

Greenhouse gas intensities of transport fuels in the EU in 2023

Monitoring under the Fuel Quality Directive



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Executive summary

About this report

This report provides a summary of the information on the greenhouse gas (GHG) emission intensity of fuels supplied for road transport and non-road mobile machinery in the European Union (EU) in 2023, as reported by EU Member States, Northern Ireland⁽¹⁾, Iceland and Norway⁽²⁾ under Art. 7a of Directive 98/70/EC⁽³⁾ relating to the quality of petrol and diesel fuels (the Fuel Quality Directive, FQD).

Article 7a of the Fuel Quality Directive sets out reporting requirements concerning the volume and type of fuels (including fossil fuels, other non-biofuels and biofuels) supplied for road transport and non-road mobile machinery as well as their life cycle greenhouse gas (GHG) emissions (taking into account their extraction, processing and distribution). This approach also considers the emissions resulting from indirect land use change (ILUC) for biofuels. The FQD sets a reduction target for fuel suppliers to reduce the GHG intensity of transport fuels (life cycle GHG emissions per unit of energy from fuel and energy supplied) by a minimum of 6% by 2020 as compared to 2010 levels and to ensure that suppliers respect the target of 6% after the year 2020. Member States must also analyse the share of biofuels in the total amount of fuels consumed for the purposes falling within the scope of the FQD.

The EEA supported the European Commission in the compilation, quality checking and dissemination of information reported under Article 7a of the FQD from 2017 to 2023. This is the final report of this kind by the EEA as the reporting requirement according to Article 7a of the FQD ceased to exist.

Main findings

Fuel suppliers are not sufficiently reducing the GHG intensity of fuels supplied in the EU

According to the data reported in 2024 by the 27 Member States, the average GHG intensity of the fuels⁽⁴⁾ supplied in these countries in 2023 (excluding the ILUC emissions intensity for biofuels) was 88.2 g carbon dioxide equivalent (CO₂e), 6.3% lower than the 2010 levels. This is a slight improvement (0.7 percentage points) compared to 2022, while also representing an additional reduction of 0.8 percentage points compared to the years 2020 and 2021 (5.5% reduction compared to 2010), 2 percentage points compared to 2019 (4.3% reduction compared to 2010, for 28 EU Member States) and of 2.6 percentage points compared to 2018 (3.7% reduction compared to 2010, for 28 EU Member States). Therefore, 2023 was the first year that EU fuel suppliers in the 27 reporting Member States achieved their target of reducing the GHG intensity of transport fuels by 6% compared to 2010⁽⁵⁾.

The progress achieved by fuel suppliers varies greatly across Member States. Fuel suppliers from twelve countries reached or exceeded the 6% reduction target in 2023.

From the Member States that have not yet reached the 2020 target, ten have reported reductions greater than 4%, while for the remaining Member States the reductions remain lower than 4%. The most

(1) See the Northern Ireland Withdrawal Agreement to be found here https://eur-lex.europa.eu/eli/treaty/withd_2020/2022-02-22

(2) Iceland and Norway have no reporting obligation and submit information on a voluntary basis.

(3) 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.

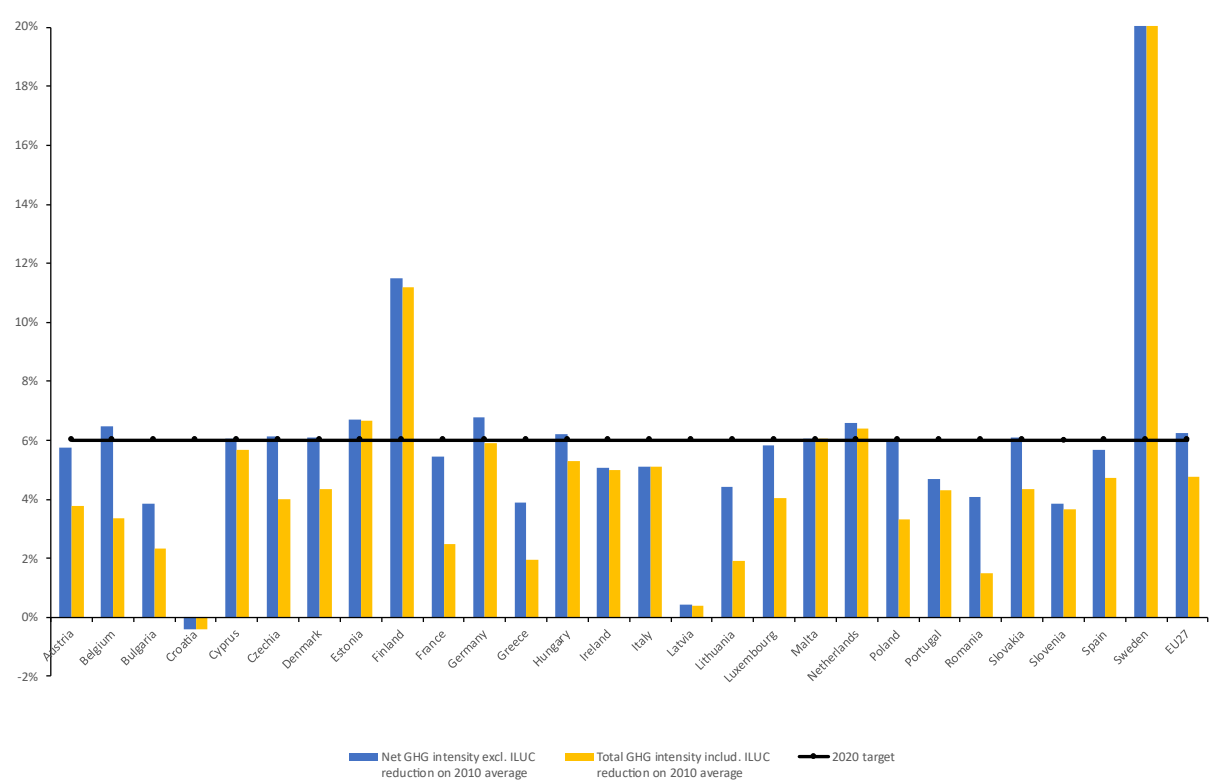
(4) Considering the electricity consumed that was voluntarily reported by 21 Member States.

(5) In 2023, upstream emission reductions were reported by fourteen Member States, which are expected to contribute to the 6% reduction target.

significant progress was made by Hungary, which reduced its GHG emission intensity by 3.26% compared to 2022, with an overall reduction of 6.2% compared to 2010.

Direct land-use change (DLUC) emissions result from the conversion of non-agricultural land, such as forests or grasslands, into agricultural land. Indirect land-use change (ILUC) emissions result from the expansion of cropland for production of displaced agricultural (food/feed) products induced by feedstock growth for biofuel production. As biofuels production increased since 2010, taking these ILUC emissions into account results in lower reductions of the GHG intensity of fuels. The average GHG intensity of the fuels consumed in 2023 was only 4.8% lower than the 2010 levels when considering ILUC – this corresponds to a saving of 52 Mt CO₂e in the year 2023. When ILUC emissions are considered, it should be noted that there is wide disparity per Member State to the type of feedstocks used to produce biofuels that are consumed in their national territories; this constitutes a key factor in the performance of each Member State towards meeting the target, see Figure ES1.1.

Figure ES-1 Reductions in GHG intensity of fuels achieved by EU fuel suppliers in Member States, 2010-2023



Note: The 2020 target of 6% refers to GHG intensity reduction excluding ILUC

Source: EEA

Diesel and biodiesel dominate fossil fuel and biofuel supply

The total fuel supply of transport in 2023 for the 27 MS was 11 726 petajoules of which 93% came from fossil fuels and 7% from biofuels. The fuel supply was dominated by diesel (53.2%) and petrol (24.7%), followed by gas oil (12.8%), biodiesel (4%), HVO (1.3%) and bioethanol (1.1%).

Regarding the main feedstock and pathways used to produce biofuels, biodiesel is produced mainly from rapeseed (43.2%), used cooking oil (20.3%) and bio-waste (12.5%); bioethanol is produced mainly from

corn (51.6%), wheat (17.8%) and sugar cane (11%); and HVO is produced mainly from palm oil (24.6%), tallow (24.2%) and used cooking oil (14.8%).

In addition to the reporting on fossil fuels and biofuels, fuel suppliers may also voluntarily report on the quantity of electricity consumed by electric vehicles and motorcycles. In 2023, this quantity accounted for 0.06% of the total energy supply, as reported by 21 Member States.

ILUC and effects of substitution by biofuels on GHG intensities

The biofuel feedstock is important when assessing the GHG reduction potential of biofuels, especially when including the ILUC effect.

For biodiesel, a substantial part (above 51% of the total quantities reported) is produced from oil crops, which have a high GHG intensity compared to other feedstocks, particularly when ILUC default reporting values are included⁽⁶⁾. When considering ILUC, biodiesel from oil crops appears to be only marginally better in terms of life cycle GHG emission than fossil diesel fuel (86.6 vs 95.1 g CO₂e/MJ).

In the case of HVO, the majority (around 83%) is produced from other feedstocks, such as tallow, PFAD, waste oils and fats, which generally have lower GHG intensity. When considering ILUC, the HVO produced from these feedstocks has a GHG intensity that is significantly lower than that of diesel (9.4 vs 95.1 g CO₂e/MJ). The quantities of HVO produced from oil crops (featuring therefore a significantly higher GHG intensity), are lower (around 17%).

Bioethanol is mainly produced from cereals and other starch-rich crops (around 72% of the total quantities reported) and sugars (around 14%). When considering ILUC, the average GHG intensity of bioethanol increases, however it still remains significantly lower than that of fossil petrol (30.8 vs 93.3 g CO₂e/MJ).

Substitution of diesel with biodiesel and HVO results in GHG emission reductions of approximately 54%, when considering ILUC, and around 78% when excluding ILUC. Substitution of petrol with bioethanol and bio-ethyl tert-butyl ether (bio-ETBE) leads to reductions of around 67% when considering ILUC, and nearly 78% when excluding ILUC. Finally, substitution of compressed natural gas with biogas leads to reductions of around 91% when considering ILUC, and nearly 92% when excluding ILUC.

⁽⁶⁾ Annex V, Part A. Provisional estimated ILUC emissions from biofuels of Directive (EU) 2015/1513 of the European Parliament and of the council of 9 September 2015.

1 Introduction

The role of fuels and their contribution to decreasing air pollution and GHG emissions has been recognized in EU legislation, which has stipulated minimum quality requirements and GHG intensity reduction targets for a range of petroleum and bio-based fuels. The reduction targets are likely to be achieved with the use of sustainable biofuels, electricity consumed by electric vehicles, fossil fuels with lower carbon-intensity, renewable fuels of non-biological origin (RFNBOs), while the reduction of upstream GHGs emitted during the crude oil production phase can also potentially play an important role.

