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Greenhouse gas intensities of transport fuels in the EU in 2022

Monitoring under the Fuel Quality Directive

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Contents

Contents 1
Acknowledgements 2
Executive summary 3
About this report 3
Main findings 3
1 Introduction 6
2 Reporting by European Union Member States 7
2.1 Reporting requirements 7
2.2 Quality of Member States’ reporting in 2022 7
3 Supplied quantities of road transport fuels in 2022 9
3.1 Fossil fuel and biofuel quantities supplied 9
3.2 Biofuel production pathways and feedstocks used 10
3.3 Electricity consumption 11
4 Progress to 2022 targets under the Fuel Quality Directive 14
4.1 Average GHG emissions intensity of transport fuels in 2022 14
4.2 Upstream emission reductions 18
5 Effects of indirect land use change on GHG intensities 19
5.1 Greenhouse gas emission intensities of crop types 19
5.2 Greenhouse gas emission savings by substituting fossil fuels with biofuels 20
6 Consistency with other reporting streamlines 24
6.1 Comparison between fuel volumes reported under Article 7a and Article 8 24
6.2 Comparison to SHARES data 25
List of abbreviations 26
Annex 28

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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 2022, 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 supports the European Commission in the compilation, quality checking and dissemination of information reported under Article 7a of the FQD.

Main findings

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

According to the data reported in 2023 by the 27 Member States, the average GHG intensity of the fuels[(4)] supplied in these countries in 2022 (excluding the ILUC emissions intensity for biofuels) was 88.8 g carbon dioxide equivalent (CO_2e), 5.6% lower than the 2010 levels. This is almost exactly the same intensity with that of 2021. However, there is a slight improvement (0.4 percentage points) compared to the year 2020 (5.5% reduction compared to 2010), while also representing an additional reduction of 1.3 percentage points compared to 2019 (4.3% reduction compared to 2010, for 28 EU Member States) and of 1.8 percentage points compared to 2018 (3.7% reduction compared to 2010, for 28 EU Member States). Therefore, in 2022, EU fuel suppliers in the 27 reporting Member States were, on average, behind their objective of reducing the GHG intensity of transport fuels by 6% compared to 2010[(5)]. In order to reach the obligatory 6%, target, an additional 0.36% reduction in the GHG intensity of all fossil fuels, biofuels and electricity supplied would have been needed.

The progress achieved by fuel suppliers varies greatly across Member States. Fuel suppliers from nine countries reached or exceeded the 6% reduction target in 2022.

(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.

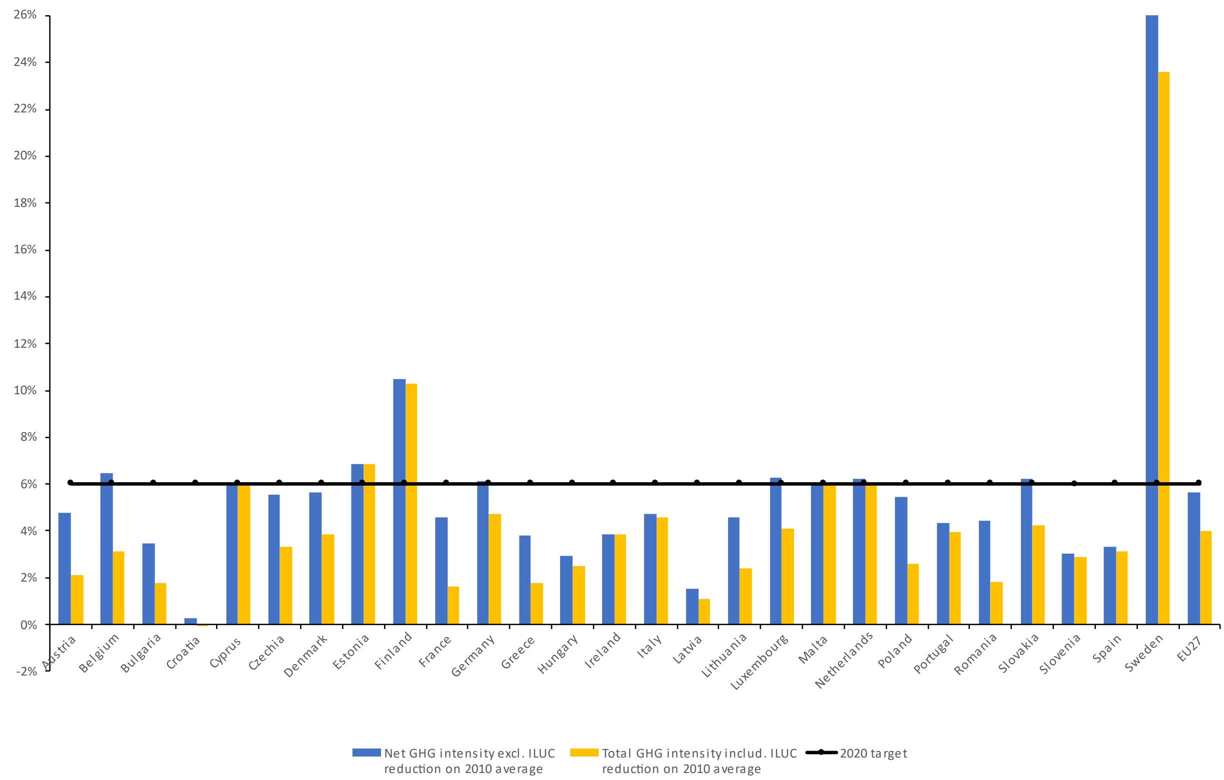
(4) Considering the electricity consumed that was voluntarily reported by 19 Member States.

(5) In 2022, upstream emission reductions were reported by fifteen Member States, which are expected to contribute to the 6% reduction target.

From the Member States that have not yet reached the 2020 target, six have reported reductions greater than 4%, while for the remaining Member States the reductions remain lower than 4%. The most significant progress was made by Italy, which reduced its GHG emission intensity by 1.1% compared to 2021, with an overall reduction of 4.7% 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 2022 was only 4% lower than the 2010 levels when considering ILUC – this corresponds to a saving of 42 Mt CO2e in the year 2022. 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 1.1.

Figure ES-1 Reductions in GHG intensity of fuels achieved by EU fuel suppliers in Member States, 2010-2022



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 2022 for the 27 MS was 11 164 petajoules of which 93.4% came from fossil fuels and 6.6% from biofuels. The fuel supply was dominated by diesel (52.8%) and petrol (23.8%), followed by gas oil (14.7%), biodiesel (3.9%), HVO (1.2%) and bioethanol (1.1%).

Regarding the main feedstock and pathways used to produce biofuels, biodiesel is produced mainly from rapeseed (44%), used cooking oil (20.8%) and bio-waste (9.5%); bioethanol is produced mainly from corn (52.6%), wheat (15.3%) and sugar cane (9.5%); and HVO is produced mainly from palm oil (21.6%), tallow (23.4%) and animal fats classified as categories 1 and 3 (15.7%).

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 2022, this quantity accounted for 0.04% of the total energy supply, as reported by 19 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 61% 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 (87.4 vs 95.1 g CO2e/MJ).

In the case of HVO, the majority (68%) 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 (8.4 vs 95.1 g CO2e/MJ). The quantities of HVO produced from oil crops (featuring therefore a significantly higher GHG intensity), are lower (around 14%).

