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Quality and greenhouse gas intensities of transport fuels in the EU in 2017

Monitoring under the Fuel Quality Directive in 2017 (2018 reporting)

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Executive summary

About this report

This annual report of the EEA provides a summary of the information on the quality of fuels in the European Union (EU) in 2017, as reported in 2018 by EU Member States, Iceland and Norway ([1]) under Directive 98/70/EC relating to the quality of petrol and diesel fuels (the Fuel Quality Directive, FQD) as amended by Directive 2009/30/EC. In addition to the information reported annually since 2015 under Article 8 of the FQD ('Monitoring compliance and reporting'), this report also includes information reported under Article 7a ('Greenhouse gas emission reductions'), reported for the first time in 2018.

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 ([2]), as well as their life cycle greenhouse gas (GHG) emissions (from their extraction, processing and distribution), including 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 compared with 2010 levels. Member States must also analyse the share of biofuels in the total amount of fuels consumed.

Article 8 requires Member States to report the volume and the quality of petrol and diesel fuels sold in 2017 in the EU. More specifically, Member States must sample fuels each year and analyse their technical characteristics to ensure that they are consistent with the requirements of the FQD. The limiting values set out by the FQD concern parameters such as, for petrol fuels, octane number, content of lead, manganese, oxygen and sulphur, etc. and, for diesel fuels, content of fatty acid methyl esters (FAME), which are the primary molecules in biodiesel fuel, manganese and sulphur, etc.

The EEA supports the European Commission in the compilation, quality checking and dissemination of information reported under Articles 7a and 8 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 by 22 Member States (all except Estonia, Lithuania, Poland, Portugal, Romania and Spain), the average GHG intensity of the fuels consumed in these countries in 2017 (excluding the ILUC emissions intensity for biofuels) was 3.4 % lower than the 2010 levels. This corresponds to a saving of 29 Mt carbon dioxide equivalent (CO_2e) in the year 2017. To ensure the delivery of the minimum 6 % reduction target by 2020, the FQD specifies that Member States may require suppliers to comply with an intermediate reduction target of 4 % for the year 2017. Using this as a reference to assess the progress achieved indicates, therefore, that in 2017, EU fuel suppliers in the 22 reporting Member States were, on average, behind their objective of reducing the GHG intensity of transport fuels by 6 % by 2020, compared with 2010 (see Figure ES.1) ([3]).

The progress achieved by fuel suppliers varies greatly across Member States. In only 4 of the 22 reporting Member States, reductions are equal to or greater than 4 %, with Sweden being the only Member State having already exceeded the 6 % reduction target for 2020 (by 11.4 percentage points).

Taking ILUC emissions into account, the average GHG intensity of the fuels consumed in 2017 was 2.3 % lower than the 2010 levels. This corresponds to a saving of 20 $MtCO_2e$ in the year 2017.

([1]) Iceland and Norway have no reporting obligation and submit information on a voluntary basis.
([2]) A large number of engine installations in machines used for purposes other than transporting goods or passengers, such as bulldozers, compressors, back loaders or front loaders.
([3]) It is to be noted that in 2017 no upstream emission reductions were reported. These are expected to contribute to the reduction target only in the year 2020.

Diesel and biodiesel dominate fuel sales in Europe

Diesel continues to dominate fuel sales in the EU: 72.3 % (270 668 million litres) of fuel sold in 2017 was diesel and 27.7 % was petrol (103 766 million litres). Petrol sales in 2017 increased by 2.9 % compared with 2016, whereas diesel sales increased by 5.2 %.

The share of diesel as compared with petrol sales has increased over the years, from 55.6 % of total sales in 2001 to 72.3 % in 2017. This reflects to a large degree the increasing dieselisation of Europe's vehicle fleet during that period. Diesel fuel consumption is significant in most EU Member States, representing more than 60 % of total fuel sales in 23 Member States (all except Cyprus, Greece, Malta and the Netherlands; Romania did not submit a complete report for 2017).

All diesel in the EU was sold as containing biodiesel, whereas 87.6 % of petrol was sold as containing bioethanol. In 2017, 71.9 % of petrol fuel sold in the EU had up to 5 % ethanol content by volume, and 15.7 % had up to 10 % ethanol content. Of the diesel fuel sold, 83.8 % contained up to 7 % FAME and 16.2 % contained more.

Compliance of sold fuels with quality limits

Bulgaria, Malta and Sweden reported full compliance for both petrol and diesel fuels, while nine Member States reported full compliance for petrol (Austria, Bulgaria, Greece, Hungary, Lithuania, Malta, Netherlands, Slovenia and Sweden) and seven for diesel (Bulgaria, Croatia, Cyprus, Finland, Latvia, Malta and Sweden). One Member State (Belgium) reported more than 100 non-compliances for petrol in 2017.

Member States reported a total of 496 cases of non-compliance for petrol and 141 for diesel for 2017. For petrol, the most common parameters falling outside the specifications were summer vapour pressure (in 13 Member States), research octane number (RON) (in nine Member States) and motor octane number (MON) (in seven Member States). For diesel, the most common parameters falling outside the specifications were the FAME content (in 12 Member States) and the sulphur content (in six Member States).

All Member States have described the actions taken when non-compliant samples were identified. These included informing the competent authorities, initiating investigations, imposing penalties and fines, and resampling. In a small number of cases, no action has been taken where the non-compliant parameters were found to be very close to the tolerance limits.

Reporting coverage across Member States

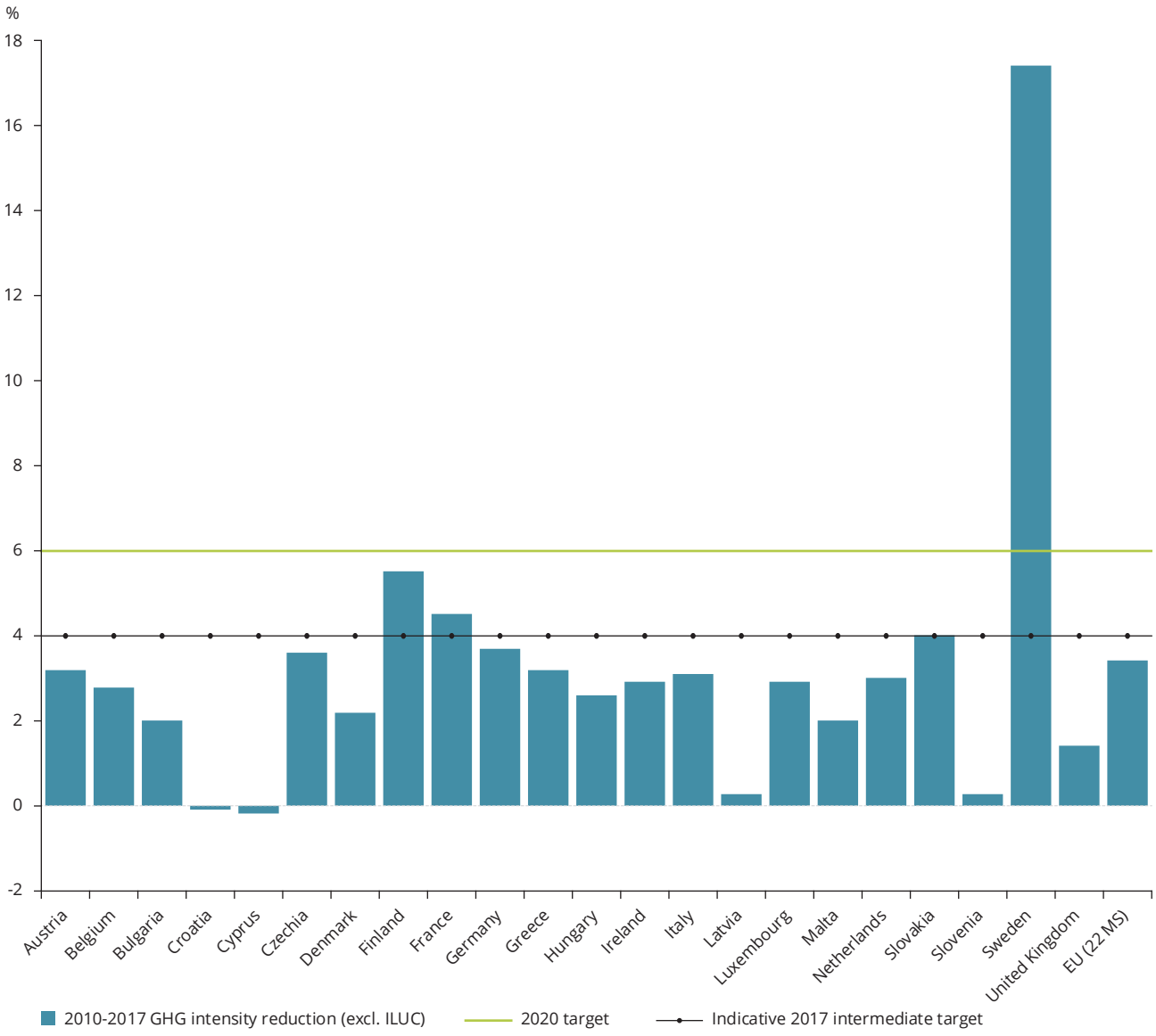
22 EU Member States plus Iceland and Norway submitted their first Article 7a reports under the FQD for the year 2017, which concern the GHG intensity of fuels. Estonia, Lithuania, Portugal, Romania and Spain did not submit any data in accordance with Article 7a, despite the extension of the reporting deadline from 31 August to 31 December 2018 ([4]). Poland submitted data that were not suitable for a detailed data analysis.

The completeness of data on the place of purchase and country of origin is rather low across the 22 Member States that submitted relevant information. The submission of this information is, however, voluntary.

For reporting under Article 8, all EU Member States, plus Iceland, submitted fuel quality reports for the year 2017. Four Member States provided reports after the legal deadline of 31 August 2018.

([4]) 31 December will be the new reporting deadline according to the amendments to Regulation 2018/1999/EU. Until these amendments came into force, the reporting deadline for Article 7a was 31 August.

Figure ES.1 Reductions in GHG intensity of fuels achieved by EU fuel suppliers in Member States, 2010-2017



Source: EEA.

1 Introduction

The road transport sector is a major contributor to air pollution and greenhouse gas (GHG) emissions in Europe. Efforts are made by vehicle manufacturers to optimise vehicles in terms of energy conversion efficiency, exhaust emission levels and the durability of emission control systems (e.g. catalytic converters). Having clean fuels available on the market and following strict technical specifications contributes to meeting the demands of stricter emission regulations and achieving higher levels of vehicle performance. In addition to technical standards, the obligation on fuel suppliers to reduce the GHG intensity of their fuels contributes to the EU meeting its climate and energy targets for 2020.

The role of fuels and their contribution to decreasing air pollution and GHG emissions has been recognised 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, less carbon-intense fossil fuels, renewable fuels of non-biological origin, and a reduction in GHGs emitted during the crude oil production phase.

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, as well as the quality of automotive petrol and diesel, in line with their obligations under the Fuel Quality Directive 98/70/EC (FQD) Article 7a and Article 8.

The reporting on data pursuant to Article 7a applies for the first time for the reporting year 2017, following the application and transposition of Council Directive (EU) 2015/652.

Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action amended the FQD and the Council Directive by removing the reporting requirement on the origin of crude oil and the place of purchase for refined fossil fuels. This reporting is no longer obligatory. However, where this information was provided by Member States on a voluntary basis it is included in this report.

The requirements of FQD Article 8 have evolved with the introduction of new fuel specifications and reporting requirements. The first FQD specifications for petrol and diesel sold for road transport in the EU were adopted in 1998 and came into force on 1 January 2000, the second on 1 January 2005 and the third on 1 January 2009. Provisions concerning the GHG intensity of transport fuels came into force in 2015. Since 2015, this reporting has been managed cooperatively by the European Commission and the EEA.

The key documents that lay out the official requirements for the quality and GHG intensity of fuel sold in the EU, as well as its monitoring and reporting for either Article 8 or 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;
- **Commission Decision 2002/159/EC** of 18 February 2002 on a common format for the submission of summaries of national fuel quality data;
- **European Standard EN 14274:2003** describing the Fuel Quality Monitoring System (FQMS) for assessing the quality of petrol and automotive diesel fuel marketed in any of the EU Member States within the European Community;
- **Directive 2003/17/EC** of 3 March 2003 amending Directive 98/70/EC 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).

This report summarises the information provided by the EU Member States on the volume, energy consumption, origin and GHG intensity of fossil fuels and biofuels, as well as the quality of petrol and diesel fuel sold in the EU in 2017. Member States use Reportnet (part of the infrastructure of the European Environment Information and Observation Network) to report the required information.

Chapter 2 describes the reporting requirements and the summary format for each Member State's submission under FQD Article 7a and Article 8. The fuel-quality-related parameters that are monitored and their environmental relevance are defined in detail.

Chapter 3 and Chapter 4 provide an overview of the Article 7a and Article 8 reported information aggregated at EU level, while Chapter 5 compares the information provided under Article 7a and Article 8. Chapter 6 provides a summary of each Member State's submission.

2 Reporting by European Union Member States

2.1 Reporting requirements

This report provides a summary, for the EU overall and for each Member State, of the information received.

For the data submitted under Article 7a, because of confidentiality requests, only five country profiles are included in this report (Austria, Denmark, Germany, Latvia and, partially, Poland). The information provided by the Member States comprises the following aspects:

1. fossil fuels and other non-biofuels information: fuel or energy type, raw material source and process, fuel quantity, energy quantity and greenhouse gas (GHG) intensity, as well as the following voluntary information: place of purchase (country and facility name), country of origin, feedstock trade name, American Petroleum Institute (API) gravity;

2. biofuels information: biofuel or energy type, sustainability of biofuel, feedstock used, biofuel production pathway, biofuel quantity, energy quantity, GHG intensity and indirect land use change (ILUC) feedstock category and emissions intensity, as well as the following voluntary information — country of origin, place of purchase (country);

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.

Regarding Article 8, the individual country profiles included in Chapter 6 are based exclusively on the information provided by the Member States ([5]). They present information on the following aspects:

1. country details: responsible organisations, country size, summer period, a description of the fuel quality monitoring system (FQMS) used and the location of sampling;

2. FQMS information, including a description of the sampling undertaken, FQMS administration, national legislation that transposed the FQD and reporting periods;

3. fuel sales information, including details of fuel sales by fuel type, bioethanol/biodiesel contents, the number of samples taken in winter and summer periods, and the number of technical parameters measured;

4. exceedances of the fuel quality limits, including a summary of the parameters for which exceedances were reported for the fuel grades measured.

Two Excel templates are used by EU Member States for their reporting obligations under Article 7a and Article 8 of the FQD. Their 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. A number of consistency tools and checks are included in the template to facilitate data entry, as well as to provide a standard format for the presentation of the collected data.

2.2 Parameters reported in accordance with Article 7a

For each fuel and energy supplied in road transport and non-road mobile machinery, Member States must report the following data, as defined in Annex I of Council Directive (EU) 2015/652:

- fuel or energy type;
- volume or quantity of fuel or electricity;
- GHG intensity, which is the rate of GHG emitted — expressed in grams of CO_2 equivalent (CO_2e) — over the energy produced (in megajoules, MJ);

([5]) The textual information provided by the Member States is taken verbatim from the template submitted; editing was undertaken to improve the flow for reading.

- production pathways of biofuels.

Following the amendment of the Council Directive and of the FQD by Regulation (EU) 2018/1999, reporting on the following data is voluntary:

- place of purchase, which refers to the country and name of the processing facility where the fuel or energy underwent the last substantial transformation;
- origin, which refers to the feedstock trade name (FTN), but only where suppliers hold the necessary information.

2.2.1 Parameters for fossil fuels and other non-biofuels

The origin of fossil fuels is directly linked to the FTN, from which the API gravity and the sulphur content of the fuel can be specified. API gravity is a measure of how heavy or light a petroleum liquid is compared with water. Thus, API gravity is an inverse measure of a petroleum liquid's density. The importance of sulphur content specification lies in the formation of sulphur oxides (SO_x) when a fuel is burned, which contributes to the overall GHG intensity of the fuel as substantial energy quantities are needed to remove it from the fuel.

2.2.2 Parameters for biofuels

For biofuels, the origin is linked to the biofuel production pathway. The determination of the biofuel production pathway is essential to specify the GHG emission saving and thus the sustainability of the fuel. Feedstock refers to the raw material used in the production of the biofuel.

While biofuels are important in helping the EU meet its GHG reduction targets, biofuel production typically takes place on cropland, which was previously used for other agriculture, such as growing animal feed or food for humans. Since demand for this agricultural production still has to be met, agricultural production might be partly displaced to other land that was previously non-cropland, such as forests or grasslands. This process is known as ILUC. It risks reducing the GHG savings that result from increased biofuels because forests and grasslands absorb high levels of CO_2. By converting these land types to cropland, CO_2 emissions may increase. Hence, in an encompassing life cycle analysis, the ILUC-related GHG emissions intensity should be added to the GHG intensity that is directly attributed to the production and transport of biofuels.

Biofuels not meeting the sustainability criteria set out under the FQD and the Renewable Energy Directive are accounted for as fossil fuels under the FQD. However, as ILUC effects still result from the production of such fuels, these should be taken into account ([6]).

Electricity refers to the electricity consumed by electric vehicles and motorcycles.

2.3 Parameters reported in accordance with Article 8

The consumption of fossil fuels affects the environment, causing pollution in a direct or indirect way. Humans are exposed to this pollution because their activities are related to the use of fossil fuels. As a result, the fuel combustion products are affecting human and animal health directly or indirectly: directly by inhaling gaseous pollutants and particles floating in the air and indirectly by consuming harmful substances, which are deposited in soil, food and crops.

To minimise the negative effects on health and the environment from the use of petrol and diesel fuels in road transport, the FQD establishes minimum quality requirements. These include minimum and/or maximum values for a number of fuel parameters, which are listed in Table 2.1 below. The limit values for each parameter are also included in the same table. A number of fuel components serve different roles during the fuel combustion process. However, the exceedance of specific thresholds for these components may lead to increased GHG and air pollutant emissions, which negatively affect the environment and consequently human health.

The parameters regulated by the FQD in petrol and diesel fuel grades in the EU as well as their effect on the environment and human health are presented below.

([6]) Article 7b of the FQD and Article 17 of the Renewable Energy Directive 2009/28/EC define the criteria under which a biogenic fuel is considered sustainable. 97 % of the biofuels reported by the 22 EU Member States were marked as sustainable and only 3 % as not sustainable. So the vast majority of biofuels are in fact indicated as sustainable.

Table 2.1 List of fuel parameters regulated by the FQD Article 8 (cont.)

Parameter	Unit	Limit values	
		Minimum	Maximum
Petrol			
Research Octane Number (RON)	-	95	
Motor Octane Number (MON)	-	85	
Dry vapour pressure equivalent (DVPE)			
Summer period (normal)	kPa		60
Summer period (with bioethanol)	kPa		66-68
Summer period (arctic or severe weather conditions)	kPa		70
Distillation			
Evaporated at 100 °C	% v/v	46	
Evaporated at 150 °C	% v/v	75	
Hydrocarbon analysis			
Olefins	% v/v		18
Aromatics (from 2005)			35
Benzene	% v/v		1
Oxygen content	% m/m		3.7
Oxygenates			
Methanol	% v/v		3
Ethanol	% v/v		10
Iso-propyl alcohol	% v/v		12
Tert-butyl alcohol	% v/v		15
Iso-butyl alcohol	% v/v		15
Ethers with 5 or more carbon atoms per molecule	% v/v		22
Other oxygenates	% v/v		15
Sulphur content	mg/kg		10
Lead content	g/l		0.005
Manganese	mg/l		2
Diesel			
Cetane number	-	51.0	-
Density at 15 °C	kg/m^3		845
Distillation — 95 % point	°C		360
Polycyclic aromatic hydrocarbons	% m/m		11
Sulphur content (sulphur free, from 2005)	mg/kg		10
Fatty acid methyl ester (FAME) content	% v/v		7
Manganese	mg/l		2

2.3.1 Parameters regulated in the Fuel Quality Directive for petrol and their effects

Volatility is the property of a liquid fuel that defines its evaporation characteristics and is mainly described by two metrics: **vapour pressure** and **distillation**. High petrol vapour pressure causes high evaporative emissions of Volatile Organic Compounds (VOCs). As a result of their low boiling points, VOCs can be emitted to the atmosphere and contaminate the air, causing respiratory-related diseases. Furthermore, VOCs are key ground-level ozone (O_3) precursors as they react with nitrogen oxides (NO_x) in the presence of sunlight to form ozone. The photochemical smog, which is characterised by high concentrations of O_3 and fine particles, is of great concern in many urban centres around the world as they affect inter alia tissues of the respiratory tract or lung. Their release might take place during the delivery and transfer of petrol to storage, the refuelling of vehicles, the breathing of vehicle fuel tanks (as they heat up and cool down with normal daily temperature variations), and the losses that occur from carburettors and other equipment during the vehicle operation. Reducing fuel volatility will essentially reduce evaporative emissions from vehicles (Walsh, 2004).