EU Member States report annually information on the volumes, energy content and life cycle GHG emissions of fuels used in road transport and non-road mobile machinery, in line with their obligations under the Fuel Quality Directive 98/70/EC (FQD) Article 7a.

The reporting on data pursuant to Article 7a applied for the first time in 2018 in relation to the year 2017, following the application and transposition of Council Directive (EU) 2015/652. This years report relating to 2023 will be the last of its kind as the reporting requirement according to Article 7a of the FQD ceased to exist.

The key documents that lay out the official requirements for the quality and GHG intensity of fuels sold in the EU, as well as the monitoring and reporting obligations for Article 7a, are the following:

- Directive 98/70/EC of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC;
- Directive 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels;
- Directive 2009/30/EC of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC; the Directive introduces Article 7a on GHG emission reductions;
- Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources (Renewable Energy Directive RED) defines, like the FQD, the sustainability criteria for biofuels (Article 17); in addition, it defines the lower calorific values to be used for biofuels (Annex III) and the default GHG emissions for biofuels not fulfilling the sustainability criteria (Annex V D). RED has been later amended by Directive (EU) 2018/2001 (RED II), detailing the respective provisions for the 2020 – 2030 period.

This report summarises the information reported by the EU Member States and subsequently collected, checked and compiled by the EEA on the volume, energy consumption, and GHG intensity of fossil fuels and biofuels.

Chapter 2 describes the reporting requirements and the summary format for each Member State's submission under FQD Article 7a.

Chapter 3 provides an overview of the Article 7a reported information aggregated at EU level.

Chapter 4 summarises the progress with respect to the 2020 targets under the Fuel Quality Directive, whereas Chapter 5 discusses the effects of ILUC on GHG intensities.

Chapter 6 compares the information provided under Article 7a with other sources.

2 Reporting by European Union Member States

2.1 Reporting requirements

The information provided by the Member States under Article 7a comprises the following aspects:

1. fossil fuels and other non-biofuels information: possible data confidentiality, fuel or energy type, raw material source and process, fuel quantity supplied, energy quantity supplied and greenhouse gas (GHG) intensity;
2. biofuels information: possible data confidentiality, biofuel or energy type, sustainability of biofuel, feedstock used, biofuel production pathway, biofuel quantity supplied, energy quantity supplied, GHG intensity and indirect land use change (ILUC) feedstock category and emissions intensity;
3. information on electricity consumed by electric vehicles and motorcycles, on a voluntary basis: energy quantity, including and excluding the powertrain efficiency and the GHG intensity.

An Excel template is used by EU Member States for their reporting obligations under Article 7a of the FQD⁽⁷⁾. Its purpose is to provide the necessary information and guidance for the preparation of national reports and to ensure that all the required information has been provided.

The information provided by the Member States over the years is partly⁽⁸⁾ accessible in EEA's [Central Data Repository](#).

2.2 Quality of Member States' reporting in 2023

The EEA is responsible for the collection, quality assurance/quality control (QA/QC) and compilation of the data submitted at EU level and is supported in these tasks by the European Topic Centre on Climate change mitigation (ETC CM)⁽⁹⁾.

In 2024, in relation to reference year 2023, 27 EU Member States plus Northern Ireland⁽¹⁰⁾, Iceland and Norway submitted their fuel quality reports in accordance with the requirements of the FQD. During the QA/QC procedure, the ETC CM reviewers posed clarifying questions to the reporting countries, relating to the completeness and consistency of their submitted data sets. The most common findings communicated to the countries following the quality checks performed on the information reported were:

- data reported not corresponding to the data lists provided in the template;
- wrong entries inserted in the report;
- missing information, mainly on feedstock and/or production pathway;
- data reported in aggregated form.

Most of these issues could be solved directly with the Member States in the communication process, by their completing missing information, correcting erroneous values or providing the necessary

⁽⁷⁾ <http://cdr.eionet.europa.eu/help/fqd>

⁽⁸⁾ Due to the confidentiality of the data, some MS choose not to give public access to the data.

⁽⁹⁾ The ETC CM is a consortium of European organizations contracted by the EEA to carry out specific tasks identified in the EEA strategy in the area of climate change mitigation.

⁽¹⁰⁾ See the Northern Ireland Withdrawal Agreement to be found here https://eur-lex.europa.eu/eli/treaty/withd_2020/2022-02-22

clarifications. Following the QA/QC procedure, 6 Member States submitted revised data sets, while 13 Member States were asked to provide clarifications on their reported values. The last first **submission** was received on the 27.03.2025, while the last **resubmission** was received on 20.05.2025.

3 Supplied quantities of road transport fuels in 2023

3.1 Fossil fuel and biofuel quantities supplied

Fuel suppliers must report annually to the authority designated by the Member State on the greenhouse gas (GHG) intensity of fuel and energy supplied within each Member State by providing as a minimum the total volume or quantity of each type of fuel or energy supplied and the associated life cycle GHG emissions per unit of energy.

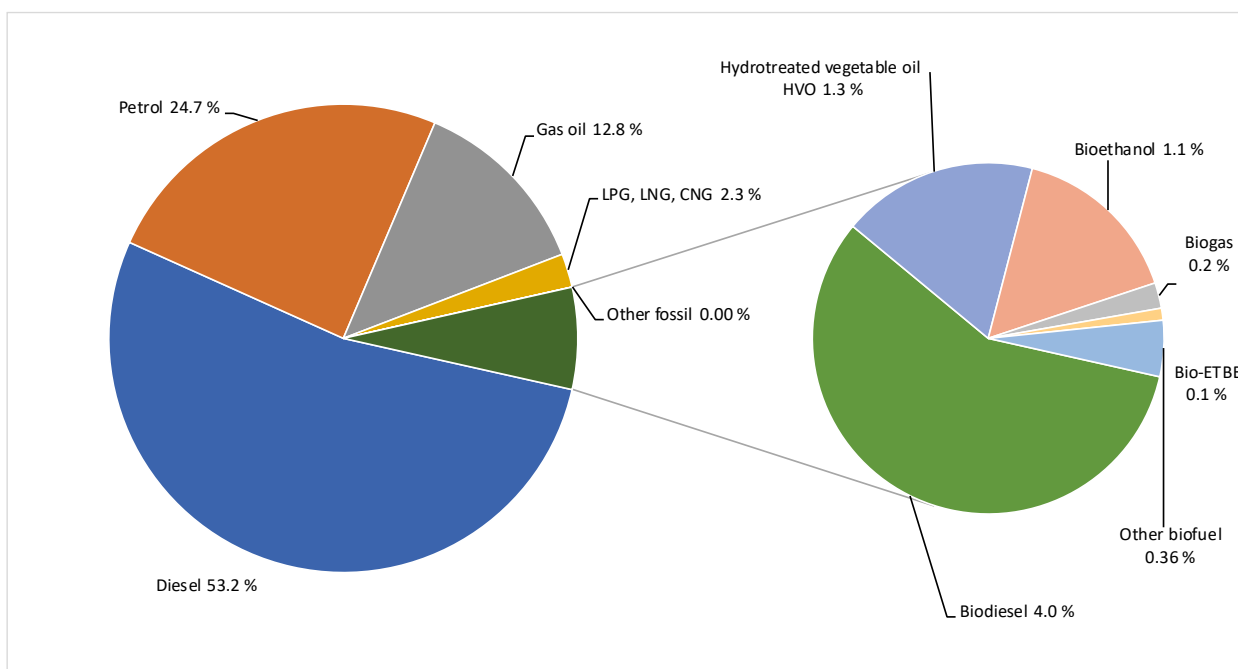
The total energy quantities supplied by suppliers are presented in Table 3-1 for the different fossil fuels and biofuels marketed in the 27 Member States.

Table 3-1 Total quantities of fossil fuels and biofuels

	Total quantity (PJ)
Fossil fuels	10 902
Diesel	6 239
Petrol	2 892
Gas oil	1 497
Liquid petroleum gas (LPG)	196
Compressed natural gas (CNG)	52
Liquefied natural gas (LNG)	25
Biofuels	824
Biodiesel	474
Hydrotreated vegetable oil (HVO)	149
Bioethanol	131
Biogas	19
Bio-ETBE	9
Other	43

Total fuel supply reported was 11 726 petajoules (PJ), of which 93% was from fossil fuels, and 7% was from biofuels (Figure 3-1). No renewable fuels of non-biological origin were reported for reference year 2023.

Figure 3-1 Fuel energy supply shares per fuel type in 2023



Notes: In category “other biofuel” the following types are included: Biomethanol, Bio-MTBE (methyl tert-butyl ether), bio synthetic oil, Bioethanol Diesel, Biofuel oil, Bio-gasoline, Bio-kerosine, Bio-LNG, Bio-LPG, Biomethane, Bionaphtha, Biopetrol, Biopropane, Bio-TAEE (bio-tertiary-amyl ethyl ether), Co-feed renewable diesel, Co-processed biomass oil, Co-processed hydrotreated vegetable oil (CHVO), Co-treated oil for diesel, Co-treated oil for jet fuel, Co-treated oil for gasoline, Hydrotreated oil – Diesel, Hydrotreated oil – Gasoline, Pure vegetable oil, Renewable gasoline.

The fossil fuel supply in 2023 was dominated by diesel (53.2% of total fuel consumption; 6 239 PJ⁽¹¹⁾), followed by petrol (24.7% of total fuel consumption; 2 892 PJ) and gas oil (12.8% of total fuel consumption; 1 497 PJ). Liquified petroleum gas (LPG), liquified natural gas (LNG) and compressed natural gas (CNG) had a total share of 2.3% (273 PJ) in the total fuel consumption.

The biofuels energy consumption in the 27 EU Member States is dominated by biodiesel (4% of total fuel consumption; 474 PJ), followed by hydrotreated vegetable oil (HVO; 1.3% of total fuel consumption; 149 PJ) and bioethanol (1.1% of total fuel consumption; 131 PJ). Bio-ETBE and biogas account for 0.3% (28 PJ) of the total fuel consumption. All other biofuels used in road transport and non-road mobile machinery in 2023 present a share of 0.4% (43 PJ) in the total fuel consumption (Figure 3-1).

3.2 Biofuel production pathways and feedstocks used

Member States must report on the feedstock and the biofuel production pathway used for each of the biofuels consumed in their territories. Feedstock is relevant for estimating the potential indirect land use change (ILUC), whereas the biofuel production pathways are relevant for calculating the GHG intensity of the produced fuels and the potential emissions savings from their use.

Feedstocks used for biofuel production may be derived from plants grown directly for the purpose of energy production, or from plant parts, processing wastes, residues and materials from human and animal activities. In relation to the feedstock used, different production pathways may be followed to develop the final biofuels that are available in the market. Hence, feedstocks refer to the origin and to the raw

⁽¹¹⁾ A petajoule (PJ) is equal to one thousand terajoules (TJ) or one million gigajoules (GJ) or one billion megajoules (MJ).

material source of the biofuel while production pathways refer to the different processes used for the production of the biofuel always relevant to the respective feedstock.