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 (31.4 vs 93.3 g CO2e/MJ).

Substitution of diesel with biodiesel and HVO results in GHG emission reductions of approximately 48%, when considering ILUC, and nearly 77% when excluding ILUC. Substitution of petrol with bioethanol and bio-ethyl tert-butyl ether (bio-ETBE) leads to reductions of around 66% when considering ILUC, and nearly 77% when excluding ILUC. Finally, substitution of compressed natural gas with biogas leads to reductions of around 89% in both cases.

(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.

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 2022 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 2022

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 2023, in relation to reference year 2022, 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 15 Member States were asked to provide clarifications on their reported values. The last **submission** was received on the 8.03.2024, while the last **resubmission** was received on 15.02.2024.

3 Supplied quantities of road transport fuels in 2022

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.

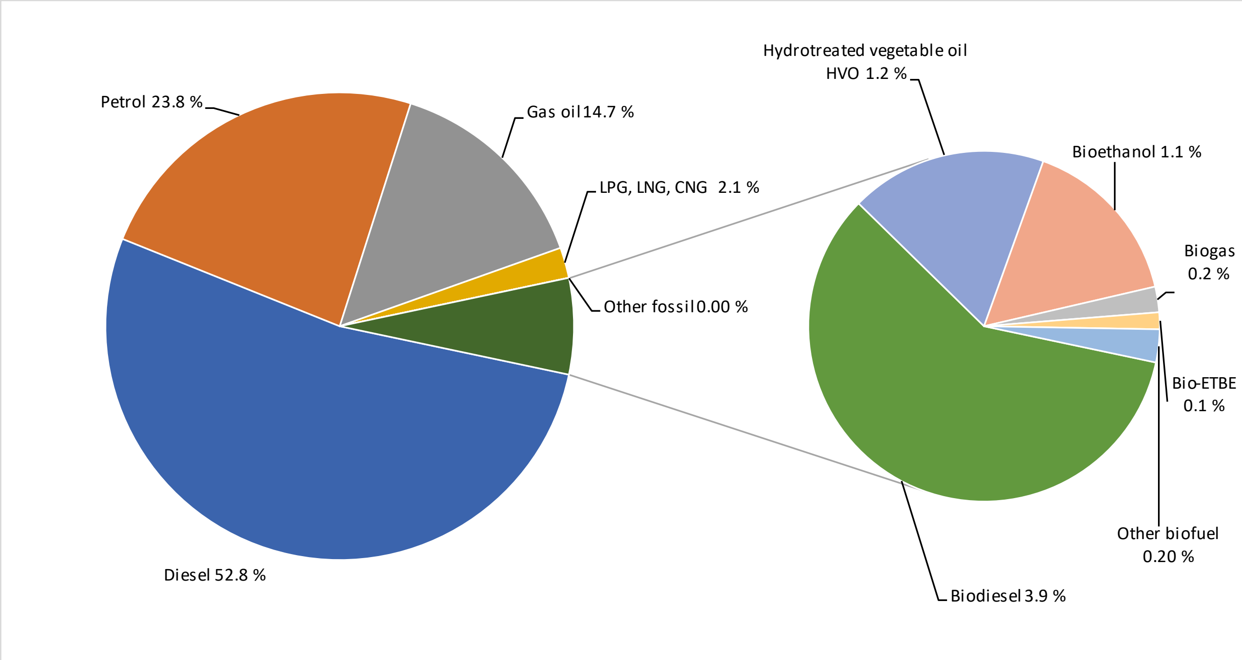
The total energy quantities supplied by suppliers are presented in Table 3-1 for the different fossil fuels and biofuels marketed in the 27 Member States.

Table 3-1 Total quantities of fossil fuels and biofuels

	Total quantity (PJ)
Fossil fuels	10 423
Diesel	5 892
Petrol	2 658
Gas oil	1 637
Liquid petroleum gas (LPG)	184
Compressed natural gas (CNG)	38
Liquefied natural gas (LNG)	13
Biofuels	742
Biodiesel	438
Hydrotreated vegetable oil (HVO)	134
Bioethanol	118
Biogas	17
Bio-ETBE	12
Other	23

Total fuel supply reported was 11 164 petajoules (PJ), of which 93.4% was from fossil fuels, and 6.6% was from biofuels (Figure 3-1). No renewable fuels of non-biological origin were reported for reference year 2022.

Figure 3-1 **Fuel energy supply shares per fuel type in 2022**



Notes: In category "other biofuel" the following types are included: Biomethanol, Bio-MTBE (methyl tert-butyl ether), Bioethanol Diesel, Biofuel oil, Bio-kerosine, Bio-LNG, Bio-LPG, Biomethane, Bionaphtha, Biopetrol, Biopropane, Co-processed hydrotreated vegetable oil (CHVO), Co-treated oil for diesel, Co-treated oil for gasoline, Cracked hydrotreated vegetable oil for gasoline, FAEE (fatty acid ethyl esters), hydrocarbons from co-hydrogenation from rapeseed oil, Hydrotreated oil – Diesel, Hydrotreated oil – Gasoline, Pure vegetable oil, Renewable naphtha.

The fossil fuel supply in 2022 was dominated by diesel (52.8% of total fuel consumption; 5 892 PJ[(11)]), followed by petrol (23.8% of total fuel consumption; 2 658 PJ) and gas oil (14.7% of total fuel consumption; 1 637 PJ). Liquified petroleum gas (LPG), liquified natural gas (LNG) and compressed natural gas (CNG) had a total share of 2.1% (236 PJ) in the total fuel consumption.

The biofuels energy consumption in the 27 EU Member States is dominated by biodiesel (3.9% of total fuel consumption; 438 PJ), followed by hydrotreated vegetable oil (HVO; 1.2% of total fuel consumption; 134 PJ) and bioethanol (1.1% of total fuel consumption; 118 PJ). Bio-ETBE and biogas account for 0.3% (29 PJ) of the total fuel consumption. All other biofuels used in road transport and non-road mobile machinery in 2022 present a share of 0.2% (23 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

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

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 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	44.1%
Used cooking oil / waste vegetable oil or animal fat	25.0%
Palm oil	8.0%
Other	22.4%
N/A	0.54%
Bioethanol	**Feedstock**
Corn (maize)	52.6%
Wheat	15.3%
Sugar cane	9.5%
Other	22.5%
N/A	0.14%
Hydrotreated vegetable oil	**Feedstock**
Tallow	24.1%
Palm oil	21.6%
Animal fats classified as categories 1 and 2	16.4%
Other	37.8%
N/A	0.01%

- The main types of feedstock used to produce **biodiesel** (3.9% of total fuel consumption) are rapeseed (44.1%), used cooking oil and waste vegetable oil or animal fat (25.0%) and palm oil (8.0%). These feedstocks account for about 77.1% of the total biodiesel quantities supplied to the 27 Member States.
- **Bioethanol** (1.1% of total fuel consumption) is mainly produced from corn (52.6%), wheat (15.3%) and sugar cane (9.5%). These feedstocks account for about 77.3% of the total bioethanol quantities supplied to the 27 Member States.
- For **HVO** (1.2% of total fuel consumption) production, tallow (category 3 or unknown) accounts for 24.1%, palm oil for 21.6% and animal fats (categories 1 and 2) for 16.4%. These feedstocks account for about 62.2% 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. Nineteen 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

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

updated, while Croatia only reported the quantity of electricity that was covered by “green energy supply” certificates with the corresponding GHG intensity being equal to zero.