Vapour pressure is regulated only for petrol as it is already very low in diesel. The FQD regulates the maximum vapour pressure of summer-grade petrol, setting a limit of 60 kPa (if no derogation is granted), to control the emissions of VOCs. The dry vapour pressure equivalent (DVPE) is the most common measure of vapour pressure in Europe. As evaporative emissions are directly linked to fuel volatility, a reduction in emissions is most effectively achieved when the DVPE is limited to 60 kPa during the summer period, when typical ambient temperatures are high in most EU Member States.

Distillation is a second metric used for petrol volatility. An increase in mid-range volatility (described by T50 distillation points — the temperature for the first 50 % of the fuel to evaporate) leads to a reduction in VOC emissions for vehicles both with and without catalytic converters and a reduction in carbon monoxide (CO) emissions, mainly for cars equipped with catalytic converters. At the same time, increasing mid-range volatility leads to an increase in NO_x emissions. Benzene emissions generally decline when mid-range volatility is increased, but the effect becomes weaker at low aromatics content (Zvirin et al, 1998).

Octane number is an indication of how much the air-fuel mix can be compressed before ignition. A high octane (95 or higher) petrol fuel is recommended by vehicle manufacturers for most cars. However, in the case of cars with high compression ratio engines, such as certain luxury or sports cars, 100 octane petrol is highly recommended for higher performance. Use of petrol fuel with low knock resistance (below 95) in high compression ratio engines (which all modern cars have) may result in efficiency losses, increased pollutant emissions and engine damage, under high load conditions. The minimum octane number limit set by the FQD is 95. There are two main methods for rating the octane quality. These are the Research Octane Number (RON) ([7]) and the Motor Octane Number (MON). Both tests are similar and are based on the same laboratory equipment. The main difference between them is the engine operation regime, relating to diverse driving conditions: RON — mainly urban driving, with relatively low engine speed and load; MON — severe driving conditions with higher engine speed and load (Zvirin et al, 1998).

Olefins content. Olefins are unsaturated hydrocarbons (compounds that contain only hydrogen and carbon and at least one double or triple bond). Lower olefins content leads to a reduction in Particulate Matter (PM) emissions with no significant reductions in levels of CO and NO_x. A reduction in olefins content leads to a drop-in emissions of toxic 1,3-butadiene (a known carcinogen) for all vehicle types. However, olefins do not have a significant impact on the other primary toxins, i.e. benzene, formaldehyde, and acetaldehyde. Reducing light, volatile and very reactive olefins (e.g. butenes and pentenes) contributes to the improvement of petrol oxidation stability and the reduction of ozone formation from evaporative emissions. Olefins are good high-octane components of petrol, but they can provoke the build-up of engine deposits and elevated emissions of highly reactive ozone-forming hydrocarbons and toxic compounds.

Aromatics content. Aromatics are hydrocarbon fuel molecules based on the ringed six-carbon benzene series or related organic groups. Combustion of aromatics might lead to benzene formation in exhaust gas. Lowering the levels of aromatics content in petrol significantly reduces toxic benzene and toluene emissions from vehicle exhausts (Walsh, 2004). In addition, reducing aromatics decreases the CO and VOC emissions for both catalytic convertor and non-catalytic convertor vehicles, but it presents different results for NO_x emissions: an increase in NO_x

([7]) RON is an indication of the performance of the fuel in the engine. Higher RON numbers indicate that the fuel can withstand higher compression ratios in the combustion chamber before ignition. This fuel can be used in high-performance engines that require higher compression ratios.

in catalytic convertor-equipped cars and a reduction in NO_x in non-catalytic convertor vehicles. This is because of the reduced efficiency of the catalytic conversion of NO_x with low aromatic fuels. A slight trend towards an increase in aldehyde emissions with a reduction in aromatics content is shown, because partial oxidation of aromatics is not a significant source of aldehydes compared with the oxidation of paraffins (Zvirin, 1998).

Benzene content. Benzene is a six-carbon, colourless aromatic that occurs naturally in petrol and is also a product of catalytic reforming, and it is used to boost octane levels. Benzene in petrol leads to both evaporative and exhaust emissions (Walsh, 2004). Reducing benzene content is inextricably linked to benzene emissions in the exhaust gases: the lower the benzene level in fuel, the lower its emissions. Benzene is a human carcinogen that can contribute to the onset of leukaemia in people exposed to it.

Oxygen is added to petrol to improve combustion, to limit emissions of ozone precursors and CO and/or to raise octane levels (Walsh, 2004). The dominant oxygenates used today are ethanol and fuel ethers. Where ethanol is used, the DVPE of the fuel increases, resulting in higher evaporative emissions. CO and VOC emissions generally decrease with the use of oxygenates, especially for older vehicle technologies. This is due to the additional oxygen that these fuels provide to the combustion system, which leads to oxidation of CO and VOCs to form CO_2. This reduction in emissions is, however, marginal for modern vehicles with sophisticated control of the air-fuel ratio. Because of the more complete combustion of fuel blends containing more oxygen, higher combustion temperatures are induced. NO_x formation is favoured at these elevated temperatures. This NO_x effect is much lower for newer technology vehicles.

Lead content. Lead was added to petrol to reduce engine knocking, increase octane levels and reduce wear and tear on motor valves. Because of concerns over air pollution and health risks, lead in petrol was slowly phased out from the late 1970s onwards and has been completely banned in the EU since 2000 (only traces of lead are found in petrol and diesel today). Lead can be released directly into the air as suspended particles. Emissions from vehicle traffic are the main source of a high lead burden in the ambient air of the urban areas around the world. The particles enter the human body either by inhalation or from contaminated food, water and soil, where lead had been deposited. A decrease in lead content obviously leads to a reduction in direct air pollution by lead and, for unleaded petrol, maintains the effectiveness of the catalytic convertors and thus further reduces pollutant emissions. Nowadays, various antiknock agents ([8]) are used in petrol in place of lead. The FQD still allows petrol to contain trace amounts of lead (0.005 g/l), to account for accidental cross-contamination with lead in the petrol distribution system.

Manganese. In the form of methylcyclopentadienyl manganese tricarbonyl (MMT), this metallic additive is used to increase the octane levels by 2-3 octanes and the antiknock of petrol fuel. MMT is responsible for the contamination of water, soil and plants, and it can cause human health problems, such as headaches, nausea, chest tightness and breathing difficulties. Concerns have been expressed regarding catalyst plugging and oxygen sensor damage with MMT use, which could result in higher vehicle emissions, especially at higher mileage. The impact is greatest with vehicles meeting tight emissions standards and using high cell density catalyst substrates. Depending on the fuel used, the VOC emissions decrease significantly, while CO and NO_x emissions increase with the increase of MMT content in the fuel. Fine particles containing manganese can be absorbed by the blood through the lungs and transferred directly into the central nervous system and the brain. Moreover, MMT associated with fine particles can also reach the brain directly via the nasal passages, which contain nerves that have been shown to transport manganese into the brain (Walsh, 2004).

2.3.2 Parameters regulated in the Fuel Quality Directive for diesel and their effects

Cetane number is a measure of auto-ignition quality. High cetane number diesel fuels enable the engine to start more easily at lower ambient air temperatures, and they also enable a more complete combustion, thus reducing black smoke emissions during start up and operation. Increasing the cetane number generally results in a decrease in CO, VOC and NO_x emissions (most notably in heavy duty vehicles), as well as in benzene, 1,3-butadiene, formaldehyde and acetaldehyde emissions from light duty vehicles. These emissions tend to be less sensitive to cetane number in diesel vehicles equipped with oxidation catalysts or particle filters (Walsh, 2004).

Density is defined as the mass of fuel per unit volume. The higher the density of the fuel, the higher its energy content per unit volume. However, a maximum

([8]) An antiknock agent is a petrol additive used to reduce engine knocking while increasing the fuel's octane rating by raising the pressure and temperature at which auto-ignition occurs.

density limit is established, because a high fuel density affects the engine calibration, causing over-fuelling and increasing black smoke (visible PM emissions) and other gaseous emissions (Walsh, 2004). Fatty acid methyl esters (FAME), in addition to increasing the density, lead to an increased oxygen content of the fuel. Therefore, emissions and especially PM can be reduced. In other words, a higher density due to a higher FAME content is offset by the oxygen content of the resulting blend.

Polyaromatic hydrocarbons (PAHs) are attracting special attention because many are known human carcinogens. Reduction of PAHs content in the fuel leads to a reduction of PM and NO_x emissions.

Sulphur content. Sulphur is a natural compound in crude oil, and in fuels it acts as a lubricant in vehicle engines. When fuel is burned, sulphur combines with oxygen to create sulphur oxides (SO_x) emissions that reduce the air quality and have a negative impact on the environment and human health. The vast majority (95 %) of the SO_x emitted from the combustion of fossil fuels is sulphur dioxide (SO_2), which is a toxic gas directly affecting human health. When inhaled, it irritates the skin and the mucous membranes of the eyes, nose, throat and lungs. The symptoms include coughing, chest pain when taking a deep breath and breathing difficulties. The presence of sulphur in vehicle fuels can also cause an increase in the release of other environmentally damaging compounds such as NO_x, CO and VOC emissions through low catalytic conversion capacity. The major environmental concerns related to sulphur emissions are acid rain and the formation of PM. When SO_2 is emitted and combined with water, sulphuric acid or acid rain is formed. Acid rain has many adverse environmental impacts, such as acidification of aquatic systems, increased soil acidity and damage of vegetation. Acid rain might also cause the degradation of buildings and other infrastructure. Sulphur is also released from vehicles in the form of sulphate particles (SO_4). Along with NO_x, these particles contribute to PM formation.

Fatty acid methyl esters are esters of fatty acids. There is no direct environmental harm linked to the use of FAME in diesel. However, the increase in FAME content is related to poor fuel oxidation stability that causes the fuel to biodegrade over time. This process might be amplified by improper storage and handling along the fuel distribution chain. The results of oxidation may include bacterial growth in gas tanks and sludging of engines, fuel filters and fuel injectors (Dodge, 2014).

Manganese is a metallic additive used only in petrol to boost the octane number, as mentioned above. However, the FQD limits the manganese content in all fuels, although it has no application in diesel.

3 Reductions in greenhouse gas emissions (Article 7a)

3.1 Fossil fuel and biofuel consumption

22 EU Member States (all except Estonia, Lithuania, Poland, Portugal, Romania and Spain) plus Iceland and Norway submitted a report under Article 7a for the year 2017.

Total fuel supply reported was 8 976 petajoules (PJ), of which 95.5 % was from fossil fuels, and 4.5 % was from biofuels. No renewable fuels of non-biological origin were reported in 2017.

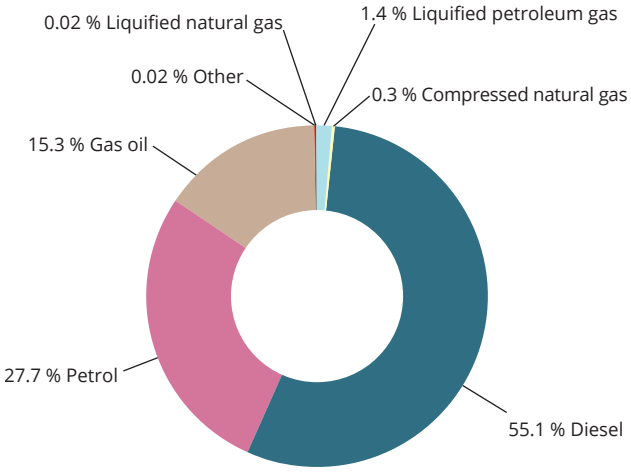
The fossil fuel supply in 2017 was dominated by diesel (55.8 %; 5 007 PJ ([9])), followed by petrol (27.6 %; 2 474 PJ) and gas oil (14.8 %; 1 324 PJ). Liquified petroleum gas and compressed natural gas had a total share of 1.8 % (167 PJ) (Figure 3.1).

The biofuels energy consumption in the 22 EU Member States is dominated by biodiesel (FAME) (62.3 %; 267 PJ), followed by bioethanol (17.5 %; 75 PJ) and hydrotreated vegetable oil (HVO; 16.6 %; 71 PJ). Bio-ethyl tert butyl ether (bio-ETBE) and biogas account for almost 3 % (12 PJ). All other biofuels used in road transport and non-road mobile applications in 2017 present a much smaller share (about 1 %) (Figure 3.2).

3.2 Fuel quantities purchased

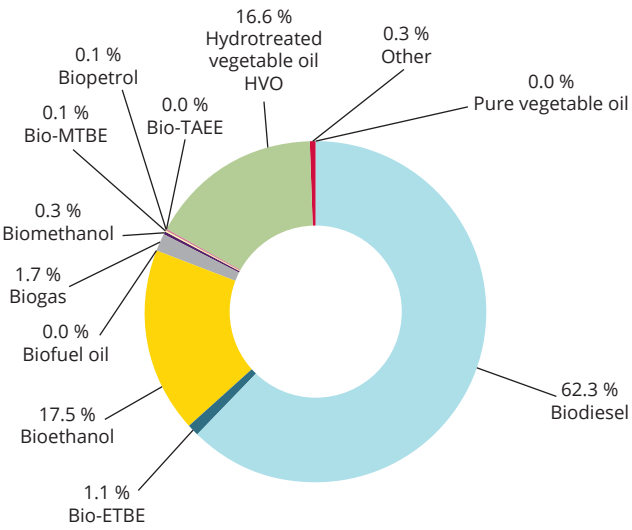
Fuel suppliers must report annually to the authority designated by the Member State, on the greenhouse gas (GHG) intensity of fuel and energy supplied within each Member State by providing, as a minimum, the total volume or quantity of each type of fuel or energy supplied and the life cycle GHG emissions per unit of energy. They may also indicate where fuels were purchased and their origin.

Figure 3.1 Fossil fuel energy supply shares per fuel type in 2017



Note: Based on 22 Member States' submissions.

Figure 3.2 Biofuel energy supply shares per fuel type in 2017



Notes: For 2017, 22 Member States delivered complete reports.
ETBE, ethyl tert-butyl ether;MTBE, methyl tert-butyl ether;
TAEE, tert-amyl ethyl ether.

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

Table 3.1 Origin and place of purchase reporting for fossil fuels and biofuels per Member State

	Fossil fuels		Biofuels	
Member State	**Place of purchase**	**Origin**	**Place of purchase**	**Origin of feedstock**
Austria				•
Belgium (confidential)			•	•
Bulgaria (confidential)	•	•	•	•
Cyprus (confidential)	•		•	
Czechia (confidential)	•	•		
Germany				
Denmark				•
Finland (confidential)		•		
France (confidential)			•	
Greece (confidential)				•
Croatia (confidential)	•	•	•	•
Hungary (confidential)	•	•	•	•
Ireland (confidential)				•
Iceland (confidential)			•	•
Italy (confidential)	•	•	•	•
Luxembourg (confidential)	•	•	•	•
Latvia	•			
Malta (confidential)	•	•	•	•
Netherlands (confidential)				
Norway (confidential)				•
Sweden (confidential)	•	•		•
Slovenia (confidential)	•	•		•
Slovakia (confidential)	•	•	•	•
United Kingdom (confidential)			•	•

Table 3.2 Total quantities of fossil fuels and biofuels, and shares of reported place of purchase and country of origin

	Total quantity (PJ)	Reported place of purchase (%)	Reported country of origin (%)
Fossil fuels	**8 975**	**11.4**	**10.5**
Petrol	2 474	11.0	8.4
Diesel	5 007	11.8	12.0
Liquid petroleum gas	136	24.4	28.5
Compressed natural gas	29	8.1	4.8
Gas oil	1 324	9.1	7.2
Liquefied natural gas	2.1	30.9	11.5
Other	2	16.5	0.0
Biofuels	**429**	**33.1**	**55.3**
Biodiesel	267	41.2	52.9
Bioethanol	75	32.6	41.4
Hydrotreated vegetable oil	71	4.5	76.9
ETBE	5	45.8	42.2
Other	11	17.5	76.4

Table 3.1 shows which of the 22 Member States (plus Iceland and Norway), having submitted a report under Article 7a, provided information on the origin and place of purchase for fossil fuels and biofuels. Member States should also indicate if the data, for both fossil fuels and biofuels, were the result of aggregating the amounts from three or fewer suppliers, in which case it is considered to be confidential. This information is also included in the same table below.

The total energy quantities purchased by suppliers are presented in Table 3.2, for the different fossil fuels and biofuels marketed in the 22 Member States that have provided relevant data. The percentages of these quantities for which the place of purchase and country of origin has been reported is also included in the same table. The data show a rather low percentage for the place of purchase of fossil fuels (11.3 %) and a lower percentage for the country of origin (10.5 %). For biofuels, the shares are higher: 33.1 % for the place of purchase and 55.3 % for the country of origin of the feedstock. The respective numbers by fuel type are summarised in Table 3.2. The low level of reporting is explained by the fact that reporting the place of purchase of fossil fuels and biofuels, as well as the country of origin of the fossil fuel and biofuel feedstock, is voluntary.

For most of the fossil fuel quantities reported, the region from which these quantities have been purchased was not reported. The relative share for non-reported place of purchase is of the order of 90 % for all fuels, except for liquid petroleum gas (LPG) and 'other' fuels. For LPG about 16 % is imported from EU Member States and 8 % from Africa (mainly Algeria). Table 3.3 summarises the share of energy quantities by fuel and region.

For biofuels, the energy quantities imported for which the place of purchase is not reported are about 60 % for biodiesel, 68 % for bioethanol and 96 % for hydrotreated vegetable oil (HVO). Almost half of ETBE consumed in the EU is purchased from EU countries. Table 3.4 summarises the relevant quantities by fuel and region.

For the imported crude oil, the Feedstock Trade Name (FTN) may be reported on a voluntary basis. For a given country of origin, the default FTN can be selected or additional trade names can be specified by the reporting Member State. For total imported crude oil quantities, the FTN has been reported for only a small fraction, 6.4 %.

Table 3.3 Share of energy (%) from fossil fuels by region of purchase

	EU	Europe, non-EU	Africa	Other regions	Not applicable
Petrol	10.9	0.1	0.0	0.0	89.0
Diesel	11.5	0.2	0.0	0.1	88.2
LPG	15.5	0.3	7.6	0.9	75.6
Compressed natural gas	8.0	0.1	0.0	0.0	91.9
Gas oil	9.0	0.1	0.0	0.0	90.9
Other	16.5	0.0	0.0	0.0	83.5

Note: For 'Europe, non-EU', Russia accounts for about 50 %. For 'Africa', Algeria accounts for about 79 %. 'Other regions' include the Middle East, Asia and North America.

Table 3.4 Share of energy (%) from biofuels by region of purchase

	EU	Europe, non-EU	Asia-Pacific	Other regions	N/A
Biodiesel	31.0	1.3	5.3	2.7	59.7
Bioethanol	28.7	2.8	0.0	0.9	67.7
HVO	3.8	0.1	0.4	0.0	95.7
ETBE	45.8	0.0	0.0	0.0	54.2
Other	16.4	0.0	0.9	0.2	82.5

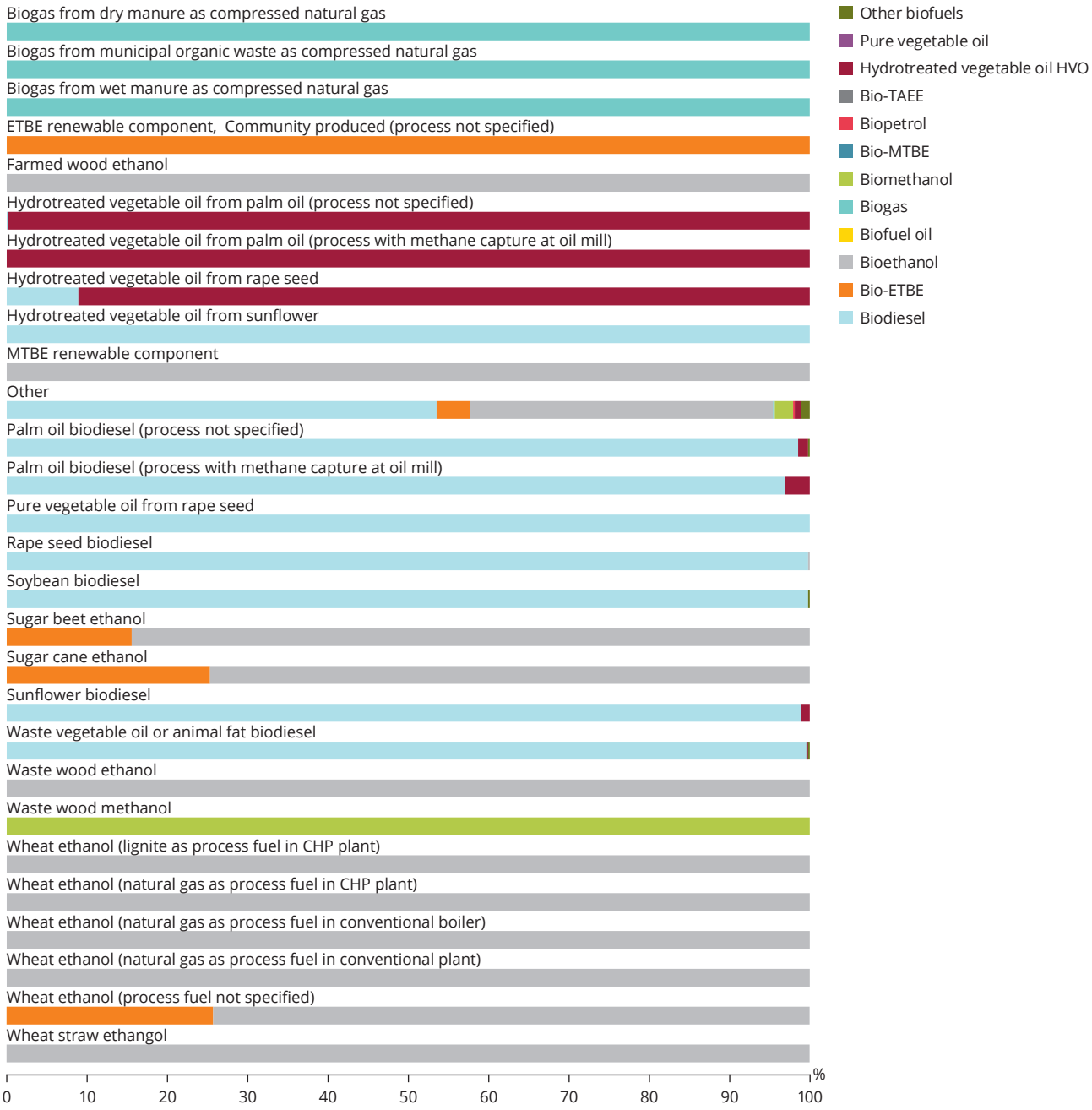
Note: For 'Europe, non-EU', Switzerland and Ukraine account for about 99 %. For 'Asia-Pacific', Indonesia, China and Malaysia account for about 86 %. 'Other regions' include Africa, the Middle East and North, South and Central America.