The main feedstocks for the three main categories of biofuels, as these have been reported by the 27 Member States, are summarised below in Table 3-2.

Table 3-2 Summary of main feedstock by biofuel

Biodiesel	Feedstock
Rapeseed	43.2%
Used cooking oil / waste vegetable oil or animal fat	20.3%
Bio-waste	12.5%
Other	12.7%
N/A	0.1%
Bioethanol	Feedstock
Corn (maize)	51.6%
Wheat	17.8%
Sugar cane	11.0%
Other	27.7%
N/A	0.73%
Hydrotreated vegetable oil	Feedstock
Palm oil	24.6%
Tallow	24.2%
Used cooking oil	14.8%
Other	40.1%
N/A	0.39%

- The main types of feedstock used to produce **biodiesel** (4% of total fuel consumption) are rapeseed (43.2%), used cooking oil and waste vegetable oil or animal fat (20.3%) and bio-waste (12.5%). These feedstocks account for about 82% of the total biodiesel quantities supplied to the 27 Member States.
- **Bioethanol** (1.1% of total fuel consumption) is mainly produced from corn (51.6%), wheat (17.8%) and sugar cane (11%). These feedstocks account for about 80.4% of the total bioethanol quantities supplied to the 27 Member States.
- For **HVO** (1.3% of total fuel consumption) production, palm oil accounts for 24.6%, tallow (category 3 or unknown) for 24.2% and used cooking oil for 14.8%. These feedstocks account for about 63.6% of the total HVO quantities supplied to the 27 Member States.

3.3 Electricity consumption

The reporting of the quantity of electricity consumed by electric vehicles and motorcycles by fuel suppliers is voluntary, despite the fact that it can be considered for the 6% reduction target. Twenty-one countries reported the electricity consumed by electric vehicles and motorcycles⁽¹²⁾. As per the Art. 7a requirements, reported consumed electricity is also accompanied by the associated electricity GHG intensity. In the case of Portugal, a provisional value was provided for the GHG intensity of electricity which was not later updated, while Slovenia only reported the quantity of electricity that was covered by “green energy supply” certificates with the corresponding GHG intensity being equal to zero. The GHG intensity of electricity provided by Ireland corresponds to 2022, since the respective value for 2023 was not available.

⁽¹²⁾ Namely: Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

In

Table 3-3 the energy quantities consumed by electric vehicles, excluding and including powertrain efficiency, are summarized for the twenty-one Member States which accurately provided this information. An adjustment factor of 0.4 for powertrain efficiency is assigned to the battery electric powertrain⁽¹³⁾. This includes all electric powertrains, without distinguishing between battery electric vehicles and plug-in hybrid electric vehicles.

Actual electricity consumption in the different Member States may be larger since it is not a compulsory field under Article 7(a) and is not actually considered towards the target by many Member States albeit it could be.

GHG intensities of electricity, as reported by Member States under Article 7a are presented in Table 3-3⁽¹⁴⁾, together with data provided by a study⁽¹⁵⁾ on the average carbon intensity of the electricity consumed at low voltage in the EU in 2019 for comparison purposes.

⁽¹³⁾ Based on Annex I (f) of Council Directive (EU) 2015/652 of 20 April 2015.

⁽¹⁴⁾ Austria has reported the same quantity of energy when including and excluding powertrain efficiency. However, in order for the data reported in Table 4.3 to be presented in a consistent manner, the energy quantity was multiplied by the adjustment factor of 0.4 to account for powertrain efficiency.

⁽¹⁵⁾ Quantification of the carbon intensity of electricity produced and used in Europe, 2022, <https://doi.org/10.1016/j.apenergy.2021.117901>.

Table 3-3 Electricity consumed by electric vehicles and motorcycles in 2023 as a reported contribution by fuel suppliers to their GHG reduction target

Member State	Quantity of energy		GHG intensity		2019 study data (g CO ₂ e/kWh)
	excluding powertrain efficiency (GJ)	including powertrain efficiency (GJ)	reported by Member State (g CO ₂ e/MJ)	reported by Member State (g CO ₂ e/kWh)	
Austria	897 831	359 132	18.9	68.0	264
Belgium	58 517	23 407	74.0	266.4	230
Bulgaria	163 256	65 302	142.3	512.1	544
Czechia	20 793	8 317	177.0	637.2	544
Denmark	69 776	27 910	45.0	162.0	158
Estonia	187 601	75 040	114.5	412.0	472
France	8 170 963	3 268 385	16.1	58.0	98
Germany	9 320	3 728	135.0	486.0	422
Greece	9 669	3 867	116.7	420.0	780
Hungary	49 083	19 633	61.0	219.6	338
Ireland	822 040	328 816	100.3	361.1	384
Italy	511 453	204 581	110.3	397.0	356
Luxembourg	4 733	1 893	50	180	338
Netherlands	5 900 000	2 360 000	93.5	336.6	450
Poland	7	3	182.1	655.6	805
Portugal	323 972	129 589	56.4	203.0	324
Romania	5 451	2 180	58.2	209.6	464
Slovakia	42 673	17 069	46.4	167.0	346
Slovenia	11 005	4 402	0.0	0.0	307
Spain	345 438	138 175	82.0	295.2	279
Sweden	87 828	35 131	7.2	26.0	40

Note: Member States data are for 2023 whereas data provided by the study refer to 2019 (shown for comparison purposes).

Hungary reported several GHG intensities, accompanied by the respective electricity consumptions. The values presented in this Table corresponds to the weighted average of the reported values. Slovenia reported the electricity that was generated exclusively from RES with the corresponding GHG intensity being equal to zero.

The above data on GHG intensity are not directly comparable as individual Member States may have used a calculation methodology different from that used by the respective study⁽¹⁶⁾. For example, electricity consumed versus electricity generated and/or applied corrections for the effect of cross-border electricity trade may have an impact on the calculated intensities. In addition, the data used in the study for the calculation of the carbon intensity of electricity generation refer to the year 2019 whereas Member States data are for 2023.

⁽¹⁶⁾ As foreseen by Directive 2015/652, Annex I Part 2, Point 6.

4 Progress to 2023 targets under the Fuel Quality Directive

4.1 Average GHG emissions intensity of transport fuels in 2023

The Fuel Quality Directive (FQD) required a reduction in the GHG intensity of transport fuels by a minimum of 6% by 2020 compared to 2010 levels via the suppliers' monitoring mechanism⁽¹⁷⁾ and by an additional optional 4% via reduction technologies and the Clean Development Mechanism of the Kyoto Protocol. The baseline for this reduction is the average GHG intensity of the EU's fuel mix in 2010, which was 94.1 g CO₂/MJ⁽¹⁸⁾. The fuel baseline standard is calculated based on EU average fossil fuel consumption of petrol, diesel, (non-road) gasoil, LPG and CNG.

For each Member State, Table 4-1 shows the GHG emissions from the consumption of all fuels (fossil fuels and biofuels) and electricity used in transport for the year 2023. The average GHG intensity calculated for each Member State, as well as the relative reduction over the 2010 default baseline value are shown in the same table.

The average GHG intensity of the fuels supplied in the 27 EU Member States (excluding ILUC for biofuels) was 88.2 g carbon dioxide equivalent (CO₂e) in 2023. Thus, a reduction of 6.3% was achieved in 2023 compared to 2010, reaching the target for the first time. This corresponds to an additional reduction of 2.6 percentage points compared to 2018 (3.7% reduction compared to 2010, for 28 EU Member States), 2 percentage points, compared to 2019 (4.3% reduction compared to 2010, for 28 EU Member States), 0.8 percentage points with respect to 2020 and 2021 (5.5% reduction compared to 2010, for 27 EU Member States) and 0.7 percentage points with respect to 2022. The reduced reduction rate since 2020 can be partly justified by the fact that the GHG intensity reduction target remained unchanged with respect to 2020, thus not providing additional motives for the Member States to further reduce their transport fuel GHG intensity. In addition, upstream emission reductions (UERs) were reported by fourteen countries in 2023 (see details in section 0), contributing to a further reduction of the GHG intensity of about 0.6% to reach 6.3% in total. Again in 2022 and 2021, fifteen countries reported upstream emission reductions, reducing their GHG intensity by about 0.5%, while in 2020 eleven countries reported upstream emission reductions, reducing the GHG intensity by about 0.3% and in 2019, only two countries had reported upstream emission reductions, reducing the GHG intensity by about 0.2%.

The average GHG intensity, depends on the share and type of fossil fuels and biofuels in the total fuel mix. The highest GHG intensities of all fuels correspond to diesel (95.1 g CO₂e/MJ) and petrol (93.3 g CO₂e/MJ), whereas substitution with bioethanol (20.3 g CO₂e/MJ, excluding ILUC), HVO (12.1 g CO₂e/MJ, excluding ILUC) and biodiesel (23.2 g CO₂e/MJ, excluding ILUC) reduces significantly the overall GHG intensity, providing thus the highest GHG reduction benefits.

The two Member States with the **lowest** achievements in reducing their GHG intensities over the 2010 – 2023 period (lower than 2%) are Croatia (increased its GHG intensity by 0.4% with respect to 2010 EU average) and Latvia (achieved a reduction of only 0.4%). The main reason for this is the low share of biofuels (0% in Croatia and 0.1% in Latvia, which are the lowest in the entire EU), in combination with the relatively high GHG intensity for biofuels in these countries (38.2 g CO₂eq/MJ for Croatia and 20.4 g CO₂eq/MJ for Latvia, which are among the highest in the entire EU). In comparison, the average GHG intensity for biofuels in the EU is 19.2 g CO₂eq/MJ, while the average share of biofuels is equal to 7%.

⁽¹⁷⁾ For the purposes of Article 7a of the FQD, Member States shall ensure that suppliers use the calculation method set out in Annex I of Directive 2015/652 to determine the GHG intensity of the fuels they supply.

⁽¹⁸⁾ Baseline value for 2010, according to Annex II of the Council Directive (EU) 2015/652.

Box 1 Northern Ireland

Since 2020, the reporting commitments under the Fuel Quality Directive continue to apply only to Northern Ireland (NI) and not the UK as a whole anymore (see Annex 2 of the [Withdrawal Agreement](#)). 2021 was the first reporting year for which data was provided. However, the NI data does not influence Europe's overall progress to achieve the target value - it still remains at 6.3% percent. In detail, the average GHG intensity of the fuels supplied in NI in 2023 (excl. ILUC emissions) was 89.0 g carbon dioxide equivalent (CO₂e), 5.5% lower than the 2010 EU average. In order to reach the obligatory 6% target, an additional 0.5% reduction in the GHG intensity of all fossil fuels, biofuels and electricity supplied would have been needed in NI.