In Table 3-3 the energy quantities consumed by electric vehicles, excluding and including powertrain efficiency, are summarized for the nineteen 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. It should be noted that there is an ongoing discussion that is taking place regarding the methodology for calculating the powertrain efficiency[(14)]. Along these lines, Austria provided the same quantity of energy from electricity when including and excluding powertrain efficiency, while they also made a remark stating that the adjustment factor should be applied to the quantity of energy excluding powertrain efficiency, in line with the fact that the electric powertrain is more efficient that the fossil fuel one.

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[(15)]. In order to investigate the reasons for which certain Member States did not report data on the electricity consumed by electric vehicles in 2022, the respective Member States were asked to provide clarifications on the subject. In most cases, electricity for transport was not reported as fuel suppliers did not provide such data. This is due to the fact that in some Member States charging stations are not operated by fuel suppliers but by electricity providers, who do not have the means to measure and monitor electricity supplied for use in transport. Furthermore, it was noted by some Member States with a low penetration of EVs in their transport fleet, that electric vehicles represent such a small share of the vehicle fleet that their contribution to the 6% target is negligible, while in other cases that electricity providers might not be supplying electricity from RES and could therefore have a high GHG intensity.

GHG intensities reported by Member States under Article 7a are presented in Table 3-3[(16)], together with data provided by a study[(17)] on the average carbon intensity of the electricity consumed at low voltage in the EU in 2019 for comparison purposes.

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

(14) https://www.hernieuwbarebrandstoffen.nl/post/error-in-the-calculation-of-the-greenhouse-gas-intensity-of-electricity-in-fqd-and-red

(15) A justification was requested from the Member Stated that did not make use of the possibility to reduce the reported GHG intensity by reporting data on electricity used for road transport.

(16) As mentioned above, 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.

(17) 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 2022 as a reported contribution by fuel suppliers to their GHG reduction target

Member State	Quantity of energy		GHG intensity		
	excluding powertrain efficiency (GJ)	including powertrain efficiency (GJ)	reported by Member State (g CO_2e/MJ)	reported by Member State (g CO_2e/kWh)	2019 study data (g CO2e/kWh)
Austria	334 033	133 613	17.7	63.6	264
Belgium	21 443	8 577	74.0	266.4	230
Czechia	20 114	8 046	177.0	637.2	544
Croatia	125	50	0.0	0.0	372
Denmark	31 286	12 514	57.5	207.0	158
Estonia	72 361	28 944	114.5	412.0	472
France	5 083 200	2 033 280	14.4	51.8	98
Germany	4 285	1 714	119.0	428.4	422
Greece	3 373	1 349	116.7	420.0	780
Hungary	39 585	15 834	62.4	224.5	338
Ireland	458 711	183 484	96.0	345.6	384
Italy	480 102	192 041	110.3	397.0	356
Netherlands	3 900 000	1 560 000	93.5	336.6	450
Poland	6 495	2 598	200.3	721.1	805
Portugal	145 139	58 055	56.4	203.0	324
Slovakia	206 048	82 419	46.4	166.9	346
Slovenia	8 221	3 289	84.4	303.8	307
Spain	5 624	2 250	83.1	299.2	279
Sweden	9 306	3 722	7.2	26.0	40

Note: Member States data are for 2022 whereas data provided by the study refer to 2019 (shown for comparison purposes).

Spain and 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. Croatia reported the electricity that was generated exclusively from one RES producer 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[18]. 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 2022.

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

4 Progress to 2022 targets under the Fuel Quality Directive

4.1 Average GHG emissions intensity of transport fuels in 2022

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[(19)] 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 CO_2/MJ[(20)]. 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 2022. 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 88.8 g carbon dioxide equivalent (CO_2e) in 2022. Thus, a reduction of 5.6% was achieved in 2022 compared to 2010. This corresponds to an additional reduction of 1.3 percentage points, compared to 2019 (4.3% reduction compared to 2010, for 28 EU Member States) and 1.8 percentage points compared to 2018 (3.7% reduction compared to 2010, for 28 EU Member States), while there was no significant improvement with respect to 2020 and 2021 (5.5% reduction compared to 2010, for 27 EU Member States). This 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 Stated to further reduce their transport fuel GHG intensity. In order to reach the obligatory 6% target, an additional reduction of 0.4 percentage points in the GHG intensity of all fossil fuels and biofuels supplied will be needed on average in the EU[(21)]. Consequently, additional efforts are necessary to meet the 6% target. In 2022, upstream emission reductions (UERs) were reported by fifteen countries (see details in section 4.2), contributing to a further reduction of the GHG intensity of about 0.5% to reach 5.6% in total. Again in 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, and hence also the relative distance to meet the target, 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 CO_2e/MJ) and petrol (93.3 g CO_2e/MJ), whereas substitution with bioethanol (20.8 g CO_2e/MJ, excluding ILUC), HVO (10.1 g CO_2e/MJ, excluding ILUC) and biodiesel (25.1 g CO_2e/MJ, excluding ILUC) reduces significantly the overall GHG intensity, providing thus the highest GHG reduction benefits.

The distance to meet the set target varies across Member States from 5.8% (for Croatia) to 0.1% (for Cyprus).

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(19) 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.

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

(21) Determined across the 27 Member States that reported data.

The two Member States with the **lowest** achievements in reducing their GHG intensities over the 2010 – 2022 period (lower than 2%) are Croatia and Latvia (achieving a reduction of only 0.2% and 1.6 respectively). The main reason for this is the low share of biofuels (0.8% in Croatia and 1.9% in Latvia, which are the lowest in the entire EU), in combination with the relatively high GHG intensity for biofuels in these countries (22.8 g CO_2eq/MJ for Croatia and 20.7 g CO_2eq/MJ for Latvia, which are among the highest in the entire EU). In comparison, the average GHG intensity for biofuels in the EU is 21.5 g CO_2eq/MJ, while the average share of biofuels is equal to 6.5%.