3.3 Biofuel production pathways and feedstock used

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.

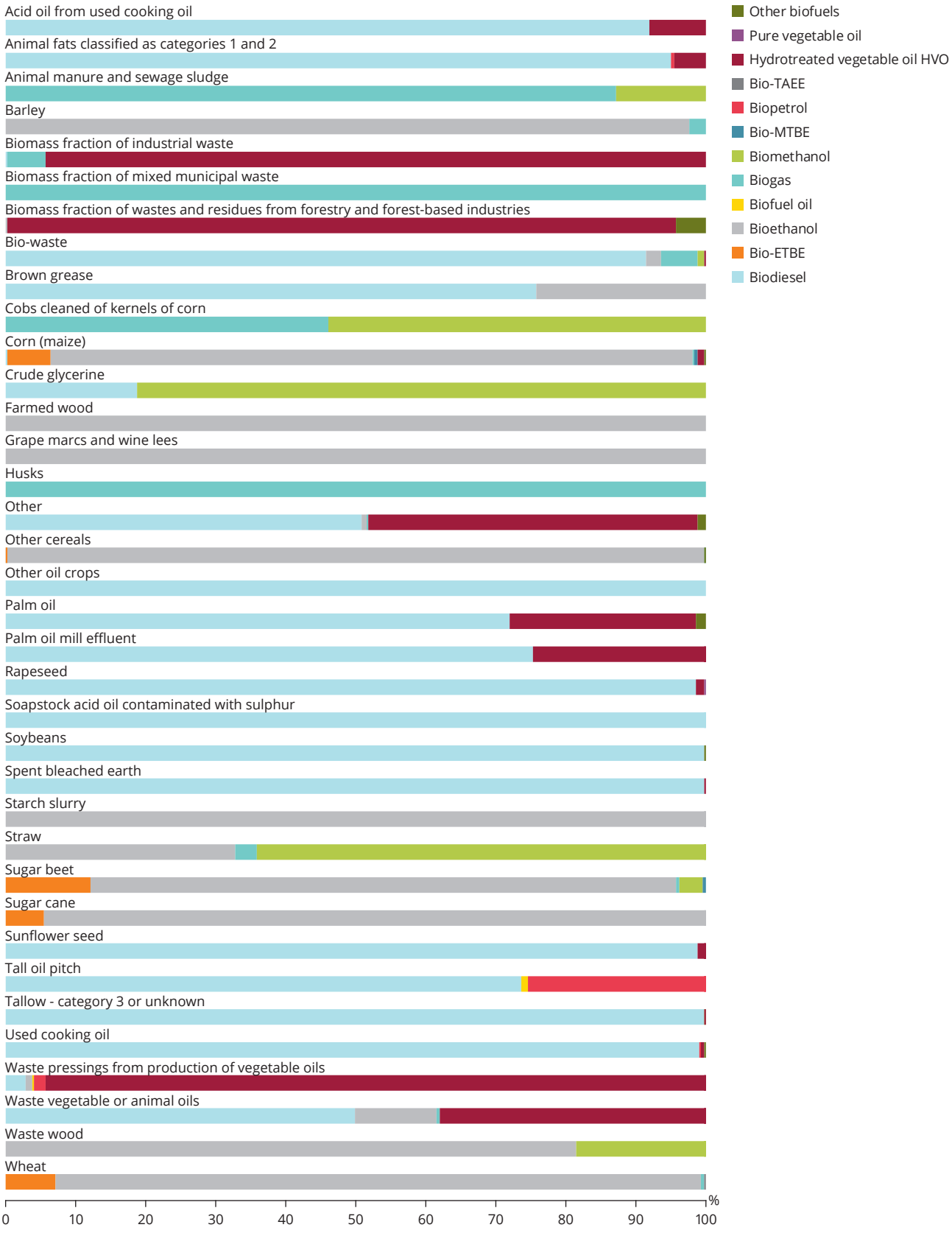
The Member States must report on the feedstock and the biofuel production pathway used for each of the biofuels consumed in their territories. Feedstock is relevant for estimating the potential indirect land use change (ILUC), whereas the biofuel production pathways are relevant for calculating the GHG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

Figure 3.3 Share of biofuel energy supplied per production pathway followed



Notes: TAEE, tert-amyl ethyl ether; MTBE, methyl tert-butyl ether.

Figure 3.4 Share of biofuel energy supplied per feedstock used



Notes: TAEE, tert-amyl ethyl ether; MTBE, methyl tert-butyl ether.

savings from their use. A detailed list of the possible feedstocks and production pathways used for the reporting is presented in Annex 1.

In the previous figures, the relative shares of each feedstock used (Figure 3.4) and each production pathway followed for biofuel production (Figure 3.3) are presented. It has to be noted that the nomination of feedstock and production pathways in some cases coincide leading to different statements depending on the analysis performed.

The main types of feedstock used for the production of biodiesel are rapeseed (43.7 %), used cooking oil (17.9 %) and biowaste (13.2 %). Bioethanol is mainly produced from maize (40.4 %), wheat (32.2 %) and sugar beet (8.2 %). For HVO production, the biomass fraction of industrial waste accounts for 39.9 %, waste pressings from the production of vegetable oils for 22.6 % and palm oil for 19.2 %, with a total share of 81.7 %. Detailed information for all biofuels and feedstocks used can be found in Annex 1, Table A1.6.

Biodiesel is derived mainly from three production pathways: rapeseed biodiesel (51.7 %), waste vegetable oil or animal fat biodiesel (33.7 %), and palm oil biodiesel (6.1%). These three production pathways account for about 91.5 % of the total biodiesel quantities supplied to the 22 Member States. Bioethanol is mainly produced from wheat (63 %, of which 25.7 % is with natural gas as process fuel in combined heat and power plants) and sugar beet (32.2 %). These two pathways account for the production of about 95 % of the total bioethanol quantities supplied to the 22 Member States. HVO originates mainly from palm oil (80.6 %) and rapeseed (14.8%). Detailed information for all biofuels and pathways can be found in Annex 1, Table A1.7.

3.4 Electricity consumption

The reporting of the quantity of electricity consumed by electric vehicles and motorcycles by fuel suppliers is voluntary. Only seven Member States reported the electricity consumed by electric vehicles and motorcycles, while two of them, Bulgaria and Slovenia, did not report the GHG intensities of the electricity consumed. In Table 3.5, the energy quantities consumed by electric vehicles, excluding and including powertrain efficiency, are summarised for the seven Member States. Only the quantities reported by fuel suppliers are shown. Actual electricity consumption in the different Member States may be larger. GHG intensities reported by Member States under Article 7a are compared with data provided by the Joint Research Centre (JRC) of the European Commission ([10]) on the average carbon intensity of the electricity consumed at low voltage in the EU in 2015 and are presented in the same table.

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 JRC. 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 JRC data refer to the year 2015 whereas Member States data are for 2017.

Table 3.5 Electricity consumed by electric vehicles and motorcycles as a reported contribution by fuel suppliers to their GHG reduction target

Member State	Quantity of energy excluding powertrain efficiency (GJ)	Quantity of energy including powertrain efficiency (GJ)	GHG intensity reported by Member State (gCO_2e/MJ)	GHG intensity reported by Member State (gCO_2e/kWh)	GHG intensity JRC data (gCO_2e/kWh)
Bulgaria	198 000	79 200	-	-	637
Germany	565 200	226 080	161.2	580	541
France	251 462	100 585	28.1	101	80
Italy	129 195	51 678	110.3	397	426
Netherlands	103 000	41 200	199	716	594
Slovenia	134	54	-	-	361
Slovakia	273	109	46.4	167	421

([10]) *Improved calculation of carbon intensity of electricity consumed in the EU Member States in 2015 including upstream emissions and trade*, Ispra, 7 February 2018.

3.5 Greenhouse gas emissions and distance to 2020 target

The Fuel Quality Directive (FQD) requires a reduction in the GHG intensity of transport fuels by a minimum of 6 % by 2020 compared with 2010 levels, via the suppliers' monitoring mechanism ([11]), 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 GHG intensity of the fuel mix in 2010, which is 94.1 gCO_2/MJ.

For each Member State that has submitted data for 2017, Table 3.6 shows the GHG emissions from the consumption of all fuels (fossil fuels and biofuels) and electricity used in road transport. An average GHG

Table 3.6 Average GHG emissions intensity reported by fuel suppliers by Member State in 2017 and reductions compared with 2010

	Fossil fuels		Biofuels		Electricity		Average fuel GHG intensity (gCO_2e/MJ) (excluding ILUC)	2010-2017 GHG intensity reduction (excluding ILUC) (%)	Average fuel GHG intensity (gCO_2e/MJ) (including ILUC)	2010-2017 GHG intensity reduction (including ILUC) (%)
Member State	**Energy consumption (TJ)**	**GHG emissions (kt)**	**Energy consumption (TJ)**	**GHG emissions (kt)**	**Energy cosumption (TJ)**	**GHG emissions (kt)**				
Austria	332 400	31 489	20 596	666			91.1	3.2	93.9	0.2
Belgium	342 436	32 456	19 939	672			91.4	2.8	93.9	0.2
Bulgaria	94 821	8 741	1 356	129			92.2	2.0	93.0	1.2
Croatia	91 209	8 595	17				94.2	-0.1	94.2	-0.1
Cyprus [a]	24 496	2 309					94.3	-0.2	94.3	-0.2
Czechia	254 272	23 902	13 208	362			90.7	3.6	92.9	1.2
Denmark	184 953	17 486	9 151	375			92.0	2.2	93.9	0.2
Estonia										
Finland	215 076	20 349	16 604	245			88.9	5.5	89.0	5.4
France	277 685	26 292	23 197	773	251	7	89.9	4.5	93.3	0.9
Germany	2 334 799	220 063	113 029	1 780	565	91	90.6	3.7	91.9	2.3
Greece	203 062	18 893	6 929	244			91.1	3.2	92.6	1.6
Hungary	142 443	13 456	5 635	122			91.7	2.6	92.4	1.8
Ireland	155 122	14 686	6 749	109			91.4	2.9	91.5	2.8
Italy	1 501 990	140 271	45 370	810	129	14	91.2	3.1	91.4	2.9
Latvia [a]	52 140	4 893					93.8	0.3	93.8	0.3
Lithuania										
Luxembourg	80 894	7 670	4 673	150			91.4	2.9	94.0	0.1
Malta	8 470	799	334	14			92.3	2.0	92.4	1.8
Netherlands	493 443	46 473	19 395	343	103	20	91.3	3.0	91.5	2.8
Poland [b]										
Portugal										
Romania										
Slovakia	88 093	8 315	6 213	207			90.4	4.0	93.5	0.6
Slovenia	83 240	7 875	916	21			93.8	0.3	94.1	0.0
Spain										
Sweden	259 092	24 445	69 954	1 132			77.7	17.4	80.2	14.8
United Kingdom	1 803 532	170 507	41 785	723			92.7	1.5	92.8	1.4
EU (22 Member States)	**8 874 260**	**845 258**	**425 051**	**8 874**	**1 049**	**133**	**90.9**	**3.4**	**91.9**	**2.3**

Notes: [a] Average fuel GHG intensity and 2010-2017 GHG intensity reduction for Cyprus and Latvia are calculated based only on the fossil fuel consumption (no biofuels or electricity taken into account as insufficient information was provided).

[b] Details on the Polish Article 7a submission can be found in Section 6.22.

([11]) 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.

intensity has been calculated for each Member State, as well as the relative reduction over the 2010 default baseline value, also shown in the same table.

The average GHG intensity of the fuels supplied in the 22 EU Member States (excluding the ILUC for biofuels) is 90.9 g carbon dioxide equivalent (CO_2e). Thus, a reduction of 3.4 % was achieved in 2017. This corresponds to a saving of 29 $MtCO_2e$ in the year 2017. To ensure the delivery of the minimum 6 % reduction target by 2020, the FQD specifies that Member States may require suppliers to comply with an intermediate reduction target of 4 % for the year 2017. Using this as a reference to assess the progress achieved indicates therefore that, in 2017, EU fuel suppliers in the 22 reporting Member States were, on average, behind their objective of reducing the GHG intensity of transport fuels by 6 % by 2020, compared with 2010. In order to reach the obligatory 6 % target, an additional 2.6 % reduction in the GHG intensity of all fossil fuels and biofuels supplied will be needed by 2020, on average in the EU ([12]).

The average GHG intensity of the fuels consumed in the EU Member States for 2017, including the ILUC for biofuels, is 91.9 gCO_2e, showing a reduction of 2.3 %.

The EU is lagging behind its 2020 target for the GHG intensity of fuels, as the projected reduction in 2020 is 4.7 % excluding ILUC, assuming a constant reduction rate between 2010 and 2020. It is to be noted that in 2017 no upstream emission reductions were reported. These are expected to contribute to the reduction target only in the year 2020.

3.6 Indirect land use change reporting

According to Article 7a paragraph 7 of the FQD fuel suppliers have to report the life cycle greenhouse gas emissions per unit of energy including the provisional mean ([13]) values of the estimated ILUC emissions from biofuels to the Member States. As mentioned previously, ILUC emissions may significantly reduce the GHG benefits from the use of the different biofuels. Depending on the land types converted to cropland, 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 V of the FQD are used. ILUC emissions are not taken into account for assessing compliance with the obligatory 6 % reduction target.

Table 3.7 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 included.

Based on the provisional mean values of the estimated indirect land-use change emissions in the FQD (see Article 9 (k) and Annex V FQD), an average value of 1 gCO_2e/MJ has been estimated for the additional GHG intensity of ILUC, based on the total energy consumption of all fossil fuels and biofuels. Adding this value to the average GHG intensity of 90.9 gCO_2e/MJ (without ILUC) of the fuels consumed in the 22 EU Member States as calculated above (Table 3.6) results in a total value of 91.9 gCO_2e/MJ (with ILUC). If ILUC was included in the calculation of the GHG intensity, the relevant reduction from the baseline would be 2.3 % as opposed to the 3.4 % reduction calculated in Table 3.7.

The average GHG intensity and hence also the relative distance to target depends on the share and type of fossil fuels and biofuels in the total fuel mix. Diesel and gas oil have the highest GHG intensity (95.1 gCO_2e/MJ) of all fuels, whereas substitution with HVO (18.9 gCO_2e/MJ) and biodiesel (22.1 gCO_2e/MJ) reduces significantly the GHG intensity.

The distance to target varies from 6.2 % (for Cyprus) to 0.5 % (for Finland) across Member States. Sweden is the only Member State having exceeded the target (by 11.4 %).

Cyprus presents an increase of 0.2 % in the average GHG intensity of fuels compared with the 2010 baseline.

Table 3.7 ILUC summary table

Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	61 004	9 623	157 836	168 750
Default ILUC intensity Provisional mean ([14]) values of the estimated ILUC emissions (gCO_2e/MJ)	12	13	55	0

([12]) Determined across the 22 Member States that reported data.
([13]) The ranges of ILUC values can be found in Annex V of the FQD.
([14]) The mean values included here represent a weighted average of the individually modelled feedstock values (Annex V, FQD).

This is due to the low share of biofuels (1 % bioethanol) and the dominance of diesel (53 %) in the market. Croatia's GHG intensity has also increased — marginally by 0.1 % — as a result of a very small biofuel share (0.02 % bioethanol) and a high diesel share of 74 %.

On the other hand, Finland and Sweden have achieved the highest reductions in the average GHG intensity of their fuels, with 5.5 % and 17.4 %, respectively. Finland has a biofuel share of 8 % (of which 73 % is HVO and 18 % is biodiesel), while diesel and gas oil represent 42 % and 27 % of the mix, respectively. Sweden has the highest biofuel share among all Member States, amounting to 27 % (of which 71 % is HVO and 14 % is biodiesel).

3.7 Upstream emission reductions

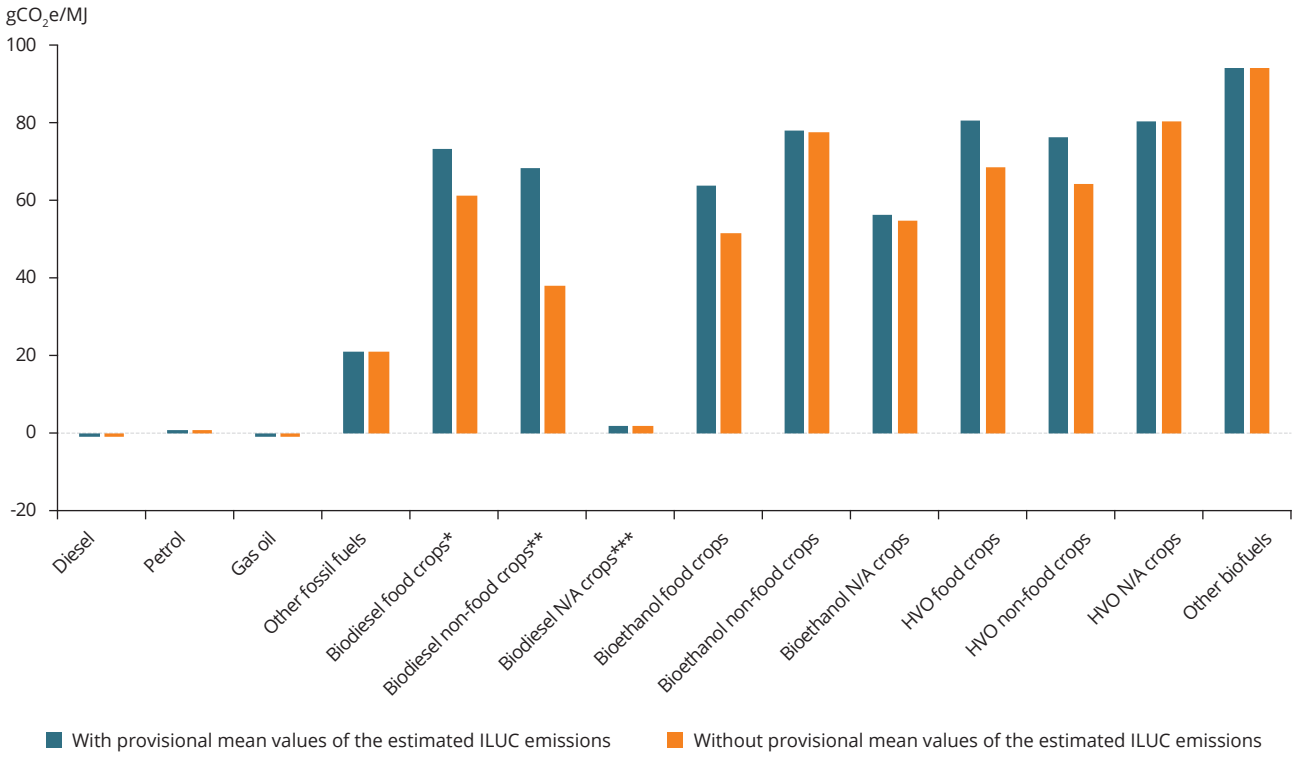
Upstream emissions refer to the GHG emissions produced during the extraction, processing, handling and transport of fuels from their original state to the refinery or processing plant where the fuel was produced. Upstream emission reductions (UER) are the reductions that can occur prior to the crude oil entering the refinery, including reductions in flaring and venting emissions. The UER claimed by a supplier have to be quantified and reported in accordance with the requirements set out in Council Directive (EU) 2015/652. There are several options for suppliers to reduce the GHG intensity of fuels and energy towards the 2020 reduction target. However, there is no obligation to use UER as a compliance option.

None of the 22 Member States that have submitted data under Article 7a has claimed any UER, hence the total UER (in gCO_2e) was reported to be zero for all of them in 2017.

3.8 Greenhouse gas emission savings by substituting fossil fuels with biofuels

Figure 3.5 depicts the reduction of the average GHG intensity of the most significant — in terms of their contribution to total energy consumption — fuel types, including and excluding provisional mean values of the estimated ILUC emissions. All GHG intensities per fuel type are normalised to their respective energy quantities supplied.