Finland and Sweden have achieved the **highest** reductions in the average GHG intensity of their fuels with respect to 2010 with 11.5% and 26.1% respectively (excluding ILUC). These two countries have been exceeding the target of 6% since 2018. Ten more Member States also exceeded the target in 2023, namely Belgium, Cyprus, Czechia, Denmark, Estonia, Germany, Hungary, Malta, Netherlands and Slovakia. Finland has a biofuel share of 14.3% (59.3% of which is HVO that has the lowest GHG intensity among biofuels, 12.8% is bioethanol and 8.4% is biodiesel) while diesel, petrol and gas oil represent 49%, 30% and 21% of the fossil fuel mix respectively. Sweden has the highest biofuel share among all

Member States amounting to 29.4% (64.3% of which is HVO, 15.7% is biodiesel and 6.7% is bioethanol) while diesel and petrol share in the fossil fuel mix are 64% and 36% respectively. The reductions achieved by these two Member States are attributed to the high biofuels share, as well as the low GHG intensity of biofuels used (15.8 g CO₂eq/MJ in Finland and 10 g CO₂eq/MJ in Sweden).

Table 4-1 shows wide disparity of performances when ILUC is accounted for across Member States, due to the different type of feedstocks used for the biofuels consumed in each country. Whereas for many Member States the difference with and without ILUC is relatively small (in the order of 1 percentage units), for some other Member States these differences are a significant fraction of their GHG intensity reductions. The performance of France, Greece, Lithuania and Romania is considerably reduced by at least 50% when ILUC effects are considered, due to the extensive consumption of oil crops (up to 78% for Romania's biofuel feedstock, mainly produced from rapeseed) that have the highest GHG intensities among feedstock categories.

Table 4-1 Average GHG emissions intensity reported by fuel suppliers by Member State in 2023 and reductions compared to 2010

Member State	Fossil fuels		Biofuels		Electricity (incl. powertrain efficiency)*	
	Energy consumption (TJ)	GHG emissions (kt)	Energy consumption (TJ)	GHG emissions (kt)	Energy consumption (TJ)	GHG emissions (kt)
Austria	299 845	28 152	21 996	460	359.1	6.79
Belgium	326 599	30 825	33 252	847	23.4	1.73
Bulgaria	143 624	13 328	6 915	294	65.3	9.29
Croatia	114 048	10 776	2	0	0.0	0.00
Cyprus	27 868	2 543	1 060	14	0.0	0.00
Czechia	263 099	24 488	15 477	119	8.3	1.47
Denmark	172 789	15 920	9 595	204	27.9	1.26
Estonia	41 460	3 775	1 606	14	75.0	8.59
Finland	156 895	14 835	26 190	414	0.0	0.00
France	1 746 521	164 854	146 667	4 244	3 268.4	52.65
Germany	1 998 105	186 447	141 767	1 272	3.7	0.50
Greece	207 122	19 352	10 647	343	3.9	0.45
Hungary	216 874	20 055	13 220	255	19.6	1.20
Ireland	174 915	16 578	12 679	222	328.8	32.98
Italy	1 443 788	134 173	73 448	1 328	204.6	22.56
Latvia	43 418	4 072	45	1	0.0	0.00
Lithuania	84 167	7 908	5 624	166	0.0	0.00
Luxembourg	63 786	6 004	5 207	109	1.9	0.09
Malta	9 576	890	562	6	0.0	0.00
Netherlands	407 774	38 319	29 930	450	2 360.0	220.65
Poland	1 016 300	93 306	58 313	1 811	0.0	0.00
Portugal	234 061	22 096	15 058	266	129.6	7.31
Romania	254 137	23 724	14 613	529	2.2	0.13
Slovakia	100 200	9 317	6 752	137	17.1	0.79
Slovenia	72 492	6 823	3 458	47	0.0	0.00
Spain	1 078 921	101 835	83 609	1 361	138.2	11.33
Sweden	205 863	19 436	85 731	857	35.1	0.25
EU (27 Member States)	10 904 247	1 019 834	823 423	15 771	7 072	380

Member State	Average fuel GHG intensity (g CO ₂ e/MJ) (excl. ILUC)	2010-2023 GHG intensity reduction (excl. ILUC) (%)	Average fuel GHG intensity (g CO ₂ e/MJ) (incl. ILUC)	2010-2023 GHG intensity reduction (incl. ILUC) (%)
Austria	88.7	5.8%	90.5	3.8%
Belgium	88.0	6.5%	90.9	3.4%
Bulgaria	90.5	3.9%	91.9	2.4%
Croatia	94.5	-0.4%	94.5	-0.4%
Cyprus	88.4	6.1%	88.7	5.7%
Czechia	88.3	6.1%	90.3	4.0%
Denmark	88.4	6.1%	90.0	4.3%
Estonia	87.8	6.7%	87.8	6.7%
Finland	83.3	11.5%	83.6	11.2%
France	89.0	5.5%	91.8	2.5%
Germany	87.7	6.8%	88.5	5.9%
Greece	90.4	3.9%	92.3	1.9%
Hungary	88.3	6.2%	89.1	5.3%
Ireland	89.3	5.1%	89.4	5.0%
Italy	89.3	5.1%	89.3	5.1%
Latvia	93.7	0.4%	93.7	0.4%
Lithuania	89.9	4.4%	92.3	1.9%
Luxembourg	88.6	5.8%	90.3	4.0%
Malta	88.4	6.1%	88.4	6.1%
Netherlands	87.9	6.6%	88.1	6.4%
Poland	88.5	5.9%	91.0	3.3%
Portugal	89.7	4.7%	90.0	4.3%
Romania	90.2	4.1%	92.7	1.5%
Slovakia	88.4	6.1%	90.0	4.4%
Slovenia	90.5	3.9%	90.6	3.7%
Spain	88.8	5.7%	89.6	4.7%
Sweden	69.6	26.1%	72.7	22.7%
EU (27 Member States)	88.2	6.3%	89.6	4.8%

Note: For SI, which has reported electricity generation only from RES providers (see also chapter 3.3) - thus resulting in zero grid intensity, the electricity consumption has been set as zero in Table 4.1

4.2 Upstream emission reductions

Upstream emissions refer to the GHG emissions produced during the extraction, processing, handling and transport of raw material from their original state to the refinery or processing plant gate where the fuel was produced. Upstream emission reductions (UER) are the GHG emissions reductions that can occur prior to the crude oil entering the refinery, during extraction, processing, handling and transport, including reductions of flaring and venting emissions. The UER claimed by a supplier have to be quantified and reported in accordance with the requirements set out in Directive (EU) 2015/652. There are several options for suppliers to reduce the GHG intensity of fuels towards the 2020 reduction target. More detailed information on approaches to quantify, monitor and report on UER can be found in the relevant guidance note⁽¹⁹⁾. It is noted however, that there is no obligation to use UER as a compliance option for the FQD Article 7a reduction target.

Fourteen out of 27 Member States that have submitted data under Article 7a have claimed UER. These are presented in Table 4-2.

Table 4-2 UERS (kt CO₂e) reported by Member States

Member State	UER (kt CO ₂ e)
Austria	242.4
Cyprus	80.8
Czechia	251
Denmark	420
Estonia	127.4
Germany	2 014
Hungary	390.9
Italy	333.6
Luxembourg	33.8
Malta	12.8
Poland	1 525.4
Romania	286.7
Slovakia	136.3
Slovenia	33.6

Overall, the total reported UER was 5 889 kt CO₂e in 2023, contributing an additional 0.6% reduction of the overall fuel GHG intensity from 5.7% to 6.3%.

⁽¹⁹⁾ https://climate.ec.europa.eu/system/files/2016-11/guidance_note_on_uer_en.pdf

5 Effects of indirect land use change on GHG intensities

5.1 Greenhouse gas emission intensities of crop types

According to Article 23 paragraph 5(f) of the RED⁽²⁰⁾, fuel suppliers have to report the life cycle greenhouse gas emissions per unit of energy, including the provisional mean⁽²¹⁾ values of the estimated ILUC emissions from biofuels to the Member States. ILUC emissions may significantly reduce the GHG benefits from the use of the different biofuels. Depending on the land types converted to cropland because of biofuels production, these GHG savings may be completely cancelled out. Hence, in an encompassing life cycle analysis, the ILUC-related GHG emissions intensity should be added to the GHG intensity directly attributed to the production and transport of biofuels. For the reporting of ILUC emissions, the mean values included in Annex VIII of the RED II are used. However, ILUC emissions are not taken into account for assessing compliance with the obligatory 6% reduction target.

Table 5-1 provides an overview of the energy supplied by the different crops from which biofuels are produced. The default GHG intensities for each crop type are also reported. ILUC emissions related to biofuel consumed were around 16.5 Mt CO₂e in 2023, an amount almost equivalent to the annual total emissions (excluding ILUC) of Finland. Oil crops were responsible for 91.2% of these ILUC emissions.

Table 5-1 ILUC summary table

Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	100 202	19 500	273 812	417 972
Default ILUC intensity provisional mean ⁽²²⁾ values of the estimated ILUC emissions (g CO ₂ e/MJ)	12	13	55	0
Total ILUC GHG emissions (kt CO₂e)	1 202	254	15 060	-

Based on the mean values of the estimated indirect land-use change emissions provided in the RED (see Annex VIII, Directive 2018/2001), and the 2023 data, an average value of 1.4 g CO₂e/MJ is added to the overall GHG intensity of the transport fuel mix that is reported under Article 7a. Adding this value to the average GHG intensity of 88.2 g CO₂e/MJ (without ILUC) of the fuels consumed in the 27 EU Member States as calculated above (Table 5-1), results in an eventual value of 89.6 CO₂e/MJ (with ILUC). It is noted that the GHG intensity including ILUC decreased in 2023 in comparison to 2022, 2021, 2020 and 2019 (90.3 g CO₂e/MJ in 2022, 90.7 g CO₂e/MJ in 2021, 91.0 g CO₂e/MJ in 2020 and 91.6 g CO₂e/MJ in 2019) due to the small reduction of the oil crops for the production of biofuels. Nonetheless, if ILUC was included in the calculation of the GHG intensity, the relevant reduction from the baseline (in the year 2010) would be 4.8% as opposed to the 6.3% reduction when excluding ILUC, see Table 4-1.

The overall GHG intensity reduction including ILUC is below 2% for five Member States, while if ILUC was considered, only five out of twelve Member States would have achieved the 2020 GHG reduction target.

⁽²⁰⁾ Directive 2009/28/EC of the European Parliament and of the council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

⁽²¹⁾ For the purposes of Article 7a of the FQD, Member States shall ensure that suppliers use the calculation method set out in Annex I of Directive 2015/652 to determine the GHG intensity of the fuels they supply.

⁽²²⁾ The mean values included here represent a weighted average of the individually modelled feedstock values (Annex VIII, Directive 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).

Considering ILUC, Sweden has the most significant improvement on its performance with a reduction of 22.7% for 2023 (23.6% in 2022, 18.4% in 2021). However, this improvement can be mainly attributed to the increased share of biofuels (29.4% in 2023, 29.2% in 2022 and 24.7% in 2021).