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 5.6% percent. In detail, the average GHG intensity of the fuels supplied in NI in 2022 (excl. ILUC emissions) was 89.8 g carbon dioxide equivalent (CO2e), 4.6% lower than the 2010 levels. In order to reach the obligatory 6%, target, an additional 1.4% 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 10.5% and 26% respectively (excluding ILUC). These two countries have been exceeding the target of 6% since 2018. Seven more Member States also exceeded the target in 2022. Cyprus, which had achieved the target in 2021 with a 6.0% reduction, missed the target for 2022, having reported a 5.9% reduction. Similarly, Denmark achieved a 6.0% reduction in 2021 but only reported a 5.7% reduction for 2022. Finland has a biofuel share of 13.3% (63.5% of which is HVO that has the lowest GHG intensity among biofuels, 13.2% is bioethanol and 6.2% is biodiesel) while diesel, petrol and gas oil represent 49%, 28% and 23% of the fossil fuel mix respectively. Sweden has the highest biofuel share among all Member States amounting to 29.2% (74% of which is HVO, 13.5% is biodiesel and 6.9% is biogas) while diesel and petrol share in the fossil fuel mix are 78% and 21% 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 (16.9 g CO_2eq/MJ in Finland and 9.5 g CO_2eq/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 Austria, Belgium, Croatia, France, Greece, Poland and Romania is considerably reduced by at least 50% when ILUC effects are considered, due to the extensive consumption of oil crops (up to 85% for Poland'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 2022 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	310 850	28 919	18 031	577	133.6	2.36
Belgium	321 875	30 406	32 748	806	8.6	0.63
Bulgaria	128 336	11 927	5 985	272	0.0	0.00
Croatia	101 450	9 584	860	20	0.0	0.00
Cyprus	26 610	2 434	1 026	13	0.0	0.00
Czechia	254 512	23 705	15 204	270	8.0	1.42
Denmark	177 063	16 317	9 863	278	12.5	0.72
Estonia	42 313	3 834	1 677	24	28.9	3.31
Finland	166 590	15 756	25 515	430	0.0	0.00
France	1 822 404	172 168	139 430	4 432	2 033.3	29.28
Germany	1 960 068	183 282	135 680	1 820	1.7	0.20
Greece	200 631	18 744	10 316	346	1.3	0.16
Hungary	441 488	41 284	13 259	248	15.8	0.99
Ireland	175 969	16 681	9 648	132	183.5	17.61
Italy	1 426 359	132 630	65 596	1 182	192.0	21.18
Latvia	35 155	3 305	669	14	0.0	0.00
Lithuania	80 600	7 571	5 292	142	0.0	0.00
Luxembourg	63 276	5 944	5 436	115	0.0	0.00
Malta	9 305	865	509	3	0.0	0.00
Netherlands	394 867	37 117	28 547	441	1 560.0	145.85
Poland	1 022 419	94 291	60 948	2 086	2.6	0.52
Portugal	219 669	20 754	13 690	258	58.1	3.27
Romania	256 620	24 000	15 558	472	0.0	0.00
Slovakia	105 315	9 770	7 077	164	82.4	3.82
Slovenia	87 896	8 288	3 412	44	3.3	0.28
Spain	380 439	35 802	16 224	285	2.2	0.19
Sweden	210 683	19 890	86 783	822	3.7	0.03
EU (27 Member States)	**10 422 760**	**975 267**	**728 979**	**15 698**	**4 332**	**232**

Member State	Average fuel GHG intensity ($g CO_2e/MJ$) (excl. ILUC)	2010-2021 GHG intensity reduction (excl. ILUC) (%)	Average fuel GHG intensity ($g CO_2e/MJ$) (incl. ILUC)	2010-2021 GHG intensity reduction (incl. ILUC) (%)
Austria	89.6	4.8%	92.1	2.1%
Belgium	88.0	6.5%	91.2	3.1%
Bulgaria	90.8	3.5%	92.4	1.8%
Croatia	93.9	0.2%	94.1	0.0%
Cyprus	88.5	5.9%	88.5	5.9%
Czechia	88.9	5.5%	91.0	3.3%
Denmark	88.8	5.7%	90.5	3.9%
Estonia	87.7	6.9%	87.7	6.8%
Finland	84.3	10.5%	84.4	10.3%
France	89.8	4.6%	92.5	1.6%
Germany	88.3	6.1%	89.7	4.7%
Greece	90.5	3.8%	92.4	1.8%
Hungary	91.3	2.9%	91.7	2.5%
Ireland	90.5	3.9%	90.5	3.8%
Italy	89.7	4.7%	89.8	4.6%
Latvia	92.6	1.6%	93.1	1.1%
Lithuania	89.8	4.6%	91.9	2.4%
Luxembourg	88.2	6.3%	90.2	4.1%
Malta	88.4	6.0%	88.4	6.0%
Netherlands	88.2	6.2%	88.4	6.0%
Poland	89.0	5.5%	91.7	2.6%
Portugal	90.0	4.4%	90.4	3.9%
Romania	89.9	4.4%	92.4	1.8%
Slovakia	88.3	6.2%	90.1	4.2%
Slovenia	91.3	3.0%	91.4	2.9%
Spain	91.0	3.3%	91.2	3.1%
Sweden	69.6	26.0%	71.9	23.6%
EU (27 Member States)	**88.8**	**5.6%**	**90.3**	**4.0%**

Note: * For HR, 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[22]. It is noted however, that there is no obligation to use UER as a compliance option for the FQD Article 7a reduction target.

Fifteen 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 CO2e)
Austria	528.9
Croatia	1
Cyprus	72.1
Czechia	238.3
Denmark	424
Estonia	151.4
Germany	1 918.3
Hungary	424.8
Italy	513.3
Luxembourg	47.9
Malta	13
Poland	1 149.2
Romania	240.8
Slovakia	171.8
Slovenia	32

Overall, the total reported UER was 5 927 kt CO_2e in 2022, contributing an additional 0.5% reduction of the overall fuel GHG intensity from 5.1% to 5.6%.

(22) https://ec.europa.eu/clima/sites/default/files/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[(23)], fuel suppliers have to report the life cycle greenhouse gas emissions per unit of energy, including the provisional mean[(24)] 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 17.2 Mt CO_2e in 2022, an amount almost equivalent to the annual total emissions (excluding ILUC) of Denmark. Oil crops were responsible for 91.9% 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)	94 665	19 476	287 907	331 004
Default ILUC intensity provisional mean[(25)] values of the estimated ILUC emissions (g CO_2e/MJ)	12	13	55	0
Total ILUC GHG emissions (kt CO_2e)	**1 136**	**253**	**15 835**	**-**

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 2022 data, an average value of 1.5 g CO_2e/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 89.3 g CO_2e/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 90.3 g CO_2e/MJ (with ILUC). It is noted that the GHG intensity including ILUC decreased in 2022 in comparison to 2021, 2020 and 2019 (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 4.0% as opposed to the 5.6% reduction when excluding ILUC, see Table 4-1.

(23) 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.

(24) 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.

(25) 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).

The overall GHG intensity reduction including ILUC is below 2% for six Member States, while if ILUC was considered, only five out of nine Member States would have achieved the 2020 GHG reduction target. Considering ILUC, Sweden has the most significant improvement on its performance with a reduction of 23.6% for 2022 (18.4% in 2021). However, this improvement can be mainly attributed to the increased share of biofuels (29.2% in 2022 and 24.7% in 2021), and to the feedstock used, since the share of oil crops, which have the highest ILUC emissions, was decreased for Sweden (12.2% in 2022 and 21.1% 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 93% 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_2e/MJ) Excluding ILUC emissions				Average GHG intensity (g CO_2e/MJ) Including ILUC emissions			
	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Biodiesel	**526 806**	**448 671**	**474 655**	**437 695**	**24.6**	**25.2**	**23.8**	**25.1**	**58.9**	**62.6**	**58.2**	**58.8**
Cereals and other starch-rich crops	24	134	82	5	34.2	24.6	10.6	33.2	46.2	36.6	22.6	45.2
Sugars	-	-	-	-	-	-	-	-	-	-	-	-
Oil crops	329 376	305 585	300 527	268 202	32.2	31.5	30.6	32.4	87.0	86.4	85.0	87.4
Other	197 406	142 945	173 265	162 943	12.0	11.7	11.9	13.6	12.0	11.7	11.9	13.6
HVO	**96 298**	**146 018**	**149 683**	**134 437**	**14.0**	**15.3**	**12.6**	**10.1**	**33.3**	**39.3**	**28.7**	**17.9**
Cereals and other starch-rich crops	48	-	-	-	7.6	-	-	-	19.6	-	-	-
Sugars	-	-	-	-	-	-	-	-	-	-	-	-
Oil crops	33 795	63 892	47 645	19 058	26.4	23.5	22.7	20	81.4	78.5	73.2	75
Other	62 455	82 084	101 803	115 083	7.3	8.8	7.9	8.4	7.3	8.8	7.9	8.4
Bioethanol	**110 866**	**97 089**	**109 311**	**117 828**	**22.6**	**20.7**	**20.1**	**20.8**	**33.9**	**31.6**	**30.7**	**31.4**
Cereals and other starch-rich crops	87 010	76 536	85 195	85 155	22.5	20.5	20.9	20.7	34.5	32.5	32.9	32.7
Sugars	15 417	10 724	10 120	17 111	26.8	25.0	19.1	23.3	39.8	38.0	32.1	36.3
Oil crops	5	52	1	43 448	24.6	46.8	30.3	32.7	79.6	101.8	85.3	87.7
Other	8 435	9 775	13 971	15 313	16.4	17.1	16.4	17.8	16.4	17.1	16.4	17.8