Figure 3.5 Average GHG intensity reduction per fuel type



Notes: *Food crops include cereals and sugars.

**Non-food crops include oil and other crops.

***N/A crops include crops of unknown feedstock category.

Table 3.8 GHG emissions from the use of biofuels and different feedstocks

		Excluding provisional mean values of the estimated ILUC emissions		Including provisional mean values of the estimated ILUC emissions	
	Energy quantity (TJ)	Average GHG intensity (gCO_2e/MJ)	GHG emissions ($ktCO_2e$)	Average GHG intensity (gCO_2e/MJ)	GHG emissions ($ktCO_2e$)
Biodiesel	267 270	26.51	7 086	56.56	15 118
Cereals and other starch-rich crops	88	21.02	2	33.02	3
Sugars	0	N/A	0	N/A	0
Oil crops	146 025	35.58	5 196	90.58	13 227
Other	118 678	13.98	1 659	13.98	1 660
N/A	2 480	92.29	229	92.30	229
HVO	71 004	16.75	1 189	25.52	1 812
Cereals and other starch-rich crops	322	13.62	4	25.62	8
Sugars	0	N/A	0	N/A	0
Oil crops	11 248	34.23	385	89.23	1 004
Other	40 067	13.27	532	13.27	532
N/A	19 368	13.85	268	13.85	268
Bioethanol	75 179	30.83	2 318	41.48	3 118
Cereals and other starch-rich crops	56 377	30.71	1 732	42.71	2 408
Sugars	8 473	28.67	243	41.67	352
Oil crops	13	25.57	0	80.57	1
Other	2 179	16.21	35	16.21	35
N/A	8 138	37.81	308	37.81	321

Note: N/A, not applicable.

Table 3.9 GHG emissions savings from the use of biofuels

Fossil fuel	Substituting biofuel	GHG emissions from fossil fuels ($ktCO_2e$)	Emissions savings ($ktCO_2e$)	GHG emission reduction (%)
Excluding provisional mean values of the estimated ILUC emissions				
Diesel	Biodiesel + HVO	32 170	23 894	74.3
Petrol	Bioethanol	7 014	4 696	67.0
Including provisional mean values of the estimated ILUC emissions				
Diesel	Biodiesel + HVO	32 170	15 240	47.4
Petrol	Bioethanol	7 014	3 896	55.5

In order to estimate the decarbonisation potential of biofuels, i.e. the GHG savings 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, differentiated for the biofuel feedstock, 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 96 % of the total biofuel energy consumption in the 22 EU Member States that have submitted valid data for the year 2017. The relevant data for this comparison are summarised in Table 3.8. The average GHG intensity and corresponding GHG emissions with and without ILUC are presented for the different feedstocks for each of the selected biofuels.

From Table 3.8 it is evident that 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 50 %) is produced from oil crops, which have a high GHG intensity. When considering ILUC, this biodiesel is only marginally better than fossil fuel diesel -(90.6 vs 95.1 gCO_2e/MJ). In the case of HVO, the majority is produced from other feedstocks (such as waste oils and fats) with a low GHG intensity (with and without ILUC), whereas the quantities produced from oil crops are much lower. Bioethanol is mainly produced from sugars, cereals and other starch-rich crops, which have a moderate GHG reduction potential, being higher than oil crops and lower than other feedstocks.

Table 3.9 shows the calculated GHG emissions saved by replacing fossil fuels with corresponding biofuels. Substitution of diesel by biodiesel and HVO results in GHG emission reductions in the order of 70 % when ILUC is excluded, whereas these reductions are in the order of 50 % when including ILUC. The respective reductions for petrol and bioethanol are somewhat lower but in the same order of magnitude.

3.9 Quality of Member States' reporting in 2017

The EEA is responsible for the quality assurance/quality control (QA/QC) of the data submitted at EU level and is assisted in these checks by the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM) ([15]).

In 2017, 22 EU Member States plus Iceland and Norway submitted their fuel quality reports in accordance with the requirements of the FQD. Estonia, Lithuania, Poland, Portugal, Romania and Spain did not submit a complete report. During the QA/QC procedure, the ETC/ACM reviewers posed clarifying questions to EU Member States, relating to the completeness and consistency of their submitted data sets. The most common findings communicated to Member States following the quality checks performed on the information reported were:

- data reported not corresponding to the data lists provided in the template;
- data reported in aggregated form (e.g. place of purchase, feedstock trade names, etc., aggregated per fuel type).

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 clarifications. Following the QA/QC procedure, six Member States submitted revised their data sets.

Except for the above-mentioned countries not having submitted a report, all issues were resolved during the QA/QC process.

([15]) The ETC/ACM is a consortium of 14 European organisations contracted by the EEA to carry out specific tasks identified in the EEA strategy in the area of air pollution and climate change mitigation.

4 Quality of fuels (Article 8)

4.1 Fuel sales

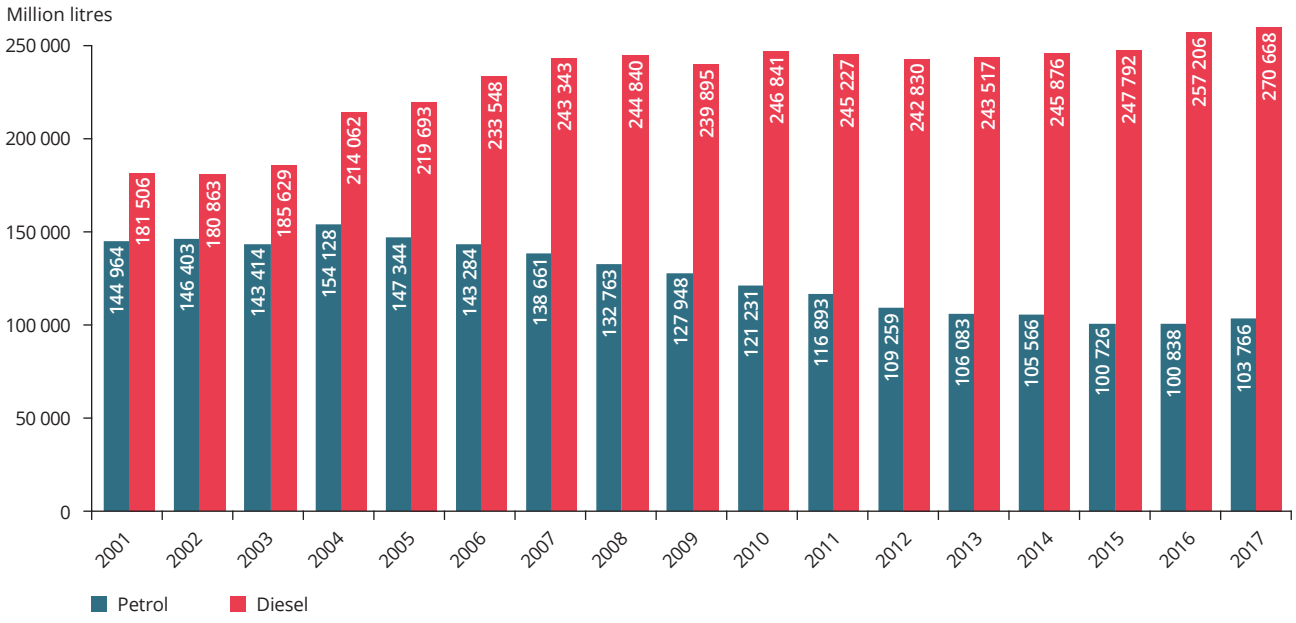
Sales of fuels used for road transport in the EU continue to be dominated by diesel: 72.3 % (270 668 million litres) of fuel sold was diesel and 27.7 % was petrol (103 766 million litres) ([16]). Petrol sales in 2017 increased by 2.9 % compared with 2016, and diesel sales increased by 5.2 % (Figure 4.1).

The proportion of diesel in total fuel sales has increased over the years, from 55.6 % of total sales in 2001 to 72.3 % in 2017 (Figure 4.2). This reflects to a large degree the increasing dieselisation of Europe's vehicle fleet during that period. While sales of diesel fuel increased by almost 9 % between 2007 and 2017, sales of petrol fuels decreased by 9 % during the same 10-year period.

The majority of petrol sales in 2017 comprised fuels with a petrol grade research octane number (RON) of 95, which accounted for 85.7 % of the total petrol fuel sales; 8.3 % of sales were 95 ≤ RON < 98; and 5.8 % were RON ≥ 98. There was an insignificant proportion of RON = 91 sales.

Diesel fuel consumption is dominant (> 60 % of total fuel sales) in most Member States, with the exception of Cyprus, Greece, Malta and the Netherlands (Table 4.1).

Figure 4.1 EU petrol and diesel fuel sales in 2017 (million litres)



Note: For 2017, only partial data had been delivered from Romania by the end of October 2018.

([16]) Fuels other than petrol and diesel are disregarded here, as the reporting under Article 8 of the FQD is limited to petrol and diesel, for which fuel specifications are laid down in Annexes I and II of the FQD.

Figure 4.2 EU petrol and diesel fuel sales, 2017

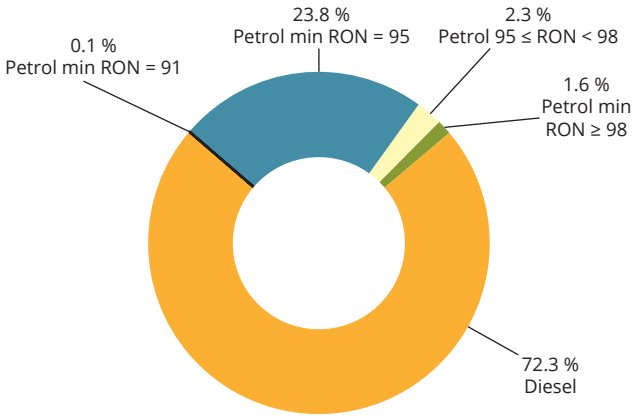


Table 4.1 Fuel sales by Member State and fuel type in 2017 (in million litres)

Member State	Minimum RON = 91	Minimum RON = 95	95 ≤ RON < 98	RON ≥ 98	Total petrol	Total diesel
Austria	21	0	2 033	108	2 162	8 319
Belgium	0	1 620	443	0	2 063	8 219
Bulgaria	0	0	641	51	692	2 490
Croatia	0	638	5	31	674	1 925
Cyprus	0	0	449	28	477	373
Czechia	0	2 056	0	72	2 127	5 847
Denmark	178	1 622	0	0	1 800	3 330
Estonia	0	0	341	31	372	756
Finland	0	1 294	0	625	1 919	3 068
France	0	7 920	0	2 337	10 257	41 054
Germany	0	23 133	0	1 100	24 233	45 802
Greece	0	2 970	1	168	3 139	3 067
Hungary	0	1 789	0	67	1 856	4 076
Ireland	0	1 488	0	0	1 488	3 503
Italy	0	8 080	0	0	8 080	30 149
Latvia	0	223	0	22	245	1 172
Lithuania	0	286	0	4	290	1 855
Luxembourg	0	323	83	0	406	1 777
Malta	0	0	102	4	106	138
Netherlands	0	5 440	0	0	5 440	7 724
Poland	0	5 198	0	518	5 716	18 912
Portugal	0	0	1 276	107	1 383	5 299
Romania	-	-	-	-	-	-
Slovakia	0	932	0	22	954	2 427
Slovenia	0	0	497	48	545	1 795
Spain	0	5 823	0	500	6 323	26 647
Sweden	0	3 059	0	104	3 163	5 664
United Kingdom	0	14 915	1 083	0	15 998	29 719

The nine Member States with the highest volumes of fuel sold account for more than 80 % of total EU sales, while the 15 Member States with the lowest volumes account for 11 % of total EU fuel sales.

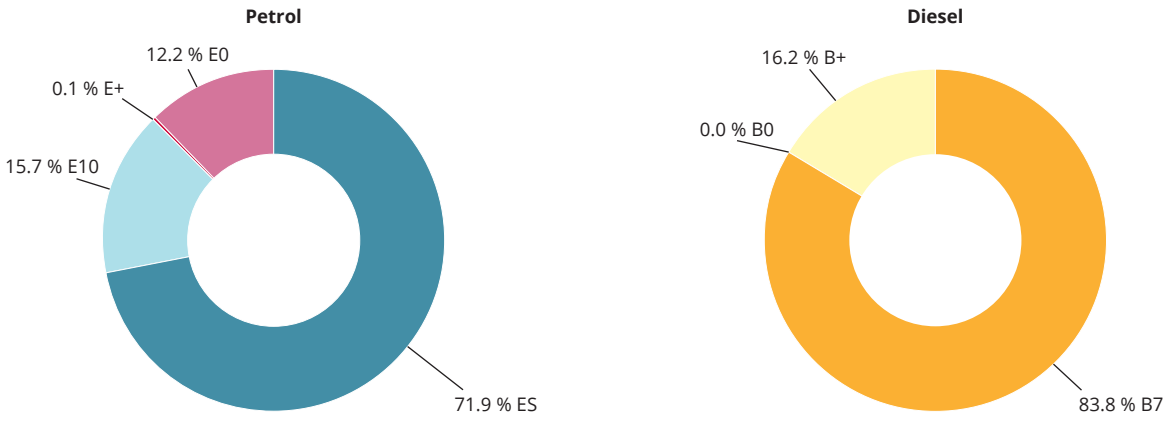
4.2 Use of regulated biocomponents

A large part of the fuel sold in the EU in 2017 contained biocomponents, for which a limit is set out in the FQD (Figure 4.3). All diesel in the EU was sold as containing biodiesel, whereas 87.6 % of petrol was sold as containing bioethanol.

Of petrol sold in the EU in 2017, 71.9 % was of the product type E5 (i.e. up to 5 % ethanol content by volume and in which the ethanol is derived from biofuels or is of biogenic origin). A total of 15.7 % was E10 (i.e. up to 10 % ethanol content by volume) and 12.2 % was E0 (no ethanol content). Only 0.1 % of petrol was E+ (i.e. > 10 % ethanol content by volume). This refers to E85, used in engines modified to accept a higher content of ethanol. Such flexi-fuel vehicles (FFV) are designed to run on any mixture of petrol and ethanol with up to 85 % ethanol by volume. E85 is widely used in Sweden and is also available in other European countries, e.g. Finland.

All diesel in the EU was sold as containing biodiesel, while 83.8 % of diesel fuel was of the B7 product type (i.e. containing up to 7 % fatty acid methyl esters, FAME) and 16.2 % was of the B+ product type (i.e. containing more than 7 % FAME). As the HVO share in diesel is not limited by the FQD it is not reported here.

Figure 4.3 Use of biocomponents in petrol and diesel fuels sold in the EU in 2017



Note: E+, petrol with > 10 % ethanol content; E0, petrol with no ethanol content; E5, petrol fuel with up to 5 % (percentage volume/volume (% v/v)) ethanol content; E10, petrol with up to 10 % ethanol content; B+, diesel fuel with > 7 % (% v/v) biodiesel content; B0, diesel fuel with no biodiesel content; B7, diesel fuel with up to 7 % (% v/v) biodiesel content.

4.3 Monitoring systems and sampling methods

Table 4.2 summarises the main information on the operation of the relevant fuel quality monitoring system (FQMS) by Member States, including model used, country size and sampling method, as well as the number of samples required.

The information contained in this table is described in more detail below.

Table 4.2 Fuel quality monitoring system summary

Member State	FQMS model	Country size	Summer and winter sampling	Total samples required (a)	
				Petrol	Diesel
Austria	Statistical model A	Small	Yes	100	100
Belgium	National	Small	Yes	National system	National system
Bulgaria	Statistical model A	Small	Yes	116	100
Croatia	Statistical model C	Small	Yes	110	100
Cyprus	Statistical model C	Small	Yes	106	100
Czechia	Statistical model C	Small	Yes	110	104
Denmark	Statistical model C	Small	Yes	200	100
Estonia	Statistical model C	Small	Yes	112	100
Finland	Statistical model A	Small	Yes	200	100
France	Statistical model A	Large	Yes	404	200
Germany	Statistical model B	Large	Yes	405	400
Greece	Statistical model A	Small	Yes	108	100
Hungary	Statistical model C	Small	Yes	120	120
Ireland	Statistical model C	Small	Yes	100	100
Italy	Statistical model A	Large	Yes	200	200
Latvia	National	Small	Yes	National system	National system
Lithuania	Statistical model C	Small	Yes	104	100
Luxembourg	National	Small	Yes	124	62
Malta	Statistical model C	Small	Yes	104	100
Netherlands	Statistical model A	Small	Yes	102	100
Poland	Statistical model B	Large	Yes	520	400
Portugal	Statistical model C	Small	Yes	100	100
Romania	Statistical model B	Small	N/A	N/A	N/A
Slovakia	Statistical model C	Small	Yes	106	100
Slovenia	Statistical model C	Small	Yes	110	100
Spain	Statistical model A	Large	Yes	218	200
Sweden	National	Small	Yes	National system	National system
United Kingdom	National	Large	Yes	National system	National system

Notes: Large country, total automotive road fuel sales of > 15 million tonnes per annum; small country, total automotive road fuel sales of < 15 million tonnes per annum.

(a) Based on EN 14274:2003.

4.3.1 Statistical models

Member States have to indicate whether their monitoring system is set up using the European Standard EN 14274:2003 statistical model A, B or C (see descriptions in Table 4.3) and whether it is based on the large or small country framework. Alternatively, they have to indicate if they are using their own nationally defined system.

22 Member States used one of the three statistical models defined by the European Standard EN 14274:2003. Five Member States (Belgium, Latvia, Luxembourg, Sweden and the United Kingdom) used a national monitoring system.

4.3.2 Information on summer and winter fuel grade sampling

Member States are also requested to define the summer/winter periods implemented in their territories and applying to their FQMS reporting. Apart from Romania, all Member States provided information for both summer and winter fuel grades. Sampling in both summer and winter periods ensures representability of the samples taken and is also relevant for the vapour pressure of petrol, for which the FQD sets a limit value during the summer period only.

4.3.3 Minimum number of samples

The minimum number of samples specified in EN 14274 refers to the minimum number of samples taken from fuel-dispensing sites to determine fuel quality at the point of use.

For fuel grades with market shares of 10 % and above, the minimum number of fuel-dispensing sites that should be sampled and tested in any country is given in Table 4.4.

For each fuel grade with a market share of < 10 %, considering petrol and diesel separately, the minimum number of fuel-dispensing sites to be sampled should be calculated in proportion to the number of samples for the corresponding parent grade, using the following equation:

$$N_{\text{grade i}} = \text{market share}_{\text{grade i}} / \text{market share}_{\text{parent grade}} \times N_{\text{parent grade}}$$

Table 4.3 Main types of statistical models used by Member States

Statistical model	Description
European Standard EN 14274 A: macro-regions	In this model, the regions within the country are grouped (preserving some geographical identity) into macro-regions so that they have similar total sales volumes relative to each other, as well as approximately the same number of supply sources. This approach is recommended, as it is designed to capture fuel variations efficiently and therefore requires a smaller number of samples. If geographical or other circumstances (e.g. force majeure) do not allow fulfilment of the requirements for the design of this preferred model, model B shall be considered the next best model. The minimum overall number of samples per grade and per season is 50 per small country and 100 per large country.
European Standard EN 14274 B: non-macro-regions	If the construction of macro-regions (based on fuel supply patterns) is not possible within a country, then the country shall be divided into regions using only geographical and administrative criteria. To ensure that fuel variability is reliably captured, a large number of samples per grade is required: 100 for small countries and 200 for large countries.
European Standard EN 14274 C: non-region model	If the country is small and it can be demonstrated that a division into macro-regions or non-macro-regions is not possible, having considered the procedures and provisions given in this European Standard, then the country shall be considered one region for sampling purposes. A total of 50 samples per grade and per season is required.
National model	Some countries have implemented their own models for the FQMS in accordance with their national legislation.

Table 4.4 Minimum number of samples per fuel grade in each winter and summer period

Fuel grade	Country size	Statistical model		
		A	B	C
Petrol	Small	50	100	50
Petrol	Large	100	200	N/A
Diesel	Small	50	100	50
Diesel	Large	100	200	N/A

Notes: N/A, not applicable.

4.4 Exceedances of fuel quality limits

Most key fuel parameters in the samples taken in 2017 were within the tolerance limits. In total, 496 non-compliances for petrol and 141 for diesel were reported for 2017 (Table 4.5).

One Member State (Belgium) reported more than 200 non-compliances for petrol and about 50 for diesel in 2017. Despite this large number of non-compliances, it represents only a small fraction of the overall number of samples taken in Belgium, which is, with 7 727 samples, the highest among EU Member States.