5.2 Greenhouse gas emission savings by substituting fossil fuels with biofuels

In order to estimate the decarbonization potential of biofuels, i.e. the GHG savings that can be achieved from the substitution of their fossil fuel counterparts, data on the actual biofuel use and the respective GHG intensities, as reported by the different EU Member States, are used.

To this aim, GHG emissions from the use of biofuels by different feedstock categories have been calculated with and without ILUC, by using the reported GHG intensities. These emissions are then compared with the calculated GHG emissions from the use of equal quantities — in terms of energy content — of conventional fuels.

The most relevant biofuels for this analysis are biodiesel, bioethanol and HVO, which account for 91% of the total biofuel energy consumption in the 27 EU Member States. The relevant data for this comparison is summarised in Table 5-2. The average GHG intensity and corresponding GHG emissions with and without ILUC are presented for the different feedstocks for each of the selected biofuels.

Table 5-2 GHG emissions from the use of biofuels and different feedstocks

	Energy quantity (TJ)					Average GHG intensity (g CO ₂ e/MJ) Excluding ILUC emissions					Average GHG intensity (g CO ₂ e/MJ) Including ILUC emissions				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Biodiesel	526 806	448 671	474 655	437 695	473 785	24.6	25.2	23.8	25.1	23.2	58.9	62.6	58.2	58.8	51.3
Cereals and other starch-rich crops	24	134	82	5	20	34.2	24.6	10.6	33.2	21.2	46.2	36.6	22.6	45.2	33.2
Sugars	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil crops	329 376	305 585	300 527	268 202	243 413	32.2	31.5	30.6	32.4	31.9	87.0	86.4	85.0	87.4	86.6
Other	197 406	142 945	173 265	162 943	229 662	12.0	11.7	11.9	13.6	14.0	12.0	11.7	11.9	13.6	14.0
HVO	96 298	146 018	149 683	134 437	148 566	14.0	15.3	12.6	10.1	12.1	33.3	39.3	28.7	17.9	21.35
Cereals and other starch-rich crops	48	-	-	-	-	7.6	-	-	-	-	19.6	-	-	-	-
Sugars	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil crops	33 795	63 892	47 645	19 058	24 952	26.4	23.5	22.7	20	24.1	81.4	78.5	73.2	75	79
Other	62 455	82 084	101 803	115 083	123 163	7.3	8.8	7.9	8.4	9.4	7.3	8.8	7.9	8.4	9.4
Bioethanol	110 866	97 089	109 311	117 828	130 582	22.6	20.7	20.1	20.8	20.3	33.9	31.6	30.7	31.4	30.8
Cereals and other starch-rich crops	87 010	76 536	85 195	85 155	94 270	22.5	20.5	20.9	20.7	20.3	34.5	32.5	32.9	32.7	32.2
Sugars	15 417	10 724	10 120	17 111	18 215	26.8	25.0	19.1	23.3	23.3	39.8	38.0	32.1	36.3	36.3
Oil crops	5	52	1	43	18	24.6	46.8	30.3	32.7	93.3	79.6	101.8	85.3	87.7	148.3
Other	8 435	9 775	13 971	15 313	17 848	16.4	17.1	16.4	17.8	17.5	16.4	17.1	16.4	17.8	17.5

	GHG emissions (kt CO ₂ e) Excluding ILUC emissions					GHG emissions (kt CO ₂ e) Including ILUC emissions				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Biodiesel	12 982	11 292	11 293	10 975	10 991	31 023	28 091	27 628	25 725	24 315
Cereals and other starch-rich crops	1	3	1	0	0	1	5	2	0	0
Sugars	-	-	-	-	-	-	-	-	-	-
Oil crops	10 612	9 618	9 203	8 680	7 753	28 652	26 415	25 537	23 431	21 078
Other	2 369	1 670	2 063	2 211	3 225	2 369	1 670	2 063	2 211	3 225
HVO	1 348	2 229	1 890	1 355	1 804	3 207	5 743	4 294	2 403	3 172
Cereals and other starch-rich crops	0.4	-	-	-	-	1	-	-	-	-
Sugars	-	-	-	-	-	-	-	-	-	-
Oil crops	892	1 501	1 083	381	602	2 751	5 015	3 487	1 429	1 970
Other	456	724	800	971	1 160	456	724	800	971	1 160
Bioethanol	2 511	2 007	2 200	2 453	2 656	3 755	3 067	3 354	3 699	4 019
Cereals and other starch-rich crops	1 959	1 569	1 777	1 766	1 911	3 003	2 488	2 799	2 787	3 037
Sugars	413	268	193	400	424	613	407	325	622	660
Oil crops	0.1	2	0	1	2	0	5	0	3	3
Other	138	167	229	272	313	138	167	229	272	313

Note: Geographical unit is EU28 for 2019 and EU27 for 2020-2023. Estimated ILUC emissions considering the average GHG intensity values of RED and the reported biofuel energy quantities.

The above table shows that the biofuel feedstock is important when assessing the GHG reduction potential of biofuels, especially when ILUC effects are considered.

For biodiesel, a substantial part (above 51% of its total quantity) is produced from oil crops, which have a high GHG intensity compared to other feedstocks suitable for biodiesel production. When considering ILUC, oil crop based biodiesel is only marginally better in terms of life cycle GHG emissions than fossil fuel diesel (86.6 vs 95.1 g CO₂e/MJ).

Bioethanol is mainly produced from cereals and other starch-rich crops (around 72%) and other feedstocks (around 14%). When including ILUC, the average GHG intensity of bioethanol increases; however, it still remains significantly lower than fossil petrol (30.8 vs 93.3 g CO₂e/MJ).

In the case of HVO, the majority is produced from feedstocks with no ILUC value associated (such as tallow, waste oils and fats, around 80%) and with a low GHG intensity, whereas the HVO quantities produced from oil crops, which have a much higher GHG intensity (24 g CO₂e/MJ without ILUC and 79 g CO₂e/MJ with ILUC), are much lower (around 17%).

Table 5-3 shows the calculated GHG emissions saved by replacing fossil fuels with corresponding biofuels for all 27 MS. Substitution of diesel by biodiesel and HVO results in GHG emission reductions as compared to the baseline in the order of 78% when ILUC is excluded, whereas these reductions are in the order of 54% when considering ILUC. The respective reductions for petrol substituted by bioethanol and ETBE are somewhat lower without ILUC but in the same order of magnitude, while they become higher when ILUC effects are considered (67%). Overall, this higher reduction in petrol-fuels compared to diesel ones is due to the high GHG ILUC values of oil crops from which mainly biodiesel is produced, and the much lower GHG ILUC values of cereals from which ethanol is produced.

The percentage of GHG emission reductions for natural gas for the 27 MS are around 91%, whether ILUC is considered or not. It is noted however that the overall effect of this substitution is rather small due to the small quantities of CNG supplied.

Table 5-3 GHG emissions savings from the use of biofuels

Fossil fuel	Substituting biofuel	Excluding provisional mean values of the estimated emissions	/including ILUC	GHG emissions from fossil fuels (kt CO ₂ e)	Emissions savings (kt CO ₂ e)	GHG emission reduction from substitution (%)
Diesel	Biodiesel + HVO	Excluding		59 186	46 391	77.6
		Including			31 698	53.6
Petrol	Bioethanol + ETBE	Excluding		13 034	10 120	77.6
		Including			8 678	66.6
CNG	Biogas	Excluding		1 343	1 230	91.6
		Including			1 226	91.3

6 Consistency with other reporting streamlines

6.1 Comparison between fuel volumes reported under Article 7a and Article 8

To ensure consistency, the reported fuel volumes under Article 7a are compared with those reported under Article 8 of the Fuel Quality Directive (FQD). The comparison is carried out for petrol and diesel only, both fossil and bio-based substitutes, as no other fuels are reported under Article 8.

The total volumes of petrol and diesel reported under Article 8 already includes blended biofuels, i.e. mainly bioethanol in petrol and biodiesel (and HVO) in diesel. To enable the comparison, all volumes of bioethanol, bio-ETBE and other petrol substitutes were added to the petrol volumes as reported by Member States under Article 7a. Similarly, all volumes of biodiesel, HVO and other diesel substitutes were added to the diesel volumes. Table 6-1 shows the results of the comparison for the 27 Member States that have reported under both Articles 7a and 8.

Table 6-1 Total quantities of fossil fuels and bio-based substitutes (million litres)

Member State	Petrol		Diesel		Difference (%)	
	Article 7a	Article 8	Article 7a	Article 8	Petrol	Diesel
Austria	2,178	2,173	7,101	6,990	0.2%	1.6%
Belgium	3,241	3,253	6,956	6,937	-0.4%	0.3%
Bulgaria	742	664	2,983	2,858	11.8%	4.4%
Croatia	718	732	2,496	2,217	-2.0%	12.6%
Cyprus	440	440	413	413	0.0%	-0.1%
Czechia	2,013	2,313	5,772	6,160	-13.0%	-6.3%
Denmark	1,740	1,793	3,230	3,006	-3.0%	7.4%
Estonia	265	274	915	940	-3.30%	-2.62%
Finland	1,706	1,723	2,717	2,727	-1.0%	-0.4%
France	14,149	14,067	34,460	34,722	0.6%	-0.8%
Germany	22,880	23,109	39,208	39,738	-1.0%	-1.3%
Greece	2,857	2,863	3,326	3,447	-0.2%	-3.5%
Hungary	2,015	2,015	662	4,556	0.0%	-85.5%
Ireland	1,007	943	3,654	3,338	6.8%	9.5%
Italy	10,869	10,910	2,042	29,428	-0.4%	-93.1%
Latvia	179	211	975	1,209	-15.1%	-19.4%
Lithuania	365	418	2,059	1,649	-12.7%	24.8%
Luxembourg	513	518	1,373	1,246	-0.9%	10.2%
Malta	116	117	178	216	-0.8%	-17.6%
Netherlands	6,170	5,866	6,555	5,119	5.2%	28.1%
Poland	7,235	7,232	21,809	22,192	0.0%	-1.7%
Portugal ⁽²³⁾	1,499	1,341	5,485	4,637	11.8%	18.3%
Romania	1,800	1,721	5,880	6,266	4.6%	-6.2%
Slovakia	828	833	2,232	2,353	-0.6%	-5.1%
Slovenia	508	566	1,661	2,002	-10.2%	-17.0%

⁽²³⁾ Several comments from Portugal asked for slight corrections. Fuel quantities in this table also take into account bio-based substitutes, hence no corrections were applied.