	GHG emissions (kt CO_2e) Excluding ILUC emissions				GHG emissions (kt CO_2e) Including ILUC emissions			
	2019	2020	2021	2022	2019	2020	2021	2022
Biodiesel	**12 982**	**11 292**	**11 293**	**10 975**	**31 023**	**28 091**	**27 628**	**25 725**
Cereals and other starch-rich crops	1	3	1	0	1	5	2	0
Sugars	-	-	-	-	-	-	-	-
Oil crops	10 612	9 618	9 203	8 680	28 652	26 415	25 537	23 431
Other	2 369	1 670	2 063	2 211	2 369	1 670	2 063	2 211
HVO	**1 348**	**2 229**	**1 890**	**1 355**	**3 207**	**5 743**	**4 294**	**2 403**
Cereals and other starch-rich crops	0.4	-	-	-	1	-	-	-
Sugars	-	-	-	-	-	-	-	-
Oil crops	892	1 501	1 083	381 205	2 751	5 015	3 487	1 429
Other	456	724	800	970 950	456	724	800	971
Bioethanol	**2 511**	**2 007**	**2 200**	**2 453**	**3 755**	**3 067**	**3 354**	**3 699**
Cereals and other starch-rich crops	1 959	1 569	1 777	1 766	3 003	2 488	2 799	2 787
Sugars	413	268	193	399 488	613	407	325	622
Oil crops	0.1	2	0	1 422	0	5	0	3
Other	138	167	229	271 938	138	167	229	272

Note: Geographical unit is EU28 for 2018/2019 and EU27 for 2020-2022. 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 61% 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 (87.4 vs 95.1 g CO2e/MJ).

Bioethanol is mainly produced from cereals and other starch-rich crops (around 72%) and other feedstocks (around 13%). When including ILUC, the average GHG intensity of bioethanol increases; however, it still remains significantly lower than fossil petrol (31.4 vs 93.3 g CO_2e/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 86%) and with a low GHG intensity, whereas the HVO quantities produced from oil crops, which have a much higher GHG intensity (20 g CO2e/MJ without ILUC and 75 g CO2e/MJ with ILUC), are much lower (around 14%).

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 77% when ILUC is excluded, whereas these reductions are in the order of 48% 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 (77%). 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 89%, 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 /including provisional mean values of the estimated ILUC emissions	GHG emissions from fossil fuels (kt CO_2e)	Emissions savings (kt CO_2e)	GHG emission reduction from substitution (%)
Diesel	Biodiesel + HVO	Excluding	54 410	42 080	77.3
		Including		26 282	48.3
Petrol	Bioethanol + ETBE	Excluding	12 068	9 290	77.0
		Including		7 903	65.5
CNG	Biogas	Excluding	1 212	1 079	89.0
		Including		1 074	88.6

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	2 003	2 006	7 429	7 336	-0.2%	1.3%
Belgium	2 979	2 991	7 007	7 000	-0.4%	0.1%
Bulgaria	679	649	2 831	2 830	4.7%	0.0%
Croatia	636	627	2 247	1 905	1.4%	18.0%
Cyprus	420	419	395	398	0.2%	-0.8%
Czechia	1 896	2 123	5 661	6 199	-10.7%	-8.7%
Denmark	1 692	1 712	3 410	3 111	-1.2%	9.6%
Estonia	264	275	949	958	-3.84%	-0.91%
Finland	1 686	1 789	2 904	2 994	-5.8%	-3.0%
France	13 521	13 256	37 187	36 961	2.0%	0.6%
Germany	22 286	22 553	39 116	41 243	-1.2%	-5.2%
Greece	2 762	2 748	3 225	3 374	0.5%	-4.4%
Hungary	3 937	2 082	838	4 886	89.1%	-82.8%
Ireland	931	931	3 635	3 603	0.0%	0.9%
Italy	10 325	10 335	1 964	29 843	-0.1%	-93.4%
Latvia	136	205	827	1 223	-33.5%	-32.4%
Lithuania	376	376	1 979	2 031	0.1%	-2.6%
Luxembourg	483	461	1 486	1 256	4.8%	18.3%
Malta	111	112	174	226	-0.9%	-23.2%
Netherlands	5 599	5 272	6 693	5 159	6.2%	29.7%
Poland	6 886	6 932	22 397	21 625	-0.7%	3.6%
Portugal	1 365	1 437	5 243	5 308	-5.0%	-1.2%
Romania	1 829	1 957	5 931	7 194	-6.6%	-17.6%
Slovakia	771	771	2 432	2 432	0.0%	0.0%
Slovenia	551	547	2 051	2 283	0.7%	-10.2%
Spain	1 973	7 647	7 593	26 260	-74.2%	-71.1%
Sweden	2 751	2 710	5 949	5 711	1.5%	4.2%
EU (27 Member States)	**88 849**	**92 923**	**181 552**	**233 349**	**-4.38%**	**-22.20%**

For many Member States, the differences for both petrol and diesel are relatively small, within ±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 2022, very high differences could be observed for Hungary, Italy, Latvia, Malta, Netherlands and Spain.

The main reasons of such discrepancies from previous years include fuel quantities purchased and sold in different years, or incomplete reporting by Member States. It is not possible to distinguish to what extent the differences can be attributed to each of these reasons. Italy for example has been reporting for the past four years diesel quantities under Article 7a that are much lower than those reported under Article 8, and also much lower compared to other Member States of similar size. A discussion on this issue can be found in the the 2021[26] report.

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 SHARED 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 tool[27], the total amount of energy corresponding to advanced biofuels, according to the feedstocks that are included in RED II Annex IX, was equal to 6 691 ktoe in 2022. For the biofuel quantities that were reported under Article 7a, 5 257 ktoe corresponded to advanced biofuels according to RED II Annex IX Part A and Part B, which is 21% (1 434 ktoe) below 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 2% 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.