Table 4.5 Number of non-compliances for petrol and diesel fuels by country in 2017

Member State	Samples taken (and samples required in brackets)		Number of non-compliances in 2017 (figures for 2016 in brackets)		Parameters outside tolerance limits for non-compliant samples
	Petrol	Diesel	Petrol	Diesel	
Austria	106 (100)	100 (100)	0 (2)	2 (1)	Density at 15 °C, FAME content
Belgium	4 046 (national system)	3 681 (national system)	242 (256)	52 (50)	RON, MON, vapour pressure, oxygen content, methanol, ethanol, density at 15 °C, diesel sulphur content, FAME content, diesel distillation 95 % point
Bulgaria	119 (116)	122 (100)	0 (1)	0 (0)	No parameters outside tolerance limit
Croatia	174 (110)	193 (100)	3 (3)	0 (0)	Aromatics
Cyprus	605 (106)	328 (100)	36 (1)	0 (1)	Vapour pressure
Czechia	1 031 (110)	1 283 (104)	12 (8)	1 (3)	RON, MON, vapour pressure, distillation point, diesel sulphur content, FAME content
Denmark	205 (200)	100 (100)	27 (33)	2 (3)	RON, MON, vapour pressure, aromatics, diesel density
Estonia	320 (112)	150 (100)	3 (9)	4 (1)	Vapour pressure, diesel sulphur content, diesel distillation 95 % point
Finland	227 (200)	117 (100)	9 (18)	0 (0)	MON, aromatics
France	421 (400)	220 (200)	15 (14)	9 (2)	Vapour pressure, oxygen content, ethanol, distillation point, diesel sulphur content, FAME
Germany	847 (405)	400 (400)	15 (19)	1 (0)	Vapour pressure, ethanol, RON, MON, sulphur content, FAME content
Greece	117 (108)	100 (100)	0 (0)	8 (7)	Sulphur content, FAME content
Hungary	120 (120)	120 (120)	0 (3)	1 (1)	Cetane number
Ireland	100 (100)	100 (100)	20 (2)	1 (0)	RON, vapour pressure, aromatics, FAME content
Italy	200 (200)	200 (200)	6 (3)	2 (4)	RON, vapour pressure, sulphur content, aromatics, FAME content, diesel sulphur content
Latvia	33 (national system)	59 (national system)	4 (11)	0 (1)	RON, aromatics
Lithuania	104 (104)	100 (100)	0 (0)	13 (0)	FAME content
Luxembourg	124 (124)	62 (62)	15 (15)	1 (4)	Vapour pressure, manganese, diesel distillation 95 % point
Malta	108 (104)	106 (100)	0 (1)	0 (0)	No parameters outside tolerance limit
Netherlands	102 (102)	100 (100)	0 (0)	2 (3)	Diesel distillation 95 % point
Poland	532 (520)	407 (400)	9 (12)	5 (2)	RON, vapour pressure, aromatics, sulphur content, diesel distillation 95 % point
Portugal	530 (108)	552 (100)	16 (64)	14 (5)	RON, MON, vapour pressure, oxygen content, diesel distillation 95 % point, diesel sulphur content, FAME content
Romania				N/A	
Slovakia	208 (106)	186 (100)	16 (6)	16 (5)	RON, MON, vapour pressure, aromatics, cetane number, diesel distillation 95 % point, diesel sulphur content, FAME content
Slovenia	130 (110)	153 (100)	0 (0)	2 (0)	Diesel sulphur content, FAME content
Spain	400 (218)	200 (200)	3 (5)	2 (3)	Oxygen content, sulphur content
Sweden	815 (national system)	847 (national system)	0 (0)	0 (0)	No parameters outside tolerance limit
United Kingdom	1 342 (national system)	2 761 (national system)	43 (21)	3 (5)	RON, vapour pressure, aromatics, oxygen content, sulphur content, diesel sulphur content, FAME content
Total			**496 (500)**	**141 (140)**	

Notes: The numbers of samples required per country are shown in Table 4.2.
N/A, not available (not reported by the Member States).

Fifteen Member States reported fewer than 10 non-compliances for petrol, nine of which have reported full compliance (Austria, Bulgaria, Greece, Hungary, Lithuania, Malta, Netherlands, Slovenia and Sweden). Exceedances of the summer vapour pressure were reported in 13 Member States, exceedances of the RON were reported in nine Member States, exceedances of the motor octane number (MON) were reported in seven Member States, and exceedances of sulphur content were reported in six Member States.

Twenty-three Member States reported fewer than 10 non-compliances for diesel, seven of which reported full compliance (Bulgaria, Croatia, Cyprus, Finland, Latvia, Malta and Sweden). Of the seven fuel parameters that require testing and analysis ([17]), the most common parameters falling outside the specifications were the FAME content (in 12 Member States) and the sulphur content (in six Member States).

All Member States have described the actions taken when non-compliant samples were identified. These included informing the competent authorities, initiating investigations, imposing penalties and fines or resampling. For a small number of cases, no action was taken if the non-compliant parameters were found to be very close to the tolerance limits.

4.5 Quality of Member States' reporting in 2017

The EEA is responsible for the quality assurance/quality control (QA/QC) of the data submitted at EU level and is assisted in these checks by the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM).

In 2017, 27 EU Member States plus Iceland submitted their fuel quality reports in accordance with the requirements of Article 8 of the FQD. Romania did not resubmit a complete report ([18]). During the QA/QC procedure, the ETC/ACM reviewers posed in total 44 questions to EU Member States, relating to the completeness and consistency of their submitted data sets. The most common findings communicated to Member States following the quality checks performed on the information reported were:

- incorrect determination of the minimum number of samples that have to be taken;
- no fuel sales reported in the regional sampling sheets;
- national fuel sales and numbers of samples not consistent with the corresponding regional data;
- missing values for various fuel parameters;
- reporting of national specifications when they are the same as in Directive 2009/30/EC;
- exceedances of certain fuel quality parameters (e.g. summer vapour pressure, sulphur content), without specifying the number of samples outside the tolerance limits or providing any explanations or a description of the action taken;
- analytical and statistical values (e.g. maximum, minimum, median, mean) reported for the full year not consistent with the corresponding summer/winter.

Most of these issues could be solved directly with the Member States during the communication process, by their completing missing information, correcting erroneous values or providing the necessary clarifications to comments. Following the QA/QC procedure, 20 Member States submitted revised data sets.

With the exception of Romania having not submitted a complete report, there were no outstanding issues that could not be resolved during the QA/QC procedure.

([17]) Cetane number, density at 15 °C, distillation 95 % point, polycyclic aromatic hydrocarbon (PAH) content, sulphur content, FAME content and manganese content. Note that manganese is a metallic additive used for octane boosting in petrol only. However, the FQD limits the manganese content in all fuels, although it has no application in diesel; hence, most Member States do not routinely test for manganese content in diesel.

([18]) Only total fuel sales and total number of samples per fuel grade for the summer and winter period were reported. No samples for analysis have been collected as required by the FQD.

5 Consistency 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, as no other fuels are reported under Article 8.

The total volumes of petrol and diesel reported under Article 8 already contain 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 5.1 shows the results of the comparison for the 22 Member States that have reported under both Articles 7a and 8.

For many Member States the differences for both petrol and diesel are very small, within ± 2 %. However, there are also a few Member States for which much larger differences are observed, where total volumes reported under Article 7a are considerably lower than those reported under Article 8. The main explanation

Table 5.1 Comparison of petrol and diesel quantities (in million litres) reported under Article 7a and Article 8

Member State	Petrol		Diesel		Difference (%)	
	Article 7a	Article 8	Article 7a	Article 8	Petrol	Diesel
Austria	2 162	2 162	7 968	8 319	0.0	-4.2
Belgium	2 066	2 063	8 332	8 219	0.2	1.4
Bulgaria	433	692	2 071	2 490	-37.5	-16.8
Croatia	672	674	1 886	1 925	-0.3	-2.0
Cyprus	474	477	374	373	-0.6	0.3
Czechia	2 115	2 127	5 412	5 847	-0.6	-7.4
Denmark	1 793	1 800	3 263	3 330	-0.4	-2.0
Finland	1 881	1 919	3 062	3 068	-2.0	-0.2
France	1 769	10 257	6 852	41 054	-82.8	-83.3
Germany	24 281	24 233	45 902	45 802	-0.2	0.2
Greece	3 130	3 139	2 755	3 067	-0.3	-10.2
Hungary	1 080	1 856	347	4 076	-41.8	-91.5
Ireland	1 205	1 488	3 460	3 503	-19.0	-1.2
Italy	8 297	8 080	4 411	30 149	2.7	-85.4
Latvia	248	245	1 174	1 172	1.2	0.2
Luxembourg	407	406	1 999	1 777	0.3	12.5
Malta	106	106	150	138	0.0	9.6
Netherlands	5 628	5 440	9 164	7 724	3.5	18.6
Slovakia	730	954	2 293	2 427	-23.5	-5.5
Slovenia	519	545	1 599	1 795	-4.8	-10.9
Sweden	3 188	3 163	6 291	5 664	0.8	11.1
United Kingdom	16 621	15 998	29 996	29 719	3.9	0.9
EU (22 Member States)	**78 805**	**87 824**	**148 762**	**211 638**	**-10.3**	**-29.7**

for these large differences is that the reporting period for Article 7a does not always cover the entire year (2017). As an example, the reporting period for France covers only the last two months of 2017 (from 1 November to 31 December). This was due to a delay in the transposition of Council Directive (EU) 2015/652 into national legislation. Other reasons include fuel quantities purchased and sold in different years, or as for Sweden the amount of vehicles gas is not included in the summary of diesel and petrol under Article 8 but is reported under Article 7a.

6 Summary of Member States' submissions

6.1 Austria

6.1.1 Country details

Responsible organisation:	Umweltbundesamt GmbH Wien (Austrian Environment Agency — AEA)
Country size:	Small
Summer period:	1 May to 30 September
Fuel quality monitoring system (FQMS) used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations

6.1.2 Fuel quality monitoring service

Sampling

The organisation responsible for sampling is Agrar Market Austria (AMA); analysing and reporting activities are performed by the Austrian Environment Agency (AEA). Samples are taken from refuelling stations that are selected at random, while the proportion of small and large marketers is constant. Each year, three campaigns are undertaken — two in winter (beginning and end of the year) and one in summer.

Fuel Quality Monitoring System administration

The Fuel Quality Directive (FQD) was implemented by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management. AMA and AEA are commissioned by the Ministry to perform the fuel quality monitoring in Austria. The samples were taken from refuelling stations three times a year (AMA campaigns) and brought to the AEA for analysis. Reporting starts when all samples from the previous year have been tested. After analysing the samples, non-compliant fuels are reported to the Ministry, where further legal action is taken.

Austria is a small country, using statistical model A, as two refineries supply Austrian filling stations with fuels. Two macro-regions are defined (west and east) and samples are divided with respect to the population and number of filling stations.

National legislation that transposed the Fuel Quality Directive

The transposition of the FQD into national law, as well as the Renewable Energy Directive, was done by an amendment of the Austrian Fuel Ordinance, published in 2012.

Reporting periods

Seasonal periods in Austria are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

There are no arctic weather conditions in Austria. Transition periods are defined as the periods from 1 to 31 October and from 1 March to 30 April. Samples taken within the transition periods are regarded as winter samples.

6.1.3 Sales

Table 6.1.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Regular unleaded petrol (minimum RON = 91) E5 (Normal)	4.7	21 396 146	16 101	3	0	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Super)	4.6	2 032 795 699	1 521 853	50	50	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (Super Plus)	5.2	107 734 741	80 734	3	0	19 of 19
Total petrol		2 161 926 586	1 618 687	56	50	
Diesel fuel B7 (Diesel)	6.4	8 318 747 292	6 945 125	50	50	6 of 7
Total diesel		8 318 747 292	6 945 125	50	50	

6.1.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.1.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.1.2 Diesel fuel B7 (Diesel)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Density at 15 °C	kg/m^3	< 845	810.22	840.95	1	100
Fatty acid methyl esters Content	% v/v	< 7 (4)	0	8.54	1	100

6.1.5 Article 7a reporting

Table 6.1.3 Total quantities of fossil fuels and biofuels and percentage of reported place of purchase and country of origin

	Total quantity (PJ)	Reported place of purchase (%)	Reported country of origin (%)
Fossil fuels			
Petrol	66 087	0	0
Diesel	266 191	0	0
Liquid petroleum gas	37	0	0
Compressed natural gas	84	0	0
Gas oil			
Liquefied natural gas			
Other	0.08	0	0
Biofuels			
Biodiesel	17 247	0	97.8
Bioethanol	2 305	0	99.7
Hydrotreated vegetable oil	1 051	0	100
Ethyl tert-butyl ether			
Other			

Table 6.1.4 Summary table

Net summary excluding upstream emission reductions				
Quantity of energy (PJ)	Average estimated ILUC emissions per total energy (gCO_2e/MJ)		Average fuel GHG intensity (gCO_2e/MJ)	
353	2.8		91.1	
Net summary including upstream emission reductions				
Net GHG intensity excluding ILUC (gCO_2e/MJ)	Net GHG intensity excluding ILUC reduction on 2010 average		Total GHG intensity including ILUC (gCO_2e/MJ)	
91.1	3.2 %		93.9	
Indirect land use change reporting				
Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	2 075	221	17 489	441
Default ILUC intensity (gCO_2e/MJ)	12	13	55	0

Notes: ILUC, indirect land use change; GHG, greenhouse gas.

6.2 Belgium

6.2.1 Country details

Responsible organisation:	Fapetro
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	National system
Location of sampling:	Refuelling stations

6.2.2 Fuel quality monitoring service

Sampling

The organisation responsible for sampling, analysing and reporting is Fapetro. Samples are taken at refuelling stations. The proportion of samples is dictated by the volume of fuels sold on the Belgian market (different blends of petrol/diesel fuels).

Belgium controls many more parameters than are imposed by the European Commission, to ensure the quality of fuel sold. A template is available that shows in detail the parameters analysed and the methods used for every fuel type. Only a very small number of samples were non-compliant, because of involuntary contamination.

All samples were analysed by laboratories that were ISO 17025 certified. All test methods were accredited (or an application for accreditation was in progress at the time of testing). In addition, Fapetro audits the laboratories twice a year to ensure the quality of the analysed samples reported. Pump labelling is regulated by national legislation.

Fuel quality monitoring system administration

The International Organization for Standardization (ISO) EN 17020-certified organisation, Fapetro, is responsible for the reporting of fuel quality in Belgium. Belgium is a small country using a national system. Eleven macro-regions are defined and samples are divided with respect to the population and number of filling stations.

The transition periods are used to give fuel producers the ability to adapt fuel production to meet the specifications for summer or winter fuel quality. Every year high levels of dry vapour pressure equivalent (DVPE) infringements can be observed in May. Those infringements are involuntary and due to low stock rotation, mainly in small retail stations (at the end of the chain). At those stations, the winter quality petrol stays in stock longer because the retail turnover is comparatively low. As a result, during the transitional period from winter to summer, petrol quality is altered as it is mixed. All these infringements were small, harmless to the environment and involuntary.

Regarding petrol, non-compliant samples for vapour pressure came about because of low stock rotation

in the transition periods between winter and summer grades.

National legislation that transposed the Fuel Quality Directive

Transposition into national law was put into effect by the Ministerial decree of 24 January 2002 (latest version) and needs to be viewed in relation to the ISO 17020 procedures of Fapetro.

Reporting periods

Seasonal periods in Belgium are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 November to 30 April.

Transition periods are defined as being the months of October and April. A vapour pressure waiver has been granted to Belgium.

6.2.3 Sales

Table 6.2.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (Essence95/Benzine95)	0.0	1 620 357 283	1 207 166	1 539	817	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Essence98/Benzine98)	0.0	443 317 572	330 272	1 036	654	19 of 19
Total petrol		2 063 674 855	1 537 438	2 575	1 471	
Diesel fuel B7 (Diesel10S)	0.1	8 218 572 629	6 846 071	1 802	1 879	7 of 7
Total diesel		8 218 572 629	6 846 071	1 802	1 879	

Note: RON, research octane number.

6.2.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.2.2 and Table 6.2.3 summarise the parameters for which exceedances were reported for petrol fuels.

Diesel fuel grades

Table 6.2.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.2.2 Unleaded petrol (minimum RON = 95) E5 (Essence95/Benzine95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	91.9	97.9	7	272
Motor octane number	-	> 85 (3)	82.8	95.1	7	2 302
Vapour pressure, DVPE	kPa	< 60	55	87.7	84	1 539
Distillation point at 150 °C	% v/v	> 75	51.2	100	1	2 306
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% m/m	< 2.7	0	4.69	9	2 306
Methanol	% v/v	< 3	0	7.58	1	2 306
Ethanol	% v/v	< 10	0	12.71	9	2 306

Table 6.2.3 Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Essence98/Benzine98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Motor octane number	-	> 85 (3)	81	89.4	2	1 635
Vapour pressure, DVPE	kPa	< 60	53.5	91.4	130	1 036
Distillation point at 100 °C	% v/v	> 46	31.2	89.8	1	1 638
Distillation point at 150 °C	% v/v	> 75	26.6	97.9	1	1 638

Table 6.2.4 Diesel fuel B7 (Diesel10S)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Density at 15 °C	kg/m^3	< 845	822.3	872	2	3 681
Distillation 95 % point	°C	< 360	256.4	375.3	2	3 681
Sulphur content	mg/kg	< 10	3	18.1	9	3 681
Fatty acid methyl ester content	% v/v	< 7 (4)	0	9.2	39	3 681

6.3 Bulgaria

6.3.1 Country details

Responsible organisation:	Ministry of Environment and Water, State Agency for Metrology and Technical Surveillance of the Ministry of Economy
Country size:	Small
Summer period:	16 April to 15 October
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations and terminals

6.3.2 Fuel quality monitoring service

Sampling

Control of liquid fuel quality is performed by the President of the State Agency for Metrological and Technical Surveillance (SAMTS) via the Directorate-General for Quality Control of Liquid Fuels (DG QCLF). DG QCLF officials are authorised by the President of SAMTS to take samples of liquid fuels, to test them and to report their results.

DG QCLF staff inspected liquid fuels in refineries, petroleum depots and terminals, refuelling stations, and mobile tanks for liquid fuel transport.

Locations were chosen by region, determined in proportion to the annual fuel consumption in each region, and using randomisation software. Each location has a unique identification number. The samples taken for the purposes of control were tested in a mobile laboratory and in the permanently sited laboratory of the DG QCLF.

Fuel quality monitoring system administration

The organisations responsible for management and implementation of the FQD are the Ministry of Environment and Water, and SAMTS-DG QCLF. Bulgaria is a small country, using statistical model A for a small country. Six macro-regions are defined and samples are divided with respect to the population and number of filling stations.

The DG QCLF is a public body responsible for taking actions where infringements are found in liquid fuel control. Every month, every 3 months and every year, the DG QCLF provides data on the SAMTS website on

the number of inspections, the number of cases of non-compliance, and the number and type of administrative measures imposed during the reference period.

National legislation that transposed the Fuel Quality Directive

European liquid fuel quality legislation has been introduced into Bulgarian legislation by the Clean Ambient Air Act, the Energy from Renewable Sources Act and the Regulation on the quality requirements, conditions, order and control of liquid fuels. The Clean Ambient Air Act and the Regulation on the quality requirements, conditions, order and control of liquid fuels implement the requirements of Directive 98/70/EC and Standards EN 228 and EN 590.

Reporting periods

Seasonal periods in Bulgaria are as follows:

- summer: from 16 April to 15 October;
- winter: from 16 October to 15 April.

A vapour pressure waiver has been granted to Bulgaria. Transition periods are defined as the period from 16 October to 30 November and from 16 April to 31 May.

Results included in the report are for samples taken and tested in the summer and winter periods, with the exception of three samples of RON 95 petrol and five samples of diesel fuel taken in the summer-winter transition period. This was because, in the relevant Bulgarian legislation, there are no transition periods concerning seasonal specifications for manufacturers and importers.

6.3.3 Sales

Table 6.3.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) E10 (Unleaded petrol RON 95 E10)	7.0	641 086 990	480 815	57	54	19 of 19
Unleaded petrol (minimum RON ≥ 98) E10 (Unleaded petrol RON ≥ 98 E10)	7.0	51 478 854	38 609	4	4	18 of 19
Total petrol		692 565 844	519 424	61	58	
Diesel fuel B7 (Diesel fuel B7)	6.0	2 490 352 777	2 116 800	62	60	6 of 7

6.3.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

6.4 Croatia

6.4.1 Country details

Responsible organisation:	Croatian Agency for the Environment and Nature
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations and terminals

6.4.2 Fuel quality monitoring service

Sampling

The organisation responsible for the sampling and analysis is the Ministry of Environment and Energy, and for the reporting it is the Croatian Agency for the Environment and Nature. The locations at which sampling is carried out by inspection body type A, accredited by norm EN 17020, are terminals and filling stations. The samples are taken each month of the year at refuelling stations and terminals, according to the 'Fuel quality monitoring programme', which is under the responsibility of the Ministry of Environment and Energy:

- Samples of heavy fuel oil, heating oil and gas oil are taken in accordance with the fuel quality monitoring programme, which is under the responsibility of the Ministry of Environmental and Energy. The Ministry sets out the 'Fuel quality monitoring programme' a year in advance.
- Sampling from terminals is in accordance with Standard HRN EN ISO 3170.
- Sampling from petrol stations is in accordance with Standard HRN EN ISO 14275.
- Determining sulphur content is in accordance with Standard EN ISO 8754 or 14596.
- Reference method used for determining the precision of the testing method and the interpretation of test results is in accordance with Standard HRN EN ISO 4259.

Fuel quality monitoring system administration

The Croatian Agency for the Environment and Nature is responsible for the reporting of fuel quality in Croatia. Croatia is a small sized country, using statistical model C. The whole country is defined as a macro-region.