Spain	7,778	8,063	22,694	25,604	-3.5%	-11.4%
Sweden	2,736	2,678	5,647	4,326	2.2%	30.5%
EU (27 Member States)	96 547	96 836	192 483	224 296	-0.3%	-14.18%

For many Member States, the differences for both petrol and diesel are relatively small, within $\pm 10\%$. However, there are also many Member States for which larger differences are observed, where total volumes reported under Article 7a are lower or higher than those reported under Article 8. For 2023, very high differences could be observed for Hungary, Italy, Lithuania, Netherlands and Sweden.

6.2 Comparison to SHARES data

The SHARES (SHort Assessment of Renewable Energy Sources) tool focuses on the harmonized calculation of the share of energy from renewable sources among EU Member States. More specifically, SHARES provides the amount of renewable fuels (electricity and sustainable biofuels) that are consumed by the transport sector in the EU. Sustainable biofuels are classified as Annex IX (RED II), biofuels from food and feed crops and other compliant biofuels. There is no detailed information about the exact feedstock categories that are reported under SHARES, apart from feedstocks that are grouped under RED II Annex IX. Furthermore, Member States are allowed to report biofuel feedstocks as “Other” under Article 7a. This does not allow for a direct comparison between the amounts of biofuels from food and feed crops, or the amounts of other compliant biofuels, that are reported by SHARES and Article 7a, as there is no information on the specific feedstocks that have been considered for each category under SHARES, or how these correspond to the feedstock categories that have been reported under Article 7a.

However, it is possible to compare the amount of advanced biofuels according to RED II Annex IX, as the respective feedstocks are strictly specified. Based to the data provided by the SHARES tool²⁴, the total amount of energy corresponding to advanced biofuels, according to the feedstocks that are included in RED II Annex IX, was equal to 7 575 ktoe in 2023. For the biofuel quantities that were reported under Article 7a, 8 644 ktoe corresponded to advanced biofuels according to RED II Annex IX Part A and Part B, which is 14% (1 069 ktoe) higher than the respective amount that is reported in SHARES (see Table A1-5 for the feedstock types from Art. 7 assigned to advanced biofuels, according to RED II Annex IX). Given that the feedstock categories corresponding to advanced biofuels among the two datasets are not identical, the deviation in the final results can be expected, especially when taking into account that in Article 7a reporting, several Member States have reported biofuel feedstock category as N/A (around 0.4% of biofuel quantity), and that there are cases where different feedstock categories have been aggregated under one feedstock category, not allowing to classify them as advanced.

(24) [https://ec.europa.eu/eurostat/web/energy/database/additional-data#Short%20assessment%20of%20renewable%20energy%20sources%20\(SHARES\)](https://ec.europa.eu/eurostat/web/energy/database/additional-data#Short%20assessment%20of%20renewable%20energy%20sources%20(SHARES))

List of abbreviations

Abbreviation	Name
CHP	Combined heat and power
CNG	Compressed natural gas
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DLUC	Direct land use change
EEA	European Environment Agency
EFB	Empty fruit bunch
Eionet	European Environment Information and Observation Network
ETBE	Ethyl tert-butyl ether
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
EU	European Union
FAEE	Fatty acid ethyl esters
FAME	Fatty acid methyl esters
FFBS	Fresh fruit brunches
FQD	Fuel Quality Directive
GHG	Greenhouse gas
GJ	Gigajoule
HVO	Hydrotreated vegetable oil
ILUC	Indirect land use change
JRC	Joint Research Centre
LBG	Liquefied biogas
LNG	Liquified natural gas
LPG	Liquid petroleum gas
MJ	Megajoule
MTBE	Methyl tert-butyl ether
PFAD	Palm fatty acid distillate (PFAD)
PJ	Petajoule
POME	Palm oil mill effluent
QA/QC	Quality assurance/quality control
RUCO	Repurpose used cooking oil
SBE	Spent bleaching earth
TAAE	Tert-amyl ethyl ether

TJ	Terajoule
UER	Upstream emission reductions

Annex

Table A1-1 Greenhouse gas (GHG) intensity per fossil fuel type

Fuel or energy type	GHG intensity (g CO ₂ e/MJ)
Liquified petroleum gas	73.6
Compressed natural gas	69.3
Diesel	95.1
Petrol	93.3
Gas oil	95.1
Liquified natural gas	74.5
Other	93.3

Table A1-2 Average reported greenhouse gas (GHG) intensity per biofuel type (excluding ILUC)

Fuel or energy type	GHG intensity (g CO ₂ e/MJ)
Biodiesel	23.6
Bio-ETBE	28.2
Bioethanol	19.9
Biogas	-29.1
Biomethanol	28.0
Bio-MTBE	37.5
Bio-TAEE	39.3
Hydrotreated vegetable oil HVO	11.3
Pure vegetable oil	29.7
Other (bio synthetic oil	29.2
Other (bio synthetic oil)	27.2
Other (Bioethanol diesel)	17.9
Other (Biofuel oil)	7.7
Other (Biogasoline)	9.9
Other (biokerosine)	7.5
Other (bio-LNG)	8.7
Other (BioLPG)	8.2
Other (Biomethane)	20.9
Other (bionafta)	10.9
Other (Bio-Naphtha / HVO in Petrol)	14.4
Other (Biopetrol)	62.6
Other (Biopropane)	1.4
Other (Co-feed Renewable Diesel)	16.0
Other (Co-processed - processed in a refinery at the same time as fossil fuels - biomass or pyrolyzed biomass oil to replace diesel oil)	9.4
Other (Co-processed hydrotreated vegetable oil - CHVO)	7.6
Other (Co-processed oil to be used for replacement of diesel)	12.1
Other (Co-processed oil to be used for replacement of jet fuel)	16.0
Other (Co-Treated Oil for Diesel)	21.1

Other (coTreated oil for gasoline))	17.9
Other (Hydrotreated oil - Gasoline)	9.0
Other (Hydrotreated oil -Diesel)	7.4
Other (Naphta)	4.9

Table A1-3 Feedstocks used for biofuels

- Acid oil from used cooking oil
- Algae
- Animal fats classified as categories 1 and 2
- Animal manure and sewage sludge
- Animal manure and sewage sludge, Other cellulosic materials of non-food origin
- Animal manure and sewage sludge, straw, husks, cobs cleaned of corn grains and other cellulosic materials of non-food origin
- Animal manure, sewage sludge, cobs cleaned of corn grains and other cellulosic materials of non-food origin
- Bagasse
- Barley
- Biomass fraction of industrial waste
- Biomass fraction of industrial waste unfit for use in the human or animal food chain
- Biomass fraction of mixed municipal waste
- Biomass fraction of mixed municipal waste and sewage sludge
- Biomass fraction of wastes and residues from forestry and forest-based industries
- Bio-waste
- Brown grease
- Cobs cleaned of kernels of corn
- Corn (maize)
- Crude glycerine
- Grape marcs and wine lees
- Husks
- N/A
- Nut shells
- Other cereals
- Other oil crops
- Other sugar crops
- Palm oil
- Palm oil mill effluent
- Palm oil mill effluent and empty palm fruit bunches
- Rapeseed
- Soapstock acid oil contaminated with sulphur
- Soybeans
- Spent bleached earth
- Starch slurry
- Straw
- Sugar beet
- Sugar cane
- Sunflower seed
- Tall oil pitch
- Tallow - category 3 or unknown
- Used cooking oil
- Waste pressings from production of vegetable oils
- Waste vegetable or animal oils
- Waste wood
- Wheat
- Other (Agri-food waste)
- Other (Animal fats classified as categorie 3)
- Other (Animal manure, triticales)
- Other (Animal manure, triticales, sorghum, corn stalks, straw, chaff of rice)
- Other (Animal manure, triticales, straw)
- Other (Bacteria)
- Other (Biomass fraction of mixed industrial and municipal solid waste and sewage sludge)
- Other (Biowaste class 3)
- Other (brown grease/grease trap fat)
- Other (Brown liquor)
- Other (cashew shell oil)
- Other (Corn oil)
- Other (EFBs)
- Other (Fatty acid distillate)
- Other (fatty acids)
- Other (Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain)
- Other (Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, Grape marc and wine lees)
- Other (Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, hay, Animal manure and sewage sludge, Grape marc and wine lees, shells, Pula)
- Other (Fraction of biomass corresponding to unsorted municipal waste)
- Other (Free fatty acid (FFA) and soap stock)
- Other (Grain)
- Other (Grass / field grass)
- Other (Molasses)
- Other (Municipal grass cuttings; manure; food waste)
- Other (oil seeds)
- Other (Organic waste as defined in Article 183, paragraph 1, letter d), of Legislative Decree no. 152 of 3 April 2006, coming from domestic collection and subject to separate collection pursuant to Article 20 of Legislative Decree no. 152 of 3 April 2006.)
- Other (Organic waste)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, Animal manure and sewage sludge)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, hay, Animal manure and sewage sludge, Grape marc and wine lees, shells, Pula)
- Other (Organic waste, Other ligno-cellulosic materials, except saw logs and veneer logs)
- Other (Palm oil mill effluent (POME))
- Other (Palm oil mill effluent and empty palm fruit bunches (POME))
- Other (Palm oil separated from the waste sludge of palm oil presses (process waste) or the fatty acid distillate obtained from it and the bottom fraction of the distillate)
- Other (PFAD)

- Other (residues from the distilling industry)
 - Other (sewage sludge)
 - Other (Spent bleaching earth oil (SBEO))
 - Other (Sugar beet residues)
 - Other (Sunflower whole plant)
 - Other (Technical corn oil from stillages)
 - Other (Technical corn oil)
 - Other (Technical waste alcohol, drip, surge, head, tails and fusel)
 - Other (Triticale)
- Other (Used cooking oil entirely of vegetable origin)
 - Other (used whitewash soil)
 - Other (vegetable oil)
 - Other (waste)
 - Other (Waste/residues from processing of alcohol)
 - Other (wastewater from palm oil extrusion plants and empty palm fruit bundles)

