article 19(7), first subparagraph, point (a)
Article 15(6), first subparagraph, point (b)(i)	Article 19(7), first subparagraph, point (b)(i)

▼B

Directive 2009/28/EC	This Directive
—	Article 19(7), first subparagraph, point (b)(ii)
Article 15(6), first subparagraph, point (b)(ii)	Article 19(7), first subparagraph, point (b)(iii)
Article 15(6), first subparagraph, points (c), (d), (e) and (f)	Article 19(7), first subparagraph, points (c), (d), (e) and (f)
—	Article 19(7), second subparagraph
Article 15(7)	Article 19(8)
Article 15(8)	—
Article 15(9) and (10)	Article 19(9) and (10)
—	Article 19(11)
Article 15(11)	Article 19(12)
Article 15(12)	—
—	Article 19(13)
Article 16(1), (2), (3), (4), (5), (6), (7) and (8)	—
Article 16(9), (10) and (11)	Article 20(1), (2) and (3)
—	Article 21
—	Article 22
—	Article 23
—	Article 24
—	Article 25
—	Article 26
—	Article 27
—	Article 28
Article 17(1), first and second subparagraphs	Article 29(1), first and second subparagraphs
—	Article 29(1), third, fourth and fifth subparagraphs
—	Article 29(2)
Article 17(2), first and second subparagraphs	—
Article 17(2), third subparagraph	Article 29(10), third subparagraph
Article 17(3), first subparagraph, point (a)	Article 29(3), first subparagraph, point (a)
—	Article 29(3), first subparagraph, point (b)
Article 17(3), first subparagraph, points (b) and (c)	Article 29(3), first subparagraph, points (c) and (d)
—	Article 29(3), second subparagraph
Article 17(4)	Article 29(4)
Article 17(5)	Article 29(5)

▼B

Directive 2009/28/EC	This Directive
Article 17(6) and (7)	—
—	Article 29(6), (7), (8), (9), (10) and (11)
Article 17(8)	Article 29(12)
Article 17(9)	—
—	Article 29(13) and (14)
Article 18(1), first subparagraph	Article 30(1), first subparagraph
Article 18(1), first subparagraph, points (a), (b) and (c)	Article 30(1), first subparagraph, points (a), (c) and (d)
—	Article 30(1), first subparagraph, point (b)
—	Article 30(1), second subparagraph
Article 18(2)	—
—	Article 30(2)
Article 18(3), first subparagraph	Article 30(3), first subparagraph
Article 18(3), second and third subparagraphs	—
Article 18(3), fourth and fifth subparagraphs	Article 30(3), second and third subparagraphs
Article 18(4), first subparagraph	—
Article 18(4), second and third subparagraphs	Article 30(4), first and second subparagraphs
Article 18(4), fourth subparagraph	—
Article 18(5), first and second subparagraphs	Article 30(7), first and second subparagraphs
Article 18(5), third subparagraph	Article 30(8), first and second subparagraphs
Article 18(5), fourth subparagraph	Article 30(5), third subparagraph
—	Article 30(6), first subparagraph
Article 18(5), fifth subparagraph	Article 30(6), second subparagraph
Article 18(6), first and second subparagraphs	Article 30(5), first and second subparagraphs
Article 18(6), third subparagraph	—
Article 18(6), fourth subparagraph	Article 30(6), third subparagraph
—	Article 30(6), fourth subparagraph
Article 18(6), fifth subparagraph	Article 30(6), fifth subparagraph
Article 18(7)	Article 30(9), first subparagraph
—	Article 30(9), second subparagraph

▼B

Directive 2009/28/EC	This Directive
Article 18(8) and (9)	—
—	Article 30(10)
Article 19(1), first subparagraph	Article 31(1), first subparagraph
Article 19(1), first subparagraph, points (a), (b) and (c)	Article 31(1), first subparagraph, points (a), (b) and (c)
—	Article 31(1), first subparagraph, point (d)
Article 19(2), (3) and (4)	Article 31(2), (3) and (4)
Article 19(5)	—
Article 19(7), first subparagraph	Article 31(5), first subparagraph
Article 19(7), first subparagraph, first, second third and fourth indents	—
Article 19(7), second and third sub-paragraphs	Article 31(5), second and third sub-paragraphs
Article 19(8)	Article 31(6)
Article 20	Article 32
Article 22	—
Article 23(1) and (2)	Article 33(1) and (2)
Article 23(3), (4), (5), (6), (7) and (8)	—
Article 23(9)	Article 33(3)
Article 23(10)	Article 33(4)
Article 24	—
Article 25(1)	Article 34(1)
Article 25(2)	Article 34(2)
Article 25(3)	Article 34(3)
Article 25a(1)	Article 35(1)
Article 25a(2)	Article 35(2) and (3)
Article 25a(3)	Article 35(4)
—	Article 35(5)
Article 25a(4) and (5)	Article 35(6) and (7)
Article 26	—
Article 27	Article 36
—	Article 37
Article 28	Article 38
Article 29	Article 39
Annex I	Annex I
Annex II	Annex II
Annex III	Annex III
Annex IV	Annex IV
Annex V	Annex V
Annex VI	—
—	Annex VI
Annex VII	Annex VII
Annex VIII	Annex VIII
Annex IX	Annex IX
—	Annex X
—	Annex XI