(26) https://www.eionet.europa.eu/etcs/etc-cm/products/greenhouse-gas-intensities-of-transport-fuels-in-the-eu-in-2021/@@download/file/2023-03_3.pdf

(27) https://ec.europa.eu/eurostat/web/energy/database/additionaldata#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_2e	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
TAEE	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_2e/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_2e/MJ)
Biodiesel	25.1
Bio-ETBE	28.2
Bioethanol	20.8
Biogas	7.6
Biomethanol	33.2
Bio-MTBE	33.9
Hydrotreated vegetable oil HVO	10.1
Other (Bioethanol diesel)	19.9
Other (Biofuel oil)	7.6
Other (bio-kerosine)	7.8
Other (bio-LNG)	9.5
Other (bio-LPG)	15.9
Other (Biomethane)	23.9
Other (Bionaphtha)	8.1
Other (Biopetrol)	72.1
Other (Biopropane)	13.7
Other (Co-processed hydrotreated vegetable oil (CHVO))	16.2
Other (Co-Treated Oil for Diesel)	16.9
Other (Co-Treated oil for gasoline))	24.0
Other (crakced hydrotreated vegetable oil for gazoline)	26.0
Other (FAEE)	1.5
Other (hydrocarbons from co-hydrogenation from rapeseed oil)	29.9
Other (Hydrotreated oil -Diesel)	10.1
Other (Hydrotreated Oil -Gasoline)	12.1
Other (Pure vegetable oil)	32.7
Other (Renewable naphta)	7.7

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
- Bagasse
- Barley
- Biomass fraction of industrial waste
- Biomass fraction of mixed municipal waste
- 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
- Nut shells
- 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 cereals
- Other oil crops
- Other sugar crops
- N/A
- Other (agricultural wastes and residues)
- Other (Agri-food waste)
- Other (Alcohol distillation residue, waste)
- Other (Animal manure and sewage sludge, straw, husks, cobs cleaned of corn grains and other cellulosic materials of non-food origin)
- Other (Animal manure, sewage sludge, cobs cleaned of corn grains and other cellulosic materials of non-food origin)
- Other (Animal manure, triticale)
- Other (Animal manure, triticale, sorghum, corn stalks, straw, chaff of rice)
- Other (Animal manure, triticale, straw)
- Other (Bacteria)
- Other (Biomass fraction of mixed municipal solid waste)
- Other (Biomass fraction of mixed municipal waste and sewage sludge)
- Other (blend of animal and waste vegetable oils)
- Other (Cashew shell oil)
- Other (Downgraded waste sugar)
- Other (ethiopian mustard seed (brassica carinata))
- Other (FAEE)
- Other (Fatty acid distillate)
- Other (Fatty acids)
- Other (FFA (used cooking oil))
- Other (FFA)
- Other (FFBs)
- Other (Food Waste)
- Other (grass)
- Other (industrial waste)
- Other (ley crops)
- Other (molasses)
- Other (municipal waste)
- Other (non-food cellulosic material)
- Other (Organic waste)
- 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 (Palm oil stearin and PFAD)
- Other (PFAD)
- Other (POME)
- Other (poultry feather acid oil)
- Other (Residues from processing alcohol)
- Other (residues from the distilling industry)
- Other (Rye ethanol)
- Other (Sewage sludge)
- Other (Soap precipitate and its derivatives)
- Other (sugar beet residues)
- Other (Tall Oil Fatty Acids (TOFA))
- Other (Tallow - category 3 or unknown and animal fats classified as categories 1 and 2)
- Other (TCO corn oil)
- Other (TCO)
- Other (Technical corn oil from stillages)
- Other (Triticale)
- Other (Used cooking oil from animal origin or animal+vegetable origin)
- Other (Waste starch slurry)
- Other (Wastes and residues from forestry and forestry-related industries)
- Other (Wastes and residues)
- Other (wastewater from palm oil extrusion plants and empty palm fruit bundles)
- Other (Whey permeate)

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 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)
- Pure vegetable oil from rape seed
- Rape seed biodiesel
- Soybean biodiesel
- Sugar beet ethanol
- Sugar cane ethanol
- Sunflower biodiesel
- Waste vegetable oil or animal fat biodiesel
- Waste wood ethanol
- 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 (1 FERMENTATION OF THE RAW MATERIAL (LEES AND MARC) 2 DISTILLATION 3 DRYING)
- Other (acid oil biodiesel)
- Other (Alcohol distillation residue, waste)
- Other (bagasse ethanol)
- Other (barley ethanol)
- Other (Biodiesel from acid oils obtained from the fat of bird feathers resulting from an industrial process, consifromred waste, not suitable for use in the human or animal food chain (poultry feather acid oil))
- Other (Biodiesel from Animal fats classified as categories 1 and 2)
- Other (biodiesel from animal fats)
- Other (Biodiesel from biomass fraction of wastes and residues from forestry and forest-based industries)
- Other (Biodiesel from bleaching clay)
- Other (Biodiesel from Brassica Carinata)
- Other (Biodiesel from brown grease)
- Other (Biodiesel from Corn)
- Other (biodiesel from crude glycerin)
- Other (BIODIESEL FROM EFFLUENT FROM OIL MILLS THAT TREAT PALM OIL AND EMPTY PALM FRUITS)
- Other (Biodiesel from elder seed)
- Other (BIODIESEL FROM ESTERIFICATION AND TRANSESTERIFICATION OF VEGETABLE FATTY ACIDS)
- Other (biodiesel from Free Faty Acid)
- Other (Biodiesel from grape pomace)
- Other (biodiesel from industrial waste)
- Other (biodiesel from palm fatty acid distillate - PFAD)
- Other (biodiesel from Palm oil mill effluent)
- Other (Biodiesel from palm oil stearin and PFAD)
- Other (Biodiesel from POME)
- Other (Biodiesel from process waste - cleaning)
- Other (Biodiesel from process waste - feed production)
- Other (Biodiesel from process waste - flotation fat)
- Other (Biodiesel from process waste - plant based oil)
- Other (Biodiesel from process waste - special oil)
- Other (Biodiesel from process waste - water cleaning facility)
- Other (Biodiesel from Rapeseed/canola)
- Other (biodiesel from sewage sludge)
- Other (biodiesel from soapstock acid oil)
- Other (Biodiesel from Tallow CAT/3)
- Other (Biodiesel from Tallow)
- Other (biodiesel from technical corn oil)
- Other (biodiesel from UCO)
- Other (Biodiesel from waste based fatty acid)
- Other (Biodiesel of separately collected used cooking oils and fats of vegetable origin)
- Other (Biodiesel produced from biomass fraction of industrial waste)
- Other (Biodiesel produced from Food Waste)
- Other (Biodiesel produced from oil palm fresh fruit bunches (FFBs))
- Other (Biodiesel produced from tallow category 3 or unknown)
- Other (Biodiesel produced from used cooking oil - origin animal oil or animal+vegetable oil)
- Other (Bio-ETBE from corn (maize))
- Other (Bioethanol diesel from biomass fraction of industrial waste and residues)
- Other (Bioethanol diesel from biomass fraction of mixed municipal waste)
- Other (Bioethanol ETBE made from corn)
- Other (Bioethanol ETBE made from rye)
- Other (bioethanol from barley)
- Other (bioethanol from bio-waste)
- Other (bioethanol from brown grease)
- Other (bioethanol from cobs)
- Other (Bioethanol from corn (maize))
- Other (Bioethanol from corn America)
- Other (Bioethanol from corn non EU)
- Other (Bioethanol from corn)
- Other (Bioethanol from maize)
- Other (Bioethanol from maize, Community produced (natural gas as process fuel in CHP plant))
- Other (bioethanol from molasses)
- Other (bioethanol from rye)
- Other (Bioethanol from starch slurry)
- Other (Bioethanol from triticale)
- Other (Bioethanol from wheat)
- Other (Bioethanol made from corn, non-EU)
- Other (bioethanol not specified)
- Other (Bio-ethanol produced from biomass fraction of industrial waste)
- Other (Biofuel oil from PFAD)
- Other (Biofuel oil from waste vegetable oil or animal fat)