National legislation that transposed the Fuel Quality Directive

The FQD was transposed into Croatian legislation by the Regulation on the quality of petroleum-derived liquid fuels (Official Gazette No 57/2017).

Reporting periods

Seasonal periods in Croatia are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April

Samples were taken and tested regardless of the transition periods, and the results of analyses were reported as usual throughout the year.

6.4.3 Sales

Table 6.4.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) (RON = 95)	0.0	638 317 755	481 930	84	79	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) (RON = 98)	0.0	5 041 038	3 806	1	2	14 of 19
Unleaded petrol (minimum RON ≥ 98) (RON = 100)	0.0	31 328 133	23 653	3	5	19 of 19
Total petrol		674 686 925	509 389	88	86	
Diesel fuel B7 (B7)	0.0	1 925 244 945	1 626 832	83	110	7 of 7
Total diesel		1 925 244 945	1 626 832	83	110	

6.4.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.4.2 summarises the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.4.2 Unleaded petrol (minimum RON = 95) (RON = 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Aromatics	% v/v	< 35	25	37.2	3	163

6.5 Cyprus

6.5.1 Country details

Responsible organisation:	Ministry of Energy, Commerce, Industry and Tourism
Country size:	Small
Summer period:	16 April to 15 October
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.5.2 Fuel quality monitoring service

Sampling

The Ministry of Energy, Commerce, Industry and Tourism (MECIT) is responsible for sampling, analysis and reporting. Analysis of samples is performed by the MECIT mobile laboratory and the laboratory of the Cyprus Petroleum Storage Company (CPSC).

Samples of all fuel grades were taken by MECIT inspectors from refuelling stations, the depot at Larnaca, vehicles and other private installations of large consumers on a daily basis. The statistical and analytical results of the fuel quality report include samples from retail sites. The MECIT mobile laboratory carried out almost all the tests required for monitoring fuel quality at filling stations. The laboratory of the CPSC conducted a number of tests for verification purposes.

Fuel quality monitoring system administration

The MECIT Energy Service is the competent authority for monitoring the quality of fuels marketed in Cyprus. Cyprus is a small sized country, using statistical model C. Cyprus is considered a single region. The supply of petrol and diesel is carried out by three companies, and distribution and retail are carried out by six marketing companies. Cyprus has no refinery.

National legislation that transposed the Fuel Quality Directive

The provisions of the FQD that correspond to the fuel specifications have been transposed into national law by Law 148(I)/2003 as amended by Decrees (KDP) P.I.252/15 plus P.I.200/16, P.I.102/15, P.I.326/13, P.I.328/13 and P.I.6/2014.

Reporting periods

Seasonal periods in Cyprus are as follows:

- summer: from 16 April to 30 September;
- winter: from 16 October to 15 April.

The transition period from summer to winter and vice versa is set at 6 weeks. Samples are taken and tested during these transition periods. Changes in vapour pressure within the transition periods are monitored (if the results are gradually complied with the seasonal specifications) and reported within the annual fuel quality report.

6.5.3 Sales

Table 6.5.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) (Unleaded gasoline-petrol RON 95)	0.0	448 786 400	329 990	179	145	18 of 19
Unleaded petrol (minimum RON ≥ 98) (Unleaded gasoline-petrol RON 95)	0.0	28 434 880	20 908	152	123	18 of 19
Total petrol		477 221 280	350 898	331	268	
Diesel fuel B7 (Eurodiesel)	0.1	373 407 600	311 173	175	154	7 of 7
Total diesel		373 407 600	311 173	175	154	

6.5.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.5.2 and Table 6.5.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.5.2 Unleaded petrol (minimum 95 ≤ RON < 98) (Unleaded petrol RON 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	55	75.9	16	179

Table 6.5.3 Unleaded petrol (minimum RON ≥ 98) (Unleaded petrol RON 98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	49	74.1	20	144

6.6 Czechia

6.6.1 Country details

Responsible organisation:	Ministry of Industry and Trade
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.6.2 Fuel quality monitoring service

Sampling

The fuel quality monitoring system is coordinated by the Ministry of Industry and Trade (MIT) for the whole country. The Czech Trade Inspection Authority (CTIA), which acts under the jurisdiction of the MIT, performed the sampling in cooperation with the accredited inspection and certification authority, and these were then tested in the laboratory. Fuel samples were tested monthly throughout 2017. The controlling process of

all fuel samples was carried out in accordance with European Standards EN 228 and EN 590, and also the amendments of the Czech Standards ČSN EN 228:2013 and ČSN EN 590:2014.

Fuel quality monitoring system administration

Fuel sampling was performed in accordance with the requirements of national and European legislation and general FQMS standards. The FQMS is used as a controlling system in accordance with the Czech Standard ČSN EN 14274:2013 and Czech versions of European Standards EN 228:2012 and EN 590:2013 for petrol and diesel, namely ČSN EN 228:2013 and ČSN EN 590:2014. If the CTIA controller finds non-compliance in the fuel quality at a service station, the sale of fuels is banned until the quality has been rectified; there is also the possibility of financial sanctions, in accordance with Act No 311/2006 Coll. for fuels and petrol stations. The national legislation is transposed by the rules and obligations of the FQD. The CTIA is a government institution that comes under the jurisdiction of the MIT. The annual data collected during the previous year's fuel quality monitoring are provided by the CTIA in the form of an annual report to the coordinating office, the MIT's Department of Gas Industry and Liquid Fuels. This department is responsible for the relevant working agenda and for reporting to the European Commission. The FQMS has been carried out under the management of the Department of Gas Industry and Liquid Fuels since 2001. Since the Czech Republic's accession to the EU in May 2004, the national FQMS has been adapted to the conditions of the EU system and is compatible with it. In addition, it has been developed in accordance with the current requirements of the FQMS.

Currently, there are two refineries and around 31 distribution terminals in the Czech Republic. The figures on annual fuel analysis were provided by the MIT's Department of Data Support and Analyses Unit, in cooperation with the Czech Statistical Office.

National legislation that transposed the Fuel Quality Directive

The FQD is transposed by national legislation in accordance with Air Protection Act No 201/2012 Coll. and national energy legislation. Fuel quality has been monitored by Decree No 133/2010 Coll. on requirements for fuels, monitoring of fuel composition and fuel quality and their records as amended, combined with Act No 311/2006 Coll. for fuels and petrol stations, as amended, in accordance with Trade Licensing Act No 455/1991 Coll., as amended and Act No 353/2003 Coll. on Excise Duties as amended.

Reporting periods

Seasonal periods in Czechia are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

The results of sampling in the transition periods have been included for two seasons, spring and autumn.

6.6.3 Sales

Table 6.6.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Regular unleaded petrol (minimum RON = 91) E5	4.3	13 000	10	8	8	19 of 19
Unleaded petrol (minimum RON = 95) E5	5.3	2 055 579 000	1 543 329	391	541	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5	4.9	71 500 000	53 754	35	48	19 of 19
Total petrol		2 127 092 000	1 597 093	434	597	
Diesel fuel B7	5.6	5 847 164 000	4 897 000	589	694	7 of 7
Total diesel		5 847 164 000	4 897 000	589	694	

6.6.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.6.2, Table 6.6.3 and Table 6.6.4 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.6.5 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.6.2 Regular unleaded petrol (minimum RON = 91) E5

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	58.9	74.3	4	8

Table 6.6.3 Unleaded petrol (minimum RON = 95) E5

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95	85.1	97.2	1	932
Motor octane number	-	> 85	75.2	85.5	1	932
Vapour pressure, DVPE		< 60	53.6	81.4	3	391
Distillation point at 100 °C	% v/v	> 46	33.5	69.5	1	932
Distillation point at 150 °C	% v/v	> 75	56.5	92.2	1	932

Table 6.6.4 Unleaded petrol (minimum RON ≥ 98) E5

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	55.2	65.2	1	35

Table 6.6.5 Diesel fuel B7 (*Motorová nafta*)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	3.1	26.1	1	1 283

6.7 Denmark

6.7.1 Country details

Responsible organisation:	Danish Environmental Protection Agency
Country size:	Small
Summer period:	1 June to 31 August
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.7.2 Fuel quality monitoring service

Sampling

Sampling and analysis is carried out by an accredited laboratory for the Danish Petroleum Association (EOF). The results are sent to the Danish Environmental Protection Agency (EPA). The laboratory where the tests are carried out is accredited according to EN 14274 and EN 14275 standards.

Samples were taken from service stations. Sampling is carried out three times a year: spring, summer and autumn. About 50 % of the samples are taken east of, and 50 % west of, the Great Belt. The populations east and west of the Great Belt are approximately equal. The laboratory sends a proposal to sampling places for approval by the Danish EPA. The Danish EPA makes sure that sampling takes place at all petrol companies and all over the country.

Fuel quality monitoring system administration

Sampling and analysis is carried out by an accredited laboratory of the EOF. Results are sent to the Danish EPA. The Danish EPA is responsible for reporting fuel quality in accordance with the FQD. Denmark is a small sized country, using statistical model C. Denmark is considered one region.

- More than 99 % of the fuels used for road transport in Denmark are distributed from two Danish refineries or from terminals owned by members of the EOF, and these should meet the EOF specifications. These specifications are in accordance with DS/EN 228 for petrol and DS/EN 590 for diesel and the current Danish Statutory Order regarding the quality of petrol and diesel fuel.
- More than 99 % of the fuels used for road transport in Denmark are delivered from terminals that are certified in accordance with ISO 9000 or equivalent quality management systems.
- More than 99 % of the fuels used for road transport in Denmark are distributed from terminals where 'Certificates of Quality' exist for every import/batch approved according to DS/EN 228 for petrol or DS/EN 590 for diesel and the current Danish Statutory Order regarding the quality of petrol and diesel.

National legislation that transposed the Fuel Quality Directive

Part of the Directive is implemented in Danish Statutory Order No 1024 of 23 August 2017.

Reporting periods

Seasonal periods in Denmark are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 May.

Denmark has been granted a Vapour Pressure Waiver because of the arctic weather conditions. Samples taken during the transitional periods (spring and autumn) cover the winter period.

6.7.3 Sales

Table 6.7.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Regular unleaded petrol (minimum RON = 91) E5 (*Oktan* 92 unleaded)	5.0	177 924 000	133 443	52	50	19 of 19
Unleaded petrol (minimum RON = 95) E5 (*Oktan* 95 unleaded)	5.0	1 622 087 000	1 216 565	53	50	19 of 19
Unleaded petrol (minimum RON ≥ 98 E5 (*Oktan* 99 unleaded)	5.0	0	0	1	1	19 of 19
Total petrol		1 800 011 000	1 350 008	106	101	
Diesel fuel B7 (*Miljødiesel* (< 0.01 % sulphur))	7.0	3 329 572 000	2 796 840	50	50	6 of 7
Total diesel		3 329 572 000	2 796 840	50	50	

6.7.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.7.2 and Table 6.7.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.7.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.7.2 Regular unleaded petrol (minimum RON = 91) E5 (*Oktan* 92 unleaded)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95	92.9	95.7	3	10
Motor octane number	-	> 85	83.7	85.9	1	10
Vapour pressure, DVPE	kPa	< 60	66.9	83	14	52

Table 6.7.3 Unleaded petrol (minimum RON = 95) E5 (*Oktan* 95 unleaded)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	63.7	78.5	6	53
Aromatics	% v/v	< 35	29.9	36.7	2	103

Table 6.7.4 Diesel fuel B7 (*Miljødiesel* (sulphur < 0.01 %))

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Density at 15 °C	kg/m^3	< 845	831.1	845.5	2	100

6.7.5 Article 7a reporting

Table 6.7.5 Total quantities of fossil fuels and biofuels, and percentage of reported place of purchase and country of origin

	Total quantity (PJ)	Reported place of purchase (%)	Reported country of origin (%)
Fossil fuels			
Petrol	54 929	0	0
Diesel	109 327	0	0
Liquid petroleum gas			
Compressed natural gas	146	0	0
Gas oil	20 551	0	0
Liquefied natural gas			
Other	0.08	0	0
Biofuels			
Biodiesel	6 634	0	100
Bioethanol	1 822	0	100
Hydrotreated vegetable oil	573	0	100
Ethyl tert-butyl ether			
Other	121	0	100

Table 6.7.6 Summary table

Net summary excluding upstream emission reductions				
Quantity of energy (PJ)	Average estimated ILUC emissions per total energy (gCO_2e/MJ)		Average fuel GHG intensity (gCO_2e/MJ)	
194	1.9		92	
Net summary including upstream emission reductions				
Net GHG intensity excluding ILUC (gCO_2e/MJ)	Net GHG intensity excluding ILUC reduction on 2010 average		Total GHG intensity including ILUC (gCO_2e/MJ)	
92	2.2 %		93.9	
Indirect land use change reporting				
Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	1 081	770	6 387	951
Default ILUC intensity (gCO_2e/MJ)	12	13	55	0

Notes: ILUC, indirect land use change; GHG, greenhouse gas.

6.8 Estonia

6.8.1 Country details

Responsible organisation:	Ministry of Environment
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.8.2 Fuel quality monitoring service

Sampling

Sampling is undertaken in accordance with Standard EN 14275 by the Estonian Environmental Research Centre, which is also responsible for analysis and reporting of results. Samples are taken only from retail fuel stations. Sampling points are selected so that most of the refuelling stations are covered within a period of 2 years. Sampling is undertaken so that summer/winter period samples are evenly distributed throughout a particular period.

Fuel quality monitoring system administration

The Estonian Ministry of Environment is responsible for managing and implementing the FQD. Fuel sampling and analysis is contracted privately to the Estonian Environmental Research Centre. When non-compliant samples occur, the public bodies responsible for taking action are the Estonian Environmental Inspectorate and the Estonian Tax and Customs Board. If necessary, new samples are taken. Estonia is a small sized country, using statistical model C. The whole country is defined as one macro-region.

National legislation that transposed the Fuel Quality Directive

Elements of the FQD requirements are described in Ministry of the Environment Regulation No 73 of 20 December 2016.

Reporting periods

Seasonal periods in Estonia are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 December to 28/29 February.

Estonia has been granted a Vapour Pressure Waiver because of arctic weather conditions. Transition periods are from 1 October to 30 November and from 1 March to 30 April. No samples were taken during the transition periods.

6.8.3 Sales

Table 6.8.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Regular unleaded petrol (minimum RON = 91) E5	0.0	333 354	248	127	75	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (RON 95)	0.5	340 731 572	253 845	73	45	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (RON 98)	0.4	30 564 657	22 771	0	0	30 of 19
Total petrol		371 629 583	276 864	200	120	
Diesel fuel B7 (D)	0.0	756 364 227	630 051	90	60	6 of 7
Total diesel		756 364 227	630 051	90	60	

6.8.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.8.2 summarises the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.8.3 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.8.2 Unleaded petrol (minimum RON = 98) E5 (RON 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	62.1	90.2	3	202

Table 6.8.3 Diesel fuel B7 (D)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	0	15.6	2	150
Distillation 95 % point	°C	< 360	0	372.6	2	150

6.9 Finland

6.9.1 Country details

Responsible organisation:	Finnish Customs Laboratory
Country size:	Small
Summer period:	1 June to 31 August
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations

6.9.2 Fuel quality monitoring service

Sampling

The Finnish Ministry of the Environment is responsible for the transposition of the FQD into national legislation, approving plans and giving general guidance. Finnish Customs is responsible for practical implementation and fuel quality monitoring. In the case of non-compliant samples, the analysis will be repeated as soon as possible. If non-compliance is confirmed, customs contact the fuel supplier/oil company to obtain a detailed account. If a clear reason for non-compliance cannot be determined, if there is no sign of intention to commit an offence, and if the case is not considered to be relevant, a written procedure is often considered appropriate and sufficient. When non-compliant samples are repeatedly found, remarks or formal complaints may also be made. According to paragraph 175 (Rectification of a violation or negligence) of the Environmental Protection Act 527/2014 (previously 86/2000), a supervisory authority may prohibit a party from continuing or repeating a procedure violating existing regulations, or order a party to fulfil its duty in some other way. The Ministry of the Environment is informed about actions taken. If there is a risk that non-compliant fuel might cause damage to vehicles (lead, sulphur), and the fuel is still on the market, the fuel supplier can be ordered to remove the product from the market. According to paragraph 183 (Decision to prohibit or require action on substances, preparations, products, equipment and machines), the Ministry of the Environment may prohibit a manufacturer, importer or other market supplier from continuing operations that contravene existing regulations by:

- prohibiting the trading, sale or other supply of products that are in violation of existing regulations;
- requiring the offender to bring the product into compliance with the regulations or otherwise meet its obligations.

If a product has been placed on the market, the Ministry may require the party acting contrary to the existing regulations to remove the product from the market.

Fuel quality monitoring system administration

The supervision of fuel quality is based on Environmental Protection Act 527/2014, the Government Decrees on the quality requirements for petrol and diesel fuel and an agreement between the Ministry of Environment and Finnish Customs. According to the agreement, Finnish Customs prepares a yearly sampling plan, which is to be approved by the Ministry of Environment. Finnish Customs is in charge of the practicalities of supervision. The national district organisation of Finnish Customs takes liquid fuel samples in accordance with the sampling plan, and the samples are analysed at the Customs Laboratory or by subcontractors whose competence has been confirmed.

Finland is a small sized country, using statistical model A. The country is divided into three macro-regions with similar sales volumes and variability factors.

National legislation that transposed the Fuel Quality Directive

An 'arctic' derogation was granted in 2011. The summer period is from 1 June to 31 August, during which the maximum vapour pressure is 70 kPa. For details, see Commission Decisions K(2011) 714 final and K(2011) 3772 final and the Finnish notification letter on the Fuel Quality Vapour Pressure Derogation (original notification dated 17 February 2010, supplementary information 26 June 2010 and 6 September 2010).

Reporting periods

Seasonal periods in Finland are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 May.

Finland has been granted a Vapour Pressure Waiver because of arctic weather conditions. Transition periods are from 1 October to 30 November and from 1 March to 30 April. Samples were taken during the transition period and test results were reported in the annual fuel quality report.

6.9.3 Sales

Table 6.9.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E10 (*Moottoribensiini* 95 E10)	10.0	1 294 323 000	970 742	56	59	19 of 19
Unleaded petrol (minimum RON ≥ 98) (*Moottoribensiini* 98 E5)	5.0	624 803 000	468 602	55	57	19 of 19
Total petrol		1 919 126 000	1 439 344	111	116	
Diesel fuel B7 (*Dieselöljy*)	7.0	3 067 577 000	2 592 102	59	58	6 of 7
Total diesel		3 067 577 000	2 592 102	59	58	

6.9.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.9.2 and Table 6.9.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.9.2 Unleaded petrol (minimum RON = 95) E10 (*Moottoribensiini* 95 E10)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Motor octane number	-	> 85 (3)	84.3	85.7	1	30

Table 6.9.3 Unleaded petrol (minimum RON ≥ 98) E5 (*Moottoribensiini* 98 E5)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Aromatics	% v/v	< 35	24.8	36.9	8	112

6.10 France

6.10.1 Country details

Responsible organisation:	Ministère de la Transition écologique et solidaire
Country size:	Large
Summer period:	May 1 to September 30
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations

6.10.2 Fuel quality monitoring service

Sampling

The service provider responsible for sampling and analysis, on behalf of the General Directorate of Energy and Climate (DGEC), is the company SGS FRANCE. The company SGS FRANCE is audited once a year by DGEC. The DGEC is responsible for the reporting based on the elements transmitted by the provider. The inspections are done throughout the national territory and concern petrol and diesel. Control points are the service stations.

The service stations are selected at random. Each refuelling station control campaign is spread over a calendar year and is organised in quarterly programmes, except for the French overseas territories (DOM) where the sampling is done once a year because of the absence of seasonality. Samples are taken throughout the year.

Fuel quality monitoring system administration

The organisation responsible for sampling, analysing and reporting is SGS FRANCE (on behalf of the DGEC). France is a large sized country, using statistical model A. Eight macro-regions are defined, including the French overseas territories.

National legislation that transposed the Fuel Quality Directive

The fuel quality requirements, as laid down in the amended Fuel Quality Directive 2009/30/EC, have been transposed into ministerial decrees relating to the fuel characteristics (one decree for each fuel) and decisions laying down the methods of determining the fuel efficiency tests related to these characteristics. Ministerial Orders and Decisions are amended as necessary with each development of Directive 98/70/EC.

Reporting periods

Seasonal periods in France are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April

For petrol, the transition periods are from 16 March to 30 April and from 1 to 31 October. Regarding diesel, there is no transition period.