Table A1-4 Biofuel production pathways

- Biogas from dry manure as compressed natural gas
- Biogas from municipal organic waste as compressed natural gas
- Biogas from wet manure as compressed natural gas
- Farmed wood ethanol
- hydrotreated tallow - category 3 or unknown
- Hydrotreated vegetable oil from palm oil (process not specified)
- Hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)
- Hydrotreated vegetable oil from rape seed
- Hydrotreated vegetable oil from sunflower
- MTBE renewable component
- Palm oil biodiesel (process not specified)
- Palm oil biodiesel (process with methane capture at oil mill)
- Rape seed biodiesel
- Soybean biodiesel
- Sugar beet ethanol
- Sugar cane ethanol
- Sunflower biodiesel
- Waste vegetable oil or animal fat biodiesel
- Waste wood ethanol
- Waste wood Fischer-Tropsch diesel
- Wheat ethanol (lignite as process fuel in CHP plant)
- Wheat ethanol (natural gas as process fuel in CHP plant)
- Wheat ethanol (natural gas as process fuel in conventional boiler)
- Wheat ethanol (process fuel not specified)
- Wheat straw ethanol
- N/A
- Other (Acid oil biodiesel)
- Other (Acidic oils extracted from soap pastes)
- Other (animal fats classified as categories 1 and 2 Biodiesel)
- Other (Animal fats from rendering (category 1) diesel)
- Other (Animal manure and sewage sludge)
- Other (bagasse ethanol)
- Other (Barley ethanol)
- Other (biodiesel from palm effluent and palm fruit bunches)
- Other (Biodiesel from "satzöl")
- Other (biodiesel from animal fat)
- Other (Biodiesel from animal fats)
- Other (Biodiesel from biodegradable food and kitchen waste from industries)
- Other (Biodiesel from biomass fraction of industrial waste and residues)
- Other (Biodiesel from EFB)
- Other (Biodiesel from elderberry seed oil)
- Other (Biodiesel from empty palm fruit bunches - process not specified)
- Other (Biodiesel from fatty acid)
- Other (Biodiesel from flotation fat)
- Other (biodiesel from Free Fatty Acid)
- Other (Biodiesel from glycerine phase)
- Other (Biodiesel from industrial food waste)
- Other (biodiesel from industrial waste)
- Other (Biodiesel from milk thistle oil)
- Other (Biodiesel from oils contaminated with sulfuric acid)
- Other (biodiesel from palm fatty acid distillate - PFAD)
- Other (Biodiesel from palm oil mill effluent - process not specified)
- Other (biodiesel from Palm oil mill effluent)
- Other (Biodiesel from PFAD)
- Other (Biodiesel from POME)
- Other (Biodiesel from process waste - feed production)
- Other (Biodiesel from process waste - water cleaning facility)
- Other (Biodiesel from SBE)
- Other (biodiesel from sewage sludge)
- Other (Biodiesel from sludges of on-site effluent treatment in the processing of palm oil (POME))
- Other (Biodiesel from soapstock)
- Other (Biodiesel from Sulfur Contaminated Soap Pastes)
- Other (biodiesel from sunflower seed)
- Other (Biodiesel from technical corn oil)
- Other (Biodiesel from the process of oils or fats collected using separators or traps placed in drains)
- Other (biodiesel from UCO)
- Other (Biodiesel from used cooking oil)
- Other (Biodiesel from waste based fatty acids)
- Other (Biodiesel from waste based vegetable oils)
- Other (Biodiesel from waste vegetable oil or animal fat)
- Other (Biodiesel from water cleaning facility)
- Other (Biodiesel produced from biomass fraction of industrial waste)
- Other (Biodiesel produced from Food Waste)
- Other (Biodiesel produced from Spent Bleaching Earth)
- Other (Biodiesel produced from Tallow Cat. 1 and/or 2)
- Other (Biodiesel produced from tallow category 3 or unknown)
- Other (Biodiesel produced from used cooking oil - origin animal oil or animal+vegetable oil)
- Other (Bioethanol diesel from biomass fraction of industrial waste and residues)
- Other (Bioethanol from bagasse)
- Other (Bioethanol from barley)
- Other (Bioethanol from brown grease)
- Other (bioethanol from cobs)
- Other (Bioethanol from corn - maize)
- Other (Bioethanol from corn (maize) with forest residues as process fuel in a CHP plant)
- Other (Bioethanol from corn)
- Other (Bioethanol from corn, non-EU)
- Other (Bioethanol from corn, overseas)
- Other (Bioethanol from molasses)
- Other (Bioethanol from organic waste)
- Other (Bioethanol from rye)
- Other (Bioethanol from sewage sludge)
- Other (Bioethanol from starch slurry)
- Other (Bioethanol from starch slurry, B&C)
- Other (Bio-ethanol from Sugar beet residues)
- Other (Bioethanol from triticale)
- Other (bioethanol from waste)
- Other (Bio-ethanol produced from biomass fraction of industrial waste)

- Other (Biofuel oil from biomass fraction of industrial waste and residues)
- Other (Biofuel oil from palm oil separated from the waste sludge of palm oil presses (process waste) or the fatty acid distillate obtained from it and the bottom fraction of the distillate)
- Other (Biofuel oil from PFAD)
- Other (Biofuel oil from tall oil)
- Other (Biofuel oil from waste vegetable oil or animal fat)
- Other (Biogas from agri-food waste as compressed natural gas)
- Other (Biogas from animal wastes and residues (cat. I or II) as compressed Biomethane)
- Other (Biogas from bacteria as compressed natural gas)
- Other (biogas from biowaste)
- Other (Biogas from corn)
- Other (biogas from crude glycerine)
- Other (biogas from starch slurry)
- Other (Biogas from green waste as compressed biomethane)
- Other (biogas from husks)
- Other (biogas from industrial waste)
- Other (Biogas from manure and agri-food waste as compressed natural gas)
- Other (biogas from manure and sewage sludge)
- Other (biogas from mixed municipal waste)
- Other (Biogas from municipal organic waste and sewage sludge as compressed natural gas)
- Other (Biogas from municipal grass cuttings; manure; food waste)
- Other (biogas from nut shells)
- Other (biogas from peel)
- Other (Biogas from sewage sludge as compressed natural gas)
- Other (biogas from soywaste)
- Other (biogas from straw)
- Other (biogas from UCO)
- Other (biogas from waste animal oil)
- Other (biogas from waste from sugar beet)
- Other (biokerosine from animal fat)
- Other (biokerosine from UCO)
- Other (bio-LNG from animal fat)
- Other (bio-LNG from crude glycerine)
- Other (bio-LNG from industrial waste)
- Other (bio-LNG from sewage sludge)
- Other (biomethan from fat separation unit)
- Other (biomethan from slurry)
- Other (biomethan from waste food)
- Other (biomethan from waste potatoes)
- Other (Biomethane from biomass as compressed natural gas)
- Other (Biomethane from biowaste as compressed natural gas)
- Other (Biomethane from sewage sludge as compressed natural gas)
- Other (Biomethane from waste from food industry as compressed natural gas)
- Other (Bio-methanol from other bio-waste)
- Other (Biomethanol produced from biomass fraction of industrial waste)
- Other (Biomethanol produced from organic municipal solid waste)
- Other (bionafta from POME)
- Other (Biopetrol from biomass fraction of industrial waste and residues)
- Other (Biopetrol from palm oil separated from the waste sludge of palm oil presses (process waste) or the fatty acid distillate obtained from it and the bottom fraction of the distillate)
- Other (Biopetrol from PFAD)
- Other (Biopetrol from POME)
- Other (Biopetrol from waste vegetable oil or animal fat)
- Other (Biopropane from animal fats classified as category 3)
- Other (Biopropane from biodegradable food and kitchen waste from homes)
- Other (Biopropane from biodegradable food and kitchen waste from industries)
- Other (Biopropane from hydrogen-treated palm oil)
- Other (Biopropane from POME)
- Other (bio-waste ethanol)
- Other (Bran as process fuel in CHP plant)
- Other (brown grease - process not specified)
- Other (brown grease biodiesel)
- Other (Brown grease)
- Other (Brown liquor ethanol)
- Other (CEREALS AND OTHER STRACH-RICH CROP)
- Other (cereals bioethanol)
- Other (Co-processed - processed in a refinery at the same time as fossil fuels - biomass or pyrolyzed biomass oil to replace diesel oil)
- Other (coprocessing)
- Other (Corn - maize - ethanol)
- Other (Corn - maize bioethanol)
- Other (Corn - maize ethanol, Community produced - natural gas as process fuel in CHP plant)
- Other (Corn - maize)
- Other (Corn / Maize cobs bioethanol)
- Other (corn biodiesel - process not specified)
- Other (corn bio-ETBE)
- Other (corn bioethanol)
- Other (Corn ETBE)
- Other (Corn ethanol - natural gas as process fuel in conventional plant)
- Other (Corn ethanol - process fuel not specified)
- Other (Corn ethanol produced in the Community)
- Other (Corn ethanol)
- Other (Corn ethanol, natural gas as process fuel in CHP plant)
- Other (Corn ethanol, natural gas as process fuel in conventional boiler)
- Other (Corn ethanol, process fuel not specified)
- Other (Corn ethanol, produced overseas - natural gas as process fuel in CHP plant)
- Other (Corn oil biodiesel)
- Other (Corn)
- Other (Corn/maize bioethanol)
- Other (coTreated oil for diesel)
- Other (CoTreated oil from Animal Fats C1 C2)
- Other (Co-Treated oil from palm effluents and bunches)
- Other (CoTreated oil from UCO)
- Other (Cottonseed biodiesel)
- Other (crude glycerine)
- Other (EFB Biodiesel)