- Other (Biogas from agri-food waste as compressed natural gas)
- Other (biogas from animal fat cat. 1 a 2)
- Other (biogas from animal fat cat. 3)
- Other (Biogas from bacteria as compressed natural gas)
- Other (biogas from bio-waste)
- Other (biogas from crude glycerine)
- Other (biogas from glycerine)
- 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 municipal organic waste and sewage sludge as compressed natural gas)
- Other (biogas from nut shells)
- Other (biogas from other non-food cellulosic material)
- Other (biogas from rye)
- Other (Biogas from sewage sludge as compressed natural gas)
- Other (biogas from starch slury)
- Other (biogas from straw)
- Other (biogas from used cooking oils)
- Other (biogas from waste animal oil)
- Other (biogas from waste wegetable oil)
- Other (biokerosine from animal fat)
- Other (biokerosine from UCO)
- Other (bio-LNG from crude glycerin)
- Other (bio-LNG from foodwaste)
- Other (bio-LNG from forestry processing residues)
- Other (bio-LNG from sewage sludge)
- Other (bioLPG from used cooking oil)
- Other (Biomass fraction of industrial waste)
- Other (Biomass fraction of mixed municipal waste)
- Other (Biomethane from biomass as compressed natural gas)
- Other (Biomethane from biowaste as compressed natural gas)
- Other (biomethane from fat seperation unit)
- Other (biomethane from flotation fat)
- Other (Biomethane from sewage sludge as compressed natural gas)
- Other (biomethane from UCO)
- Other (biomethane from waste food)
- Other (Biomethane from waste from food industry as compressed natural gas)
- Other (biomethane from waste potatos)
- Other (Biomethanol from animal manure and sewage sludge)
- Other (Biomethanol from biomass fraction of mixed municipal waste)
- Other (Biomethanol from biomethane from anaerobically fermented municipal waste)
- Other (Biomethanol from organic municipal waste)
- Other (Bio-methanol from other bio-waste)
- Other (bionafta from POME)
- Other (bionafta from UCO)
- Other (Biopetrol from biomass fraction of industrial waste and residues)
- Other (Biopetrol from biomass fraction of wastes and residues from forestry and forest-based industries)
- 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 palm oil stearin and PFAD)
- Other (Biopetrol from PFAD)
- Other (Biopetrol from POME)
- Other (Biopetrol from waste vegetable oil or animal fat)
- Other (Biopropane from empty palm fruit bunches)
- Other (Biopropane from hydrotreated vegetable oil)
- Other (Biopropane from palm oil mill effluent)
- Other (Biopropane from waste vegetable or animal oil)
- Other (Bio-waste ethanol)
- Other (Brown fat / from fats from grease traps)
- Other (Brown liquor)
- Other (Brown lye)
- Other (cereals and other starch-rich crop)
- Other (cereals bioethanol)
- Other (contaminated sugar process waste)
- Other (Co-processed (processed in a refinery at the same time as fossil fuels), biomass or pyrolyzed biomass oil to replace diesel oil)
- Other (Co-processed (processed in a refinery at the same time as fossil fuels), biomass or pyrolyzed biomass-derived oil to replace liquefied hydrocarbon gas)
- Other (COPROCESSING DESULPHURIZATION OF DIESEL IN REFINERY)
- Other (COPROCESSING OF POME OIL AND MINERAL OIL)
- Other (corn (maize) ethanol)
- Other (Corn (maize) ethanol, Community produced (natural gas as process fuel in CHP plant))
- Other (Corn ETBE)
- Other (corn ethanol - natural gas as process fuel in CHP 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)
- Other (co-Treated oil for diesel)
- Other (Cottonseed biodiesel)
- Other (Crude glycerine)
- Other (Esterification and Transesterification and distillation)
- Other (Esterification and transesterification)
- Other (Esterification with methanol)
- Other (Esterification)
- Other (ETBE renewable component)
- Other (ethanol from barley (natural gas as process fuel in CHP plant))
- 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 biomass fraction of mixed municipal waste)

- Other (Ethanol from biomass fraction of wastes and residues from forestry and forest-based industries)
- 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) (process 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 rye (natural gas as process fuel in CHP plant)
- Other (ethanol from rye (process not specified)
- Other (Ethanol from rye)
- Other (Ethanol from starch slurry)
- Other (ethanol from sugar beet residues (process not specified))
- Other (ethanol from triticale (natural gas as process fuel in CHP plant)
- Other (ethanol from triticale (process not specified)
- Other (Ethanol from triticale)
- Other (Ethanol from Waste and residues from alcohol production)
- Other (Ethanol)
- Other (Ethyl-tert-butyl-ether (ETBE) - renewable component)
- Other (FAEE from fish oil ethyl ester)
- Other (fatty acid biodiesel)
- Other (Fatty acid distillate)
- Other (FFA from UCO)
- Other (FFA)
- Other (FFA's from crude glycerin; Acid oils from soapstocks)
- Other (Food waste ethanol)
- Other (FOOD WASTE)
- Other (grape marcs and wine lees ethanol)
- Other (grape marcs ethanol - natural gas as process fuel in CHP plant)
- Other (grape marcs ethanol)
- Other (Grape Marcs)
- Other (HVO from animal fat category 1 and 2)
- Other (HVO from animal fat category 3)
- Other (HVO from animal fats)
- Other (HVO from brown grease)
- Other (HVO from industrial waste fats)
- 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 SBE)
- Other (HVO from soybeans)
- Other (HVO from UCO)
- Other (HVO from used coocking oil)
- Other (HVO from used coocking vegetable oil)
- Other (HVO from Used cooking oil)
- Other (HVO from waste vegetable oil and/or animal fat)
- Other (HVO)
- Other (HVO-DIESEL FROM ANIMAL FATS CLASSIFIED OF CATEGORIES 1 AND 2)
- Other (HVO-DIESEL FROM BIOMASS FRACTION CORRESPONDING TO INDUSTRIAL WASTE NOT SUITABLE FOR USE IN THE FOOD CHAIN)
- Other (HVO-DIESEL FROM EFFLUENT FROM OIL MILLS PROCESSING PALM OIL AND EMPTY PALM FRUITS)
- Other (HVO-DIESEL FROM PFAD)
- Other (HVO-DIESEL FROM SUNFLOWER SEEDS)
- Other (HVO-DIESEL FROM USED COOKING OIL)
- Other (HVO-LPG FROM ANIMAL FATS CLASSIFIED OF CATEGORIES 1 AND 2)
- Other (HVO-LPG FROM BIOMASS FRACTION CORRESPONDING TO INDUSTRIAL WASTE NOT SUITABLE FOR USE IN THE FOOD CHAIN)
- Other (HVO-LPG FROM EFFLUENT FROM OIL PRODUCTS THAT TREAT PALM OIL AND EMPTY PALM FRUITS)
- Other (HVO-LPG FROM PALM OIL)
- Other (HVO-LPG FROM PFAD)
- Other (HVO-LPG FROM SOYBEANS)
- Other (HVO-LPG FROM USED COOKING OIL)
- Other (HVO-NAFTA FROM PFAD)
- Other (HVO-NAPHTA FROM ANIMAL FATS CLASSIFIED CATEGORIES 1 AND 2)
- Other (HVO-NAPHTA FROM BIOMASS FRACTION CORRESPONDING TO INDUSTRIAL WASTE NOT SUITABLE FOR USE IN THE FOOD CHAIN)
- Other (HVO-NAPHTA FROM EFFLUENT FROM OIL MILLS THAT TREAT PALM OIL AND EMPTY PALM FRUITS)
- Other (HVO-NAPHTA FROM SOYBEANS)
- Other (HVO-NAPHTA FROM SUNFLOWER SEEDS)
- Other (HVO-NAPHTA FROM USED COOKING OIL)
- Other (hydrocarbons from co-hydrogenation from rapeseed oil)
- Other (Hydrogenated oil from sludges from the processing of palm oil (POME))
- Other (Hydrogenated oil obtained from rendered fats of animal origin)
- Other (hydrotreated biomass fraction of industrial waste)
- Other (hydrotreated oil from animal fats from rendering)
- Other (Hydrotreated oil from animal fats)
- Other (hydrotreated oil from emply palm oil mill effluent or fruit bunches)
- Other (Hydrotreated oil from industrial waste)
- Other (Hydrotreated oil from palm effluents and bunches)
- Other (Hydrotreated oil from palm effluents)
- Other (hydrotreated oil from Tallow cat. 3))
- Other (Hydrotreated oil from tallow)
- Other (Hydrotreated oil from UCO)
- Other (hydrotreated oil from waste cooking oil)
- Other (Hydrotreated oil palm fresh fruit bunches (FFBs))
- Other (Hydrotreated tallow - category 3 or unknown)
- 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 - soybean)
- Other (Hydrotreated vegetable oil bionafta from palm oil (process not specified))