6.10.3 Sales

6.10.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.10.2 and Table 6.10.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.10.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.10.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) (SP95 + SP98)	5.0	6 201 095 000	4 681 827	121	100	19 of 19
Unleaded petrol (minimum RON = 95) E10 (SP95-E10)	10.0	3 938 395 000	2 973 488	100	100	19 of 19
Unleaded petrol (minimum RON = 95) E+ (E85)	85.0	117 931 000	92 246	2	2	19 of 19
Total petrol		10 257 421 000	7 747 561	218	203	
Diesel fuel B7 (*Gazole*)	8.0	41 053 523 000	34 690 227	120	100	7 of 7
Total diesel		41 053 523 000	34 690 227	120	100	

Table 6.10.2 Unleaded petrol (minimum RON = 95) E5 (SP95 + SP98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	50.9	88.8	3	221
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% m/m	< 2.7	0	8.42	2	221
Ethanol	% v/v	< 5	0	16.5	1	221

Table 6.10.3 Unleaded petrol (minimum RON = 95) E10 (SP95-E10)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure	kPa	< 60	48.1	89.9	5	200
Distillation point at 100 °C	% v/v	> 46	39	65	2	200
Aromatics	% v/v	< 35	21.4	36.4	1	200
Oxygen content	% (m/m)	< 3.7	2.66	3.97	1	200

Table 6.10.4 Diesel fuel B7 (*Gazole*)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	0.1	22	1	220
Fatty acid methyl ester content	% v/v	< 7 (4)	3.6	9.9	8	220

6.11 Germany

6.11.1 Country details

Responsible organisation:	Federal Environment Agency (UBA)
Country size:	Large
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model B
Location of sampling:	Refuelling stations

6.11.2 Fuel quality monitoring service

Sampling

The organisations responsible for the sampling, analysis and reporting at regional level are the 16 governments of the federal states (*Bundesländer*) or their federal state agencies. The results of the regional sampling are forwarded to the Umweltbundesamt (Federal Environment Agency — UBA), where data are collected and subsequently consolidated into a report.

Selection of the sampling points is the responsibility of each of the 16 governments of the federal states, and it differs from state to state. The quality of petrol and diesel fuels is tested by the competent authorities of the federal states. The method for selecting fuel stations may be rotation, random selection or another way, taking into account population distribution and regional aspects. The sampling was carried out only at refuelling stations.

Fuel quality monitoring system administration

The competent authorities of the federal states monitor the quality of petrol and diesel fuels and are responsible for fuel quality monitoring in general. These authorities include district administrations, lower administrative authorities, districts, non-district municipalities and independent towns.

Germany is a large sized country regarding fuel sales, using statistical model B. Germany is divided into 16 regions, which do not comply with fuel distribution patterns. The proportions sampled for the various regions and the resulting number of samples is stipulated in the General Administrative Regulation on the Tenth Federal Emission Control Act (10th BImSchV), Annex 20. The regions have to convey their results to the Federal Environment Agency by 30 April of the following year, and it produces a general report. The Federal Environment Agency passes this report on to the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, and to the European Commission.

The governments of the German federal states and/or the lower ranking government agencies are responsible for taking action in the case of non-compliant samples. The design of the system was defined in DIN EN 14274-2003. It was adopted into legislation by the 10th BImSchV in 2008.

National legislation that transposed the Fuel Quality Directive

The elements of the Directive are transposed into the German Tenth Ordinance Implementing the Federal Emission Control Act (10th BImSchV).

Reporting periods

Transition periods are from 1 October to 15 November and from 28 February/1 March to 14 April.

Seasonal periods in Germany are as follows:

- summer: petrol from 1 May to 30 September; diesel from 15 April to 30 September;
- winter: petrol from 16 November to 15 March; diesel from 16 November to 28/29 February.

For petrol, the transition period is from 1 October to 15 November and from 16 March to 30 April. For diesel, the transition period is from 1 October to 15 November and from 1 March to 14 April.

Samples may be taken during the whole year, preferably in the summer or winter period. For diesel fuel only, a small number of samples were taken during the transition period in March but, since the cold filter plugging point (CPFF) is not reported, none of the parameters reported should be influenced. For petrol, the sample has been subsumed to the reporting period, for which the fuel has been laid out according to the measured parameters.

6.11.3 Sales

Table 6.11.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (Super)	5.0	19 899 242 384	15 023 928	204	193	19 of 19
Unleaded petrol (minimum RON = 95) E10 (Super E10)	10.0	3 234 181 457	2 441 807	202	188	19 of 19
Unleaded petrol (minimum RON ≤ 98) E5 (Super Plus)	5.0	1 099 720 530	830 289	32	28	19 of 19
Total petrol		24 233 144 371	18 237 654	438	409	
Diesel fuel B7 (*Dieselkraftstoff*)	7.0	45 801 833 136	38 702 549	216	193	6 of 7
Total diesel		45 801 833 136	38 702 549	216	193	

6.11.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.11.2 and Table 6.11.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.11.2 Unleaded petrol (minimum RON = 95) E5 (Super)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95	93.4	97.4	1	297
Vapour pressure, DVPE	kPa	< 60	53.5	69.3	5	204
Sulphur content	mg/kg	< 10	0.9	11.8	1	392
Ethanol	% v/v	< 10	0.4	9.7	2	404

Table 6.11.3 Unleaded petrol (minimum RON = 95) E10 (Super E10)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Motor octane number	-	> 85	84.1	96.4	1	390
Vapour pressure, DVPE	kPa	< 60	50	68	5	202
Sulphur content	mg/kg	< 10	1	14.9	1	374

6.11.5 Article 7a reporting

Table 6.11.4 Total quantities of fossil fuels and biofuels, and percentage of reported place of purchase and country of origin

	Total quantity (PJ)	Reported place of purchase (%)	Reported country of origin (%)
Fossil fuels			
Petrol	736 999	0	0
Diesel	1 568 926	0	0
Liquid petroleum gas	22 221	0	0
Compressed natural gas	6 654	0	0
Gas oil			
Liquefied natural gas			
Other			
Biofuels			
Biodiesel	79 955	0	0
Bioethanol	29 991	0	0
Hydrotreated vegetable oil	1 442	0	0
Ethyl tert-butyl ether	1 615	0	0
Other			

Table 6.11.5 Summary table

Net summary excluding upstream emission reductions				
Quantity of energy (PJ)	Average estimated ILUC emissions per total energy (gCO_2e/MJ)		Average fuel GHG intensity (gCO_2e/MJ)	
2 448	1.3		90.6	
Net summary including upstream emission reductions				
Net GHG intensity excluding ILUC (gCO_2e/MJ)	Net GHG intensity excluding ILUC reduction on 2010 average		Total GHG intensity including ILUC (gCO_2e/MJ)	
90.6	3.7 %		91.9	
Indirect land use change reporting				
Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	27 999	1 946	49 835	33 249
Default ILUC intensity (gCO_2e/MJ)	12	13	55	0

Notes: ILUC, indirect land use change; GHG, greenhouse gas.

6.12 Greece

6.12.1 Country details

Responsible organisation:	General Chemical State Laboratory, Directorate of Energy, Industrial and Chemical Products
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 Statistical Model A
Location of sampling:	Refuelling stations

6.12.2 Fuel quality monitoring service

Sampling

For Region A, the competent body for taking fuel samples is the Fuel Distribution and Storage Inspectorate of the Ministry of the Environment and Energy. For Regions B and C, the competent bodies for taking fuel samples are the inspection teams from the Chemical Services of the General Chemical State Laboratory, working in collaboration with the regional customs authorities. Refuelling stations are used as sampling locations. Sampling locations are chosen at random.

Based on the sales percentage of various grades of fuels in each region, the Directorate of Energy, Industrial and Chemical Products sets the minimum number of fuel samples to be taken from refuelling stations in the area. The Directorate of Energy, Industrial and Chemical Products has the option to issue a decision requiring that samples taken in each period include fuel samples from each refinery. Care is taken to ensure that samples are taken in a uniform manner across the entire year.

The competent authorities for sampling send the samples to the central fuel inspection laboratories of the General Chemical State Laboratory, which are ISO 17025 accredited. The samples received from Regions A and C are examined by the Chemical Service of Piraeus and the Aegean, while the samples from Region B are examined by the Macedonia-Thrace Chemical Service. The laboratories monitor compliance with the requirements of Decision No 316/2010 and Decision No 77/2016, relating to petrol and diesel fuels, based on analytical methods set out in ELOT EN 228 and ELOT EN 590. The central fuel inspection laboratories send the test results to the competent authorities, for sampling, and to the Directorate of Energy, Industrial and Chemical Products. Where the fuel samples do not meet the specifications, the relevant sanctions shall be imposed by the competent authorities. The Directorate of Energy, Industrial and Chemical Products uses the results in the sample testing reports for statistical purposes, to prepare and submit the annual fuel quality report to the European Commission.

Fuel quality monitoring system administration

Greece is classified as a small country, with regard to fuel sales levels. Statistical model A applies to Greece. Three macro-regions are defined.

The competent authority for the system that monitors fuel quality is the Directorate of Energy, Industrial and Chemical Products of the General Chemical State Laboratory. The system was designed using statistical model A, taking into account fuel sales. Fuel sampling is carried out by public authorities. If non-compliant samples are discovered, the sampling authority is responsible for taking action. Failure to comply with the provisions of the legislation results in the sanctions specified in Article 10 of State Supreme Chemical Council Decision No 316/2010, as amended by State Supreme Chemical Council Decision No 77/2016. In Greece, there are four refineries and approximately 7 000 refuelling stations.

National legislation that transposed the Fuel Quality Directive

Directive 2009/30 (with the exception of Articles 7(a) to 7(e) of Directive 98/70/EC, as amended by Article 1 of Directive 2009/30/EC) was transposed into Greek law with State Supreme Chemical Council Decision No 316/2010 (Government Gazette 501/B/2012), as amended by State Supreme Chemical Council Decision No 77/2016 (Government Gazette 4217/B/2016).

Reporting periods

Seasonal periods in Greece are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

The monitoring system is implemented twice a year: once for the summer period and once for the winter period.

6.12.3 Sales

Table 6.12.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) (95 RON)	0.0	2 969 591 450	2 219 770	50	50	13 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) (LRP (96 RON))	0.0	910 038	680	5	5	13 of 19
Unleaded petrol (minimum RON ≥ 98) (Super unleaded (100 RON))	0.0	167 777 317	125 414	3	4	13 of 19
Total petrol		3 138 278 805	2 345 863	58	59	
Diesel fuel B7	7.0	3 066 728 378	2 553 051	50	50	4 of 7
Total diesel		3 066 728 378	2 553 051	50	50	

6.12.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.12.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.12.2 Diesel fuel B7

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	3.2	11.3	1	100
Fatty acid methyl ester content	% v/v	< 7 (4)	5.2	7.8	7	100

6.13 Hungary

6.13.1 Country details

Responsible organisation:	ÁMEI Zrt.
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.13.2 Fuel quality monitoring service

Sampling

The organisation responsible for sampling, analysis and reporting is ÁMEI Petroleum Products Quality Inspection Company, which has a contract with the Ministry of National Development (NFM). Fuel samples were taken from retail stations that had been randomly selected from the list of refuelling stations drawn up by the National Tax and Customs Administration (NAV). Hungary's system is equivalent to the system proposed by the European Committee for Standardisation (CEN). In evaluating the system, Hungary determines all parameters requested by the Directive.

Fuel quality monitoring system administration

The NFM is responsible for managing and implementing the FQD. Sampling, analysis and reporting are contracted to ÁMEI Zrt. The annual data set is provided by 31 March for the previous year. Test results, including non-compliance samples, are reported quarterly to the NFM.

Hungary is a small sized country, using statistical model C for design and implementation of monitoring. The whole country is defined as one macro-region.

Hungary has one oil refinery and several distribution terminals. Since importation via road transport to retail stations is considerable, fuels at retail stations were also sampled.

National legislation that transposed the Fuel Quality Directive

Based on the Directive, National Decree of 30/2011 NFM (valid from 28 June 2011) is in place.

Reporting periods

Seasonal periods in Hungary are as follows:

- summer: from 1 May to 30 September;
- winter: from 15 November to 28/29 February.

Transition periods are from 1 March to 30 April and from 1 October to 14 November. No samples were taken during the transition periods.

6.13.3 Sales

Table 6.13.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (ESZ-95)	5.0	1 789 000 000	1 330 000	50	50	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (ESZ-98)	5.0	67 000 000	50 000	10	10	19 of 19
Total petrol		1 856 000 000	1 380 000	60	60	
Diesel fuel B7 (*Dízelgázolaj*)	7.0	4 076 000 000	3 411 000	60	60	6 of 7
Total diesel		4 076 000 000	3 411 000	60	60	

6.13.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.13.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.13.2 Diesel fuel B7 (*Dízelgázolaj*)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Cetane number	-	-	48.4	56.8	1	120

6.14 Iceland

6.14.1 Country details

Responsible organisation:	Environment Agency of Iceland
Country size:	Small
Summer period:	1 June to 31 August
FQMS used:	National system
Location of sampling:	Terminals

6.14.2 Fuel quality monitoring service

Sampling

Fjölver surveyor and fuel inspection oversees the testing of each fuel batch delivery in Iceland.

Fuel quality monitoring system administration

In Iceland, each fuel batch delivery is controlled by Fjölver surveyor and fuel inspection. The test results of the fuel products are directly compared with the agreed product requirements and are accepted if the results are within given specifications. The data for delivered fuel batches are reported to the competent authority, the Environment Agency of Iceland. Iceland is a small sized country, applying a national system. The whole country is defined as one region.

National legislation that transposed the Fuel Quality Directive

The requirements of the FQD are transposed into Icelandic Regulation No 960/2016 and National Law on Chemicals No 61/2013.

Reporting periods

Seasonal periods in Iceland are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 May.

Samples were taken and tested during the transition period. The results of samples taken during the transition period are reported.

6.14.3 Sales

Table 6.14.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Unleaded petrol (RON > 95))	0.5	184 776 126	134 931	26	35	18 of 19
Total petrol		184 776 126	134 931	26	35	
Diesel fuel B7 (*Diesel fuel*)	0.0	261 011 584	219 241	11	23	4 of 7
Total diesel		261 011 584	219 241	11	23	

6.14.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.14.2 summarises the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.14.2 Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Unleaded petrol (RON > 95))

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	93.5	95.5	19	61

6.15 Ireland

6.15.1 Country details

Responsible organisation:	Department of Communications, Climate Action and Environment
Country size:	Small
Summer period:	1 June to 31 August
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.15.2 Fuel quality monitoring service

Sampling

Samples of petrol and diesel are taken by the Irish Petroleum Industry Association and are analysed by ITS Testing Services (UK) Ltd. Reporting is the responsibility of the Department of Communications, Climate Action and Environment. Samples are taken from refuelling stations. Selection of sampling points is on a random basis and is carried out throughout the year.

Fuel quality monitoring system administration

The Department of Communications, Climate Action and Environment has responsibility for managing and implementing the FQD. Samples of petrol and diesel are taken by the Irish Petroleum Industry Association and are analysed by ITS Testing Services (UK) Ltd. Annual data are provided by the Irish Petroleum Industry for the winter period in January of each year and for the summer period in September of each year. When non-compliant samples are discovered, it is the responsibility of the Department of Communications, Climate Action and Environment to report, manage and monitor the non-compliance. All non-compliances are reported in the annual fuel quality report and follow-up action is also reported. Ireland is a small country, using statistical model C. Whitegate Oil Refinery in County Cork is Ireland's only refinery. There are five distribution terminals in Ireland.

National legislation that transposed the Fuel Quality Directive

European Communities Act 1972 (Environmental Specifications for Petrol, Diesel Fuels and Gas Oils for use by non-road mobile machinery, including waterway vessels, agricultural and forestry tractors, and recreational craft) Regulations 2011 (SI No 155 of 2011).

Reporting periods

Seasonal periods in Ireland are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 May.

A Vapour Pressure Waiver has been granted because of arctic weather conditions.

6.15.3 Sales

Table 6.15.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5	3.0	1 487 856 586	1 102 116	47	47	11 of 19
Total petrol		1 487 856 586	1 102 116	47	47	
Diesel fuel B7	4.0	3 503 256 465	2 961 333	47	47	6 of 7
Total diesel		3 503 256 465	2 961 333	47	47	

6.15.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.15.2 summarises the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.15.3 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.15.2 Unleaded petrol (minimum RON = 95) E5

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	93.9	96.6	15	94
Vapour pressure, DVPE	kPa	< 60	67.8	71.8	4	47
Aromatics	% v/v	< 35	20.9	38.9	1	94

Table 6.15.3 Diesel fuel B7

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Fatty acid methyl ester content	% v/v	< 7 (4)	0.09	8.2	1	94

6.16 Italy

6.16.1 Country details

Responsible organisation:	Ministry of Environment Land and Sea
Country size:	Large
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations

6.16.2 Fuel quality monitoring service

Sampling

A total of 200 petrol samples and 200 diesel fuel samples were analysed. The distribution of samples throughout Italy was 29 % north-west, 14 % north-east, 27 % centre, 18 % south and 12 % islands. The testing required for fuel quality monitoring was performed by laboratories that regularly participate in one or more national inter-laboratory proficiency testing schemes and that are accredited in accordance with EN ISO 17025 or certified in accordance with ISO 9000 standards. The proficiency testing schemes include all test methods listed in the FQMS. In accordance with the requirements of EN 14274, analytical results for petrol and diesel fuel were reported separately for each season and for each grade. Selection of sampling points is on a random basis; in 2017 the sampling was carried out only at refuelling stations. Samples of petrol and diesel are taken by independent supervisory bodies.

Fuel quality monitoring system administration

The competent authority for the system of monitoring fuel quality is the Ministry of the Environment and Protection of Land and Sea. Italy is a large sized country regarding fuel sales, using statistical model A. Five macro-regions are defined, and samples are divided with respect to the population and number of filling stations.

The fuel quality monitoring (sampling and measurements) is carried out by independent supervisory bodies on behalf of the main oil companies. The supervisory bodies forward their results to the Italian National Institute for Environmental Protection and Research, which produces a general report. On the basis of this report, the Ministry of the Environment and Protection of Land and Sea produces data for the European Commission.

National legislation that transposed the Fuel Quality Directive

The Fuel Quality Directive 98/70/EC was transposed by Legislative Decree of 21 March 2005, n. 66 into national legislation. Decree of 21 March 2017 n. 51 transposed into national legislation EU Directive 2015/652, which establishes calculation methods and reporting obligations pursuant to Directive 98/70, relating to the quality of petrol and diesel, and Directive 2015/1513, amending Directive 98/70.

Reporting periods

Seasonal periods in Italy are as follows:

- summer: petrol from 1 May to 30 September; diesel from 16 March to 14 November;
- winter: petrol from 16 November to 15 March; diesel from 15 November to 15 March.

No samples were taken during the transition period.

6.16.3 Sales

Table 6.16.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) (Unleaded petrol)	0.0	8 079 799 550	6 084 074	100	100	19 of 19
Total petrol		8 079 799 550	6 084 074	100	100	
Diesel fuel B7 (Diesel fuel (< 10 ppm sulphur))	0.0	30 149 035 550	25 102 087	100	100	6 of 7
Total diesel		30 149 035 550	25 102 087	100	100	

6.16.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.16.2 summarises the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.16.3 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.16.2 Unleaded petrol (minimum RON = 95) (Unleaded petrol)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	94.4	100.5	1	180
Vapour pressure, DVPE	kPa	< 60	0	62.3	4	56
Sulphur content	mg/kg	< 10	0.3	16.2	1	182

Table 6.16.3 Diesel fuel B7 (Diesel fuel (< 10 ppm sulphur))

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	3.3	11.9	1	194
Fatty acid methyl ester content	% v/v	< 7 (4)	0	7.4	1	200

6.17 Latvia

6.17.1 Country details

Responsible organisation:	Ministry of Economics of the Republic of Latvia
Country size:	Small
Summer period:	1 June to 31 August
FQMS used:	National system
Location of sampling:	Refuelling stations and terminals

6.17.2 Fuel quality monitoring service

Sampling

The organisations responsible for sampling, analysis and reporting are the Ministry of Economics of the Republic of Latvia and the State Revenue Service. Samples have been taken from refuelling stations and terminals. The samples have been collected throughout the year.

Fuel quality monitoring system administration

The Ministry of Economics of the Republic of Latvia is responsible for managing and implementing the FQD. The State Revenue Service is responsible for supervision of the fuel market in accordance with the 'Requirements for Conformity Assessment of Petrol and Diesel Fuel of Cabinet Regulation No 332. The State Revenue Service each year must submit FQM report to the Ministry of Economics by 1 June. There are no oil refineries in Latvia and the fuel is imported. In 2017, there were 67 valid licences for operations with petroleum products in tax warehouses, and two valid licences for registered consignees of petroleum products. Latvia is small sized country, using a national system to monitor fuel quality.

National legislation that transposed the Fuel Quality Directive

Cabinet Regulation No 332, 'Requirements for Conformity Assessment of Petrol and Diesel Fuel', determines the technical specifications on health and environmental grounds for fuels placed on the Latvian market for use with positive ignition and compression-ignition engines of motor vehicles, non-road mobile machinery (including inland waterway vessels when not at sea), agricultural and forestry tractors, and recreational craft when not at sea, taking account of the technical requirements of those engines.

Cabinet Regulation No 772, 'Regulations regarding Requirements for Biofuel Quality, Conformity Assessment, Market Supervision and Procedures for Consumer Information', prescribes the quality requirements for biofuel, the procedures by which the conformity assessment of biofuel and the transfer thereof for processing shall be carried out, the procedures by which the production of biofuel and blending thereof with fossil fuel shall be controlled, the procedures by which biofuel not conforming to quality requirements shall be destroyed and the procedures by which consumers shall be informed regarding the content of biofuel present at sale points and the conformity thereof with quality requirements.

Cabinet Regulation No 545, 'Regulation regarding the Sustainability Criteria for Biofuels and Bioliquids, the Mechanism for introducing thereof, and the Procedure by which they shall be supervised and monitored', prescribes the sustainability criteria for biofuels and bioliquids, the mechanism for introducing them and the procedure by which they shall be supervised and monitored.