- Other (Electrolysis completely powered by renewable energy of non-biological origin)
- Other (Esterification)
- Other (Esterification and transesterification)
- Other (ETBE renewable component)
- Other (ETBE, bio part corn ethanol, produced outside of the community - process fuel not specified)
- Other (ethanol from barley (process not specified))
- Other (Ethanol from biomass fraction of industrial waste and residues)
- Other (ethanol from biomass fraction of industrial waste)
- Other (Ethanol from biowaste class 3)
- Other (ethanol from cobs cleaned of kernels of corn (natural gas as process fuel in CHP plant))
- Other (ethanol from cobs cleaned of kernels of corn (process not specified))
- Other (ethanol from corn (maize) (natural gas as process fuel for technological processes in a conventional boiler))
- Other (ethanol from corn (maize) (natural gas as process fuel in CHP plant))
- Other (ethanol from corn (maize) (processes not specified))
- Other (ethanol from industrial waste)
- Other (ethanol from molasses (process not specified))
- Other (Ethanol from Molasses)
- Other (ethanol from residues from the distilling industry)
- Other (Ethanol from sorghum)
- Other (Ethanol from starch slurry)
- Other (ethanol from sugar beet residues (process not specified))
- Other (Ethanol from sugar beet residues)
- Other (ethanol from triticale (natural gas as process fuel in CHP plant))
- Other (ethanol from triticale (natural gas as process fuel in conventional boiler))
- Other (Ethanol from Triticale)
- Other (Ethanol from Waste and residues from alcohol production)
- Other (Ethanol from Waste/residues from processing of alcohol)
- Other (Ethanol)
- Other (Ethyl-tert-butyl-ether (ETBE) - renewable component)
- Other (fatty acid biodiesel)
- Other (Fatty acid distillate)
- Other (fatty acids from rapeseed)
- Other (FFA UCO Biodiesel)
- Other (FFBS)
- Other (Filtered bleaching of soils spent in an industrial process)
- Other (Food Waste biodiesel)
- Other (food waste bioethanol)
- Other (Free fatty acid (FFA) and soap stock diesel)
- Other (Free fatty acids from UCO and resulting from an industrial process)
- Other (grape marcs and wine lees ethanol)
- Other (grape marcs ethanol)
- Other (Grape marcs)
- Other (Grease trap fat)
- Other (HVO (waste vegetable or animal oils))
- Other (HVO from animal fat category 2)
- Other (HVO from animal fats classified as categories 1 & 2)
- Other (HVO from animal fats classified as category 3)
- Other (HVO from industrial food waste)
- Other (HVO from industrial waste)
- Other (HVO from palm fatty acid distillate - PFAD)
- Other (HVO from palm oil mill effluent)
- Other (HVO from POME)
- Other (HVO from soybeans)
- Other (HVO from UCO)
- Other (HVO from used cooking oil)
- Other (HVO PFAD)
- Other (HVO(Palm oil mill effluent and empty palm fruit bunches))
- Other (HVO)
- Other (Hydrobiodiesel from animal fats category 3)
- Other (Hydrobiodiesel from POME)
- Other (Hydrobiodiesel from used cooking oil)
- Other (hydrocarbons from co-hydrogenation from rapeseed oil)
- Other (Hydrodiesel from used cooking oil)
- Other (Hydrogenated oil obtained from rendered fats of animal origin)
- Other (HYDROGENATION)
- Other (Hydrogen-treated vegetable oil from biodegradable household food and kitchen waste)
- Other (hydrotreated biomass fraction of industrial waste)
- other (Hydrotreated brown grease)
- Other (hydrotreated oil from animal fats C1-C2))
- Other (hydrotreated oil from animal fats from rendering)
- Other (Hydrotreated oil from C1-C2 fats)
- Other (hydrotreated oil from industrial waste)
- Other (hydrotreated oil from rapeseed)
- Other (Hydrotreated oil from separately collected used cooking oils and fats of vegetable origin)
- Other (hydrotreated oil from Tallow cat. 3))
- Other (Hydrotreated oil from tallow)
- Other (Hydrotreated oil from UCO)
- Other (hydrotreated oil from used cooking oil)
- Other (hydrotreated oil from waste cooking oil)
- Other (hydrotreated oil from wood waste)
- Other (Hydrotreated oil palm fresh fruit bunches - FFBs)
- Other (Hydrotreated palm oil mill effluent)
- Other (Hydrotreated tallow - category 3 or unknown)
- Other (Hydrotreated tallow category 1 or 2)
- Other (Hydrotreated used cooking oil - 100% origin vegetable oil)
- Other (Hydrotreated used cooking oil - origin animal oil or animal+vegetable oil)
- Other (Hydrotreated vegetable oil from technical corn oil)
- Other (hydrotreated vegetable oil - soybean)
- Other (Hydrotreated vegetable oil bionafra from palm oil - process not specified)
- Other (Hydrotreated vegetable oil from animal fat cat. 3)
- Other (Hydrotreated vegetable oil from animal fat)

- Other (Hydrotreated vegetable oil from biomass fraction of industrial waste and residues)
- Other (Hydrotreated vegetable oil from Crude Tall Oil)
- Other (Hydrotreated vegetable oil from Palm fatty acid distillate (PFAD))
- Other (Hydrotreated vegetable oil from palm oil separated from the waste sludge of palm oil presses (process waste) or the fatty acid distillate obtained from it and the bottom fraction of the distillate)
- Other (Hydrotreated vegetable oil from palm oil)
- Other (Hydrotreated vegetable oil from PFAD)
- Other (Hydrotreated vegetable oil from POME)
- Other (Hydrotreated vegetable oil from Soybeans)
- Other (Hydrotreated vegetable oil from tall oil)
- Other (Hydrotreated vegetable oil from UCO)
- Other (Hydrotreated vegetable oil from used cooking oil - origin 100% vegetable oil)
- Other (Hydrotreated vegetable oil from used cooking oil - origin animal or animal+vegetable oil)
- Other (Hydrotreated vegetable oil from Used cooking oil)
- Other (Hydrotreated vegetable oil from waste and residues)
- Other (Hydrotreated vegetable oil from waste vegetable oil or animal fat)
- Other (Hydrotreated vegetable oil HVO from PFAD)
- Other (Hydrotreated vegetable oil produced from tallow category 3 or unknown)
- Other (Hydrotreated Waste vegetable or animals oils)
- Other (Industrial Food Waste)
- Other (industrial waste biodiesel)
- Other (industrial waste ethanol)
- Other (Industrial waste)
- Other (lignocellulose ethanol)
- Other (maize ethanol)
- Other (molasses ethanol)
- Other (Molasses)
- Other (MTBE, bio part biomethane from organic municipal solid waste - MSW)
- Other (non-sustainable biodiesel)
- Other (non-sustainable bioethanol)
- Other (non-sustainable biofuel oil)
- Other (non-sustainable biopetrol)
- Other (non-sustainable hydrotreated vegetable oil HVO)
- Other (Oil palm fresh fruit bunches (FFBs) HVO)
- Other (oil palm fresh fruit bunches)
- Other (Oils from spent bleaching or filtering earth from an industrial process)
- Other (Oils or fats collected by separators or traps placed in drains, considered waste)
- Other (Oils or fats collected through separators or traps placed in drains)
- Other (Organic waste as defined in Article 183, paragraph 1, letter d), of Legislative Decree no. 152 of 3 April 2006, coming from domestic collection and subject to separate collection pursuant to Article 20 of Legislative Decree no. 152 of 3 April 2006.)
- Other (other cereals excluding maize ethanol)
- Other (Palm Fatty Acid Distillate)
- Other (Palm oil biodiesel - open effluent pond)
- Other (Palm oil mill effluent and empty palm fruit bunches)
- Other (Palm oil mill effluent)
- Other (Palm oil press effluent)
- Other (Palm oil)
- Other (palmolein biodiesel)
- Other (PFAD HVO)
- Other (PFAD)
- Other (POME Hydrobiodiesel)
- Other (POME)
- Other (Rape seed / Canola biodiesel)
- Other (residual oils or greases from drains)
- Other (Separately collected used cooking oil)
- Other (Sewage Sludge)
- Other (soap acid oil biodiesel)
- Other (Soapstock acid oil contaminated with sulphur biodiesel)
- Other (Soapstock acid oil contaminated with sulphur)
- Other (Soapstock acid oils biodiesel)
- Other (soapstock contaminated with sulphur - process not specified)
- Other (Soapstock contaminated with sulphur)
- Other (Sorghum ethanol)
- Other (Spent bleached earth - process fuel not specified)
- Other (Spent bleached earth - process not specified)
- Other (Spent bleached earth Biodiesel)
- Other (Spent bleached earth)
- Other (Spent bleaching earth oil (SBEO) diesel)
- Other (starch slurry ethanol)
- Other (Starch slurry ethanol)
- Other (sugar beet bio-ETBE)
- Other (sugar beet residues ethanol)
- Other (sugar cane bio-ETBE)
- Other (Sugarcane Bioethanol)
- Other (Syntetic Oil from industrial waste)
- Other (Synthetic oil from Grape marcs))
- Other (TAE renewable component)
- Other (Tallow - category 3 or unknown)
- Other (Technical corn oil diesel)
- Other (Technical corn oil from stillages diesel)
- Other (Transesterification and Distillation)
- Other (Transesterification)
- Other (Tritical ethanol)
- Other (Triticale ethanol - process fuel not specified)
- Other (Triticale ethanol)
- Other (Triticale)
- Other (UCO)
- Other (Used Bleached Earth Oil)
- Other (Used cooking oil - origin animal / or animal+vegetable fat)
- Other (Used cooking oil - origin vegetable oil)
- Other (Used cooking oil - process fuel not specified)
- Other (Used Cooking Oil (Vegetable))
- Other (used cooking oil biodiesel)
- Other (Used cooking oil)
- Other (Vegetable oil from animal fats classified as category 3)
- Other (Vegetable oil from empty fruit bunches)
- Other (Vegetable oil from palm oil mill effluent)
- Other (Vegetable oil from soapstock contaminated with sulphur)
- Other (Vegetable oil from spent bleached earth)
- Other (Waste from manufacturing, tubing, distribution)

- Other (Waste pressings from production of vegetable oils)
 - Other (Waste Starch Slurry Ethanol)
 - Other (Waste vegetable or animal oils)
 - Other (Waste/residues from processing of alcohol)
 - Other (wheat bio-ETBE)
- Other (Wheat ethanol - bran as process fuel in CHP plant)
 - Other (Wheat ethanol - forest residues as process fuel in CHP plant)
 - Other (Wheat)

Table A1-5 Feedstocks assigned to advanced biofuels, according to RED II Annex IX

- Acid oil from used cooking oil
- Algae
- Animal fats classified as categories 1 and 2
- Animal manure and sewage sludge
- Animal manure and sewage sludge, Other cellulosic materials of non-food origin
- Animal manure and sewage sludge, straw, husks, cobs cleaned of corn grains and other cellulosic materials of non-food origin
- Animal manure, sewage sludge, cobs cleaned of corn grains and other cellulosic materials of non-food origin
- Bagasse
- Biomass fraction of industrial waste
- Biomass fraction of industrial waste unfit for use in the human or animal food chain
- Biomass fraction of mixed municipal waste
- Biomass fraction of mixed municipal waste and sewage sludge
- Biomass fraction of wastes and residues from forestry and forest-based industries
- Bio-waste
- Cobs cleaned of kernels of corn
- Crude glycerine
- Grape marcs and wine lees
- Husks
- N/A
- Nut shells
- Palm oil mill effluent
- Palm oil mill effluent and empty palm fruit bunches
- Straw
- Tall oil pitch
- Used cooking oil
- Other (Agri-food waste)
- Other (Animal fats classified as categorie 3)
- Other (Animal manure, triticale)
- Other (Animal manure, triticale, sorghum, corn stalks, straw, chaff of rice)
- Other (Animal manure, triticale, straw)
- Other (Biomass fraction of mixed industrial and municipal solid waste and sewage sludge)
- Other (Biowaste class 3)
- Other (brown grease/grease trap fat)
- Other (Brown liquor)
- Other (cashew shell oil)
- Other (EFBs)
- Other (Fraction of biomass corresponding to unsorted municipal waste)
- Other (Free fatty acid (FFA) and soap stock)
- Other (Organic waste)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, Animal manure and sewage sludge)
- Other (Organic waste, Fraction of biomass corresponding to industrial waste unfit for use in the human or animal food chain, hay, Animal manure and sewage sludge, Grape marc and wine lees, shells, Pula)
- Other (Organic waste, Other ligno-cellulosic materials, except saw logs and veneer logs)
- Other (Palm oil mill effluent (POME))
- Other (Palm oil mill effluent and empty palm fruit bunches (POME))
- Other (Palm oil separated from the waste sludge of palm oil presses (process waste) or the fatty acid distillate obtained from it and the bottom fraction of the distillate)
- Other (PFAD)
- Other (sewage sludge)
- Other (Spent bleaching earth oil (SBEO))
- Other (Technical waste alcohol, drip, surge, head, tails and fusel)
- Other (Used cooking oil entirely of vegetable origin)
- Other (used whitewash soil)
- Other (vegetable oil)

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