- Other (Hydrotreated vegetable oil bionafta from palm oil mil effluent (process not specified))
- Other (Hydrotreated vegetable oil bionafta from used cooking oil (process not specified))
- Other (Hydrotreated vegetable oil from animal fat cat. 3)
- Other (Hydrotreated vegetable oil from biomass fraction of wastes and residues from forestry and forest-based industries)
- Other (Hydrotreated vegetable oil from palm oil fatty acid distillate)
- 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 stearin and PFAD)
- Other (Hydrotreated vegetable oil from PFAD)
- Other (Hydrotreated vegetable oil from POME)
- Other (Hydrotreated vegetable oil from SBEO)
- Other (Hydrotreated vegetable oil from soybeans)
- 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)
- Other (Hydrotreated vegetable oil from waste vegetable oil or animal fat)
- Other (Hydrotreated waste vegetable oil or animal fat (process not specified))
- Other (Hydrotreatment)
- Other (industrial food waste)
- Other (industrial waste ethanol)
- Other (industrial waste)
- Other (methanisation)
- Other (Molasse from sugar beat)
- Other (molasses ethanol)
- Other (Molasses from sugar cane)
- Other (Molasses)
- Other (municipal food waste)
- Other (Neutralization/ esterification/ transesterification and destillation)
- Other (Non-food cellulosic material)
- Other (non-sustainable biodiesel)
- Other (non-sustainable bioethanol)
- Other (non-sustainable biofuel oil)
- Other (non-sustainable biopetrol)
- Other (non-sustainable hydrotreated vegetable oil)
- Other (oils corresponding to industrial waste not suitable for use in the food chain)
- Other (Oils or fats collected through separators or traps placed in drains)
- Other (organic household waste)
- Other (Organic municipal solid waste (MSW))
- 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 ethanol, process fuel not specified)
- Other (other cereals excluding maize ethanol)
- Other (palm bunches)
- Other (palm oil biodiesel from fresh fruit bunches)
- Other (Palm oil mill effluent (POME) HVO)
- Other (Palm oil mill effluent Hydrotreated vegetable oil (process fuel not specified))
- Other (Palm oil mill effluent oil)
- Other (Palm oil mill effluent)
- Other (Palm oil press effluent)
- Other (palmolein biodiesel)
- Other (POME)
- Other (residues from processing of alcohol ethanol - natural gas as process fuel in CHP plant)
- Other (Rye ethanol (rejected heat as process fuel))
- Other (Rye ethanol)
- Other (Rye)
- Other (Separatedly collected used cooking oil)
- Other (soap acid oil biodiesel)
- Other (Soap precipitate and its derivatives)
- Other (Soapstock acid oil contaminated with sulphur biodiesel)
- Other (soapstock biodiesel)
- Other (sorghum ethanol)
- Other (Spent bleached earth Biodiesel)
- Other (Spent bleached earth Hydrotreated vegetable oil (process fuel not specified))
- Other (Spent bleached earth)
- Other (Starch slurry ethanol)
- Other (Starch slurry)
- Other (sugar beet bio-ETBE)
- Other (Sugar beet residue)
- Other (Sugar beet residues ethanol)
- Other (Sugar beet residues)
- Other (sugar cane bio-ETBE)
- Other (Technical corn oil from stillages)
- Other (Technical corn oil)
- Other (Transesterification and distillation)
- Other (TRANSESTERIFICATION WITH METHANOL)
- Other (Transesterification)
- Other (Triticale ethanol)
- Other (Triticale)
- Other (Used cooking oil (UCO) entirely of veg. origin biodiesel)
- Other (Used cooking oil (UCO) entirely of veg. origin)
- Other (Used cooking oil Hydrotreated vegetable oil (process fuel not specified))
- Other (Used cooking oil)
- Other (Used Oil from Bleached Earth)
- Other (Waste ethanol (process fuel not specified))
- Other (Waste starch slurry ethanol)
- Other (Waste vegetable or animal oils)
- Other (wheat ethanol (bran as process fuel in CHP plant))
- Other (wine lees ethanol)
- Other (without PoS)
- Others (FFBS HVO)

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
- Bagasse
- Biomass fraction of industrial waste
- Biomass fraction of mixed municipal waste
- 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
- Nut shells
- Palm oil mill effluent
- Palm oil mill effluent and empty palm fruit bunches
- Straw
- Tall oil pitch
- Other (Agri-food waste)
- Other (Animal manure and sewage sludge, straw, husks, cobs cleaned of corn grains and other cellulosic materials of non-food origin)
- Other (Animal manure, sewage sludge, cobs cleaned of corn grains and other cellulosic materials of non-food origin)
- 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 municipal solid waste)
- Other (Biomass fraction of mixed municipal waste and sewage sludge)
- Other (blend of animal and waste vegetable oils)
- Other (ethiopian mustard seed (brassica carinata))
- Other (FFA (used cooking oil))
- Other (FFBs)
- Other (non-food cellulosic material)
- Other (Organic waste)
- 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 (Palm oil stearin and PFAD)
- Other (PFAD)
- Other (POME)
- Other (Sewage sludge)
- Other (Tall Oil Fatty Acids (TOFA))
- Other (Tallow - category 3 or unknown and animal fats classified as categories 1 and 2))

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