Reporting periods

Seasonal periods in Latvia are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 May.

A Vapour Pressure Waiver has been granted. There are no transition periods between summer- and winter-grade fuels and the samples have been taken in every month throughout the year.

6.17.3 Sales

Table 6.17.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (A-95)	5.0	223 172 549	170 727	4	22	13 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (A-98)	0.0	22 287 582	17 050	1	6	13 of 19
Total petrol		245 460 131	187 777	5	28	
Diesel fuel B7 (Diesel)	5.0	1 171 670 659	978 345	9	50	6 of 7
Total diesel		1 171 670 659	978 345	9	50	

6.17.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.17.2 and Table 6.17.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

Table 6.17.2 Unleaded petrol (minimum RON = 95) E5 (A-95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	94.4	96.9	3	26

Table 6.17.3 Unleaded petrol (minimum RON ≥ 95) E5 (A-98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Aromatics	% v/v	< 35	28.7	36.7	1	7

6.17.5 Article 7a reporting

Table 6.17.4 Total quantities of fossil fuels and biofuels, and percentage of reported place of purchase and country of origin

	Total quantity (PJ)	Reported place of purchase (%)	Reported country of origin (%)
Fossil fuels			
Petrol	7 624	0	0
Diesel	42 100	0	0
Liquid petroleum gas	2 416	0	0
Compressed natural gas			
Gas oil			
Liquefied natural gas			
Other			
Biofuels			
Biodiesel	40	100	0
Bioethanol	235	100	0
Hydrotreated vegetable oil			
Ethyl tert-butyl ether			
Other			

Table 6.17.5 Summary table

Net summary excluding upstream emission reductions				
Quantity of energy (PJ)	Average estimated ILUC emissions per total energy (gCO_2e/MJ)		Average fuel GHG intensity (gCO_2e/MJ)	
52	0		93.3	
Net summary including upstream emission reductions				
Net GHG intensity excluding ILUC (gCO_2e/MJ)	Net GHG intensity excluding ILUC reduction on 2010 average		Total GHG intensity including ILUC (gCO_2e/MJ)	
93.3	0.8 %		93.3	
Indirect land use change reporting				
Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	0	0	0	0
Default ILUC intensity (gCO_2e/MJ)	12	13	55	0

Notes: ILUC, indirect land use change; GHG, greenhouse gas.

6.18 Lithuania

6.18.1 Country details

Responsible organisation:	Ministry of Energy
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Service stations

6.18.2 Fuel quality monitoring service

Sampling

The State Consumer Rights Protection Authority is responsible for sampling and analysis. The organisation responsible for reporting is the Ministry of Energy. In total, 104 samples of petrol A-95 (A-98) were taken at service stations.

Fuel quality monitoring system administration

The Ministry of Energy has responsibility for managing and implementing the FQD. Fuel sampling was carried out by the State Consumer Rights Protection Authority, which is responsible for taking action when non-compliant samples are discovered. Lithuania is a small sized country, using statistical model C. The whole country is defined as one region.

National legislation that transposed the Fuel Quality Directive

Standards EN 228 and diesel EN 590 have been transposed into national legal acts. All acts are related to researching parameters of fuel and diesel samples, and are fully transposed into Lithuanian legislation.

Reporting periods

Seasonal periods in Lithuania are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

Samples are taken during transition periods, as there are no filtering and cloud temperatures in the reports, and the indicators mentioned are also suitable for the winter period. Samples from 1 October to 30 November and from 1 March to 30 April are also covered by data from the winter period.

6.18.3 Sales

Table 6.18.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E10 (A-95 (RON 95))	5.00	290 954 995	218 798	50	50	19 of 19
Unleaded petrol (minimum RON ≥ 98) (A-98 (RON 98))	5.0	6 849 503	5 151	2	2	19 of 19
Total petrol		297 804 498	223 949	52	52	
Diesel fuel B+4 (> 7 % FAME content ≤ 30 % (Diesel)	8.0	1 984 400 163	1 676 818	50	50	7 of 7
Total diesel		1 984 400 163	1 676 818	50	50	

6.18.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.18.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.18.2 Diesel fuel B7 (Diesel)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Fatty acid methyl ester content	% v/v	< 7 (4)	0	8.3	13	100

6.19 Luxembourg

6.19.1 Country details

Responsible organisation:	Environmental Administration of Luxembourg
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	National system
Location of sampling:	Refuelling stations and terminals

6.19.2 Fuel quality monitoring service

Sampling

For 2017, the sampling, analysis and reporting of fuel quality was managed by three organisations. The samples were taken at depots and public refuelling stations. The sampling points were selected at random. Test methods are those specified in EN 228 and EN 590. The samples have to be taken in accordance with the methods described in the European standards:

- EN 14275, if taken at fuel stations;
- EN ISO 3170, if taken at terminals.

Fuel quality monitoring system administration

The FQMS is under the responsibility of the Environmental Administration, part of the Department of Environment of the Ministry of Sustainable Development and Infrastructures. Fuel sampling, analysis and reporting were each carried out by a contracted organisation. Luxembourg is a small sized country, using a national system to monitor fuel quality. In 2009, the Environmental Administration developed, in collaboration with the Austrian Federal Environment Agency, a concept to establish an FQMS for Luxembourg.

In the case of a non-compliant sample, the agreed organisation had to inform the Environmental Administration at once. After a written warning, the provider or operator had 48 hours to take the necessary measures. The provider or operator had to inform the Environmental Administration of the measures undertaken. A new sample then had to be taken within 3 working days following the written warning.

Luxembourg does not have its own refinery; therefore it is dependent on imports of petrol and diesel from other Member States, mainly from Belgium, the Netherlands and Germany.

National legislation that transposed the Fuel Quality Directive

Directive 98/70/CE amended by Directive 2009/30/CE is entirely transposed into national law by the Grand-ducal ordinance of 16 May 2012 concerning the quality of petrol and diesel fuels and the sustainable use of biofuels.

Reporting periods

Seasonal periods in Luxembourg are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

The transition periods are regulated by the Grand-ducal ordinance. During the transition period, no samples are taken or tested.

6.19.3 Sales

Table 6.19.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (Euro 95)	5.0	323 211 624	239 177	27	35	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Euro 98)	5.0	83 049 513	61 457	27	35	19 of 19
Total petrol		406 261 137	300 633	54	70	
Diesel fuel B+4 (Diesel)	7.0	1 776 739 370	1 483 577	26	36	7 of 7
Total diesel		1 776 739 370	1 483 577	26	36	

6.19.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.19.2 and Table 6.19.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.19.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.19.2 Unleaded petrol (minimum RON = 95) E5 (Euro 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Manganese	mg/l	< 2	0.25	4.1	9	62

Table 6.19.3 Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Euro 98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	54.5	66.3	1	27
Manganese	mg/l	< 2	0.25	4.7	5	62

Table 6.19.4 Diesel fuel B7

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Distillation 95 % point	°C	< 360	335.1	360.3	1	62

6.20 Malta

6.20.1 Country details

Responsible organisation:	Regulator for Energy and Water Services
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.20.2 Fuel quality monitoring service

Sampling

The organisations responsible for sampling and reporting is the Regulator for Energy and Water Services. The organisation responsible for the analysis is an independently contracted laboratory.

Fuel quality monitoring system administration

A total of 208 fuel samples, 104 diesel EN 590 and 104 unleaded petrol EN 228, were taken and analysed. Malta is a small sized country, using statistical model C. The whole country is defined as one region.

A minimum of 50 samples were taken per period (winter/summer) and per fuel grade, which exceeded the 10 % market share of the parent grade. A total of 203 samples were collected by REWS compliance officers from fuel dispensing sites and then analysed at the independently contracted laboratory.

National legislation that transposed the Fuel Quality Directive

The actions related to the reduction of the GHG intensity of fuels supplied, under Article 7a of the Fuel Quality Directive, are performed by the Malta Resources Authority. The national subsidiary legislation is S.L. 423.48, Lifecycle Greenhouse Gas Emissions from Fuels Regulations.

Reporting periods

Seasonal periods in Malta are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

Monthly fuel samples were taken throughout the whole calendar year, including the transition period.

6.20.3 Sales

Table 6.20.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) (EN 228 minimum RON 95)	0.0	101 664 256	75 307	52	50	19 of 19
Unleaded petrol (minimum RON ≥ 98) (EN 228 minimum RON 98)	0.0	3 514 681	2 603	2	4	19 of 19
Total petrol		105 178 937	77 910	54	54	
Diesel fuel B7 (EN 590)	≤ 7	137 555 947	116 081	52	54	6 of 7
Total diesel		137 555 947	116 081	52	54	

6.20.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

6.21 Netherlands

6.21.1 Country details

Responsible organisation:	Human Environment and Transport Inspectorate
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations

6.21.2 Fuel quality monitoring service

Sampling

The organisation responsible for sampling is the Human Environment and Transport Inspectorate. Fuel samples were taken by inspectors at fuel service stations. The Dutch Customs laboratory is responsible for the analysis. It was decided to take samples at fuel service stations from various oil companies. The Netherlands has 12 provinces. Samples were taken in each province based on the population and the number of fuel stations in each province. Fuel samples were collected throughout the year.

Fuel quality monitoring system administration

The Human Environment and Transport Inspectorate is responsible for the report. The petrol service stations where the limits were exceeded received a warning letter from the Dutch authorities. The Netherlands is a small sized country regarding fuel sales, using statistical model A to monitor fuel quality. The country is divided into 12 regions/provinces. In cases of limit exceedances, the refuelling stations received a warning letter from the Dutch authorities.

National legislation that transposed the Fuel Quality Directive

Decision on air pollution.

Reporting periods

Seasonal periods in the Netherlands are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

There are no transitional periods.

6.21.3 Sales

Table 6.21.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5	10.0	5 440 000 000	4 095 776	50	50	17 of 19
Unleaded petrol (minimum RON ≥ 98) E5	5.0	67 000 000	50 444	1	1	17 of 19
Total petrol		5 507 000 000	5 507 000	51	51	
Diesel fuel B7	7.0	7 724 000 000	6 457 264	50	50	6 of 7
Total diesel		7 724 000 000	6 457 264	50	50	

6.21.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.21.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.21.2 Diesel fuel B7

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Distillation 95 % point	°C	< 360		367	2	100

6.22 Poland

6.22.1 Country details

Responsible organisation:	Urząd Ochrony Konkurencji i Konsumentów
Country size:	Large
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model B
Location of sampling:	Refuelling stations

6.22.2 Fuel quality monitoring service

Sampling

The tasks related to the system administration are performed by the President of the Office of Competition and Consumer Protection, while scrutiny of fuel quality is carried out by the Trade Inspectorate. Samples taken during inspection are tested in laboratories that have accreditation certificates issued by the Polish Centre for Accreditation. Tests of fuel samples verify all or some of the parameters laid down in the legislation.

Poland has adopted an FQMS defined in EN 14274 statistical model B. In the process of developing the new system, account was taken of the specific characteristics of the Polish fuel market, and special solutions were introduced to make it possible to initiate inspections not only on the basis of statistical factors but also on the basis of any information on fuel of poor quality. Thus, the system is used to pursue yet another objective, namely to try to eliminate fuel that is not compliant with quality requirements laid down in the legislation and to prevent it from being placed on the market.

Fuel quality monitoring system administration

The tasks related to the FQMS are performed by the President of the Office of Competition and Consumer Protection (the administrator of the system). Poland is a large sized country, using statistical model B to monitor fuel quality. The country is divided into 16 macro-regions.

National legislation that transposed the Fuel Quality Directive

From 1 January 2007 onwards, the Act of 25 August 2006 on fuel quality monitoring and scrutiny constitutes the legal basis for the system's operation. The scrutiny system covers the whole fuel distribution chain — from filling stations, through wholesalers and fuel bases, to fuel producers. All types of fuel available on the market are subject to scrutiny: petrol (unleaded 95 and 98); diesel fuels; liquid biofuels; liquid petroleum gas; compressed natural gas; and light heating fuel.

Tests of fuel samples verify all or some of the parameters laid down in the legislation. The administrator of the fuel quality monitoring and control system determines the minimum number of business entities subject to inspection. However, it is also possible to initiate an inspection upon obtaining information about poor quality of fuels or circumstances indicating the possibility of poor quality of fuels (in practice, this includes complaints from drivers and information from the police and the Central Bureau of Investigation).

Reporting periods

Seasonal periods in Poland are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

There are no transition periods.

6.22.3 Sales

Table 6.22.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (RON 95)	5.0	5 198 200 000	3 950 000	202	203	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (RON 98)	5.0	518 240 000	395 000	64	63	19 of 19
Total petrol		5 716 440 000	4 345 000	266	266	
Diesel fuel B7 (ON)	< 7	18 912 070 000	15 826 000	203	204	7 of 7
Total diesel		18 912 070 000	15 826 000	203	204	

6.22.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.22.2 and Table 6.22.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.22.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.22.2 Unleaded petrol (minimum RON = 95) E5 (RON 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	93.8	98.1	2	405
Vapour pressure, DVPE	kPa	< 60	55.8	89.3	3	405
Aromatics	% v/v	< 35	20.8	40	2	357
Sulphur content	mg/kg	< 10	3	15.2	3	405

Table 6.22.3 Unleaded petrol (minimum RON ≥ 98) E5 (RON 98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Aromatics	% v/v	< 35	25.1	36.1	1	103

Table 6.22.4 Diesel fuel B7 (ON)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Distillation 95 % point	°C	< 360	336.2	384	5	406

6.22.5 Article 7a reporting

Table 6.22.5 Summary table

Net summary excluding upstream emission reductions				
Quantity of energy (PJ)	Average estimated ILUC emissions per total energy (gCO_2e/MJ)		Average fuel GHG intensity (gCO_2e/MJ)	
974.30	3.1		90.1	
Net summary including upstream emission reductions				
Net GHG intensity excluding ILUC (gCO_2e/MJ)	Net GHG intensity excluding ILUC reduction on 2010 average		Total GHG intensity including ILUC (gCO_2e/MJ)	
87.0	7.5		90.1	
Indirect land use change reporting				
Feedstock category	Cereals and other starch-rich crops	Sugars	Oil crops	Other
Quantity of energy supplied (TJ)	6 430.10	680.83	52 954.01	401.66
Default ILUC intensity (gCO_2e/MJ)	12	13	55	0

Note: ILUC, indirect land use change; GHG, greenhouse gas.

6.23 Portugal

6.23.1 Country details

Responsible organisation:	Directorate-General for Energy and Geology
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.23.2 Fuel quality monitoring service

Sampling

The bodies performing the analysis are selected through a public tender held by the National Authority for the Fuel Market (ENMC) and sampling is performed by the ENMC itself.

The ENMC collects samples in filling stations across the country and throughout the year. The selection of filling stations is undertaken by the ENMC.

The methods of analysis used are those described in Directive 98/70/EC. The method used for each parameter can be found in the 'Test methods and analyses' tables of the reporting template, where the number of exceedances and their values are reported in the row corresponding to the method of analysis used.

Fuel quality monitoring system administration

The body responsible for the FQMS is the Ministry of Economy. The Directorate-General for Energy and Geology coordinates, prepares and submits the annual reports. Analysis is performed by entities selected through public tender held by the ENMC. Portugal is a small sized country, using statistical model C. The whole country is defined as one region under this model.

The consumption or marketing of fuels that do not meet the specifications in force constitutes an infraction punishable by fine, which involves reporting to the authority responsible for prosecution. Non-compliant samples are reported to the Food Safety and Economic Authority (ASAE). Two refineries supply the market, one

in the north (Matosinhos Refinery) and the other in the south (Sines Refinery).

National legislation that transposed the Fuel Quality Directive

The transposition of the FQMS is set out in Articles 13 and 14 of Decree-Law No 89/2008 of 30 May, amended by Decree-Law No 142/2010 of 31 December and Decree-Law No 214-E/2015 of 30 September and by Decree-Law nº 152-C/2017 of 11 December.

Reporting periods

Seasonal periods in Portugal are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 November to 31 March.

Transition periods are the months of April and October. Analyses performed at filling stations in transitional periods are not taken into account for the purposes of the FQMS.

6.23.3 Sales

Table 6.23.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Eurosuper)	0.4	1 276 105 898	951 975	205	297	19 of 19
Unleaded petrol (minimum RON ≥ 98) E10 (Superplus)	0.4	106 648 541	80 413	7	21	19 of 19
Total petrol		1 382 754 439	1 032 388	212	318	
Diesel fuel B7 (*Gasóleo*)	6.4	5 298 566 667	4 450 796	221	331	6 of 7
Total diesel		5 298 566 667	4 450 796	221	331	

6.23.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.23.2 and Table 6.23.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.23.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.23.2 Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Eurosuper)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	94.2	99.2	6	502
Motor octane number	-	> 85 (3)	84.1	87.2	3	502
Vapour pressure, DVPE	kPa	< 60	51.5	70.7	6	205
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% (m/m)	< 2.7	0.3	3.15	1	502

Table 6.23.3 Unleaded petrol (minimum RON ≥ 98) E10 (Superplus)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	97.3	99.3	1	28
Vapour pressure, DVPE	kPa	< 60	51.7	62.6	1	7

Table 6.23.4 Diesel fuel B7 (*Gasóleo*)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Distillation 95 % point	°C	< 360	320	386.4	4	552
Sulphur content	mg/kg	< 10	5	314	5	552
Fatty acid methyl ester content	% v/v	< 7 (4)	0.11	7.5	5	552

6.24 Slovakia

6.24.1 Country details

Responsible organisation:	VÚRUP, a.s.
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations

6.24.2 Fuel quality monitoring service

Sampling

The organisation responsible for sampling, analysis and reporting is VÚRUP, a.s. (Accredited Testing Laboratories and Accredited Inspection Body, www.snas.sk). Fuel sampling was carried out at refuelling stations only. Fuel sampling was carried out during both summer and winter periods, and the sampling locations were selected from a database of refuelling stations and on the basis of suggestions made by the Slovak Environmental Inspectorate (SIE). The applied monitoring system is equivalent to the CEN system. All the test methods used for individual petrol and diesel samples are reported in the 'Methods and limits' table of the reporting template.

Fuel quality monitoring system administration

The public bodies responsible for managing and implementing the FQD are the Ministry of Environment and the Slovak Inspection of Environment. Fuel sampling was carried out by a contracted institution (VÚRUP), accredited in accordance with EN ISO/IEC 17020 and EN ISO/IEC 17025. Slovakia is a small sized country, using statistical model C, and is defined as one region under this model. The annual data for sales of petrol and diesel in 2017 were provided by the Ministry of Environment at the end of April 2018.

When non-compliant samples were discovered, S.I.E was responsible for taking action and imposing financial penalties. S.I.E is responsible for all processes, i.e. reporting, managing and monitoring all non-compliant samples discovered during monitoring. EN 14274 statistical model C has been applied since August 2004.

There is one national refinery (the Slovnaft refinery in Bratislava) and two distribution terminals.

National legislation that transposed the Fuel Quality Directive

The FQD has been transposed into Slovak national law in the form of Directive of the Ministry of Environment No 228 (11 August 2014), establishing fuel quality requirements and keeping records of fuel as amended by Decree No 367 (3 November 2015).

Reporting periods

Seasonal periods in Slovakia are as follows:

- summer: from 1 May to 30 September;
- winter: from 15 November to 28/29 February.

Transition periods are from 1 March to 30 April and from 1 October to 14 November. Fuel samples were not taken during the transition period.

6.24.3 Sales

Table 6.24.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (Super 95)	5.0	932 061 055	699 419	106	72	19 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (Super Plus 98)	0.5	21 702 892	16 308	17	13	19 of 19
Total petrol		953 763 947	715 727	123	85	
Diesel fuel B7 (Diesel)	8.6	2 426 732 184	2 036 999	106	80	6 of 7
Total diesel		2 426 732 184	2 036 999	106	80	

6.24.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.24.2 and Table 6.24.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.24.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.24.2 Unleaded petrol (minimum RON = 95) E5 (Super 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	94.8	97.5	1	178
Motor octane number	-	> 85 (3)	84.7	87.6	1	178
Vapour pressure, DVPE	kPa	< 60	55.6	61.2	9	106
Aromatics	% v/v	< 35	22.6	35.8	1	178

Table 6.24.3 Unleaded petrol (minimum RON ≥ 98) E5 (Super Plus 98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	54.9	61.1	1	17
Aromatics	% v/v	< 35	30.4	35.8	3	30

Table 6.24.4 Diesel fuel B7 (Diesel)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Cetane number	-	> 51	47.2	58.5	5	186
Distillation 95 % point	°C	< 360	336.8	369.1	3	186
Sulphur content	mg/kg	< 10	1.8	11.9	2	186
Fatty acid methyl ester content	% v/v	< 7 (4)	0	8.6	6	186

6.25 Slovenia

6.25.1 Country details

Responsible organisation:	Slovenian Environment Agency
Country size:	Small
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model C
Location of sampling:	Refuelling stations and terminals

6.25.2 Fuel quality monitoring service

Sampling

Monitoring is carried out by the legal entities, which obtain authorisation from the Ministry of the Environment and Spatial Planning. The main condition for authorisation is that they are accredited by Slovenian Accreditation as inspection bodies, in accordance with EN ISO/IEC 17020:2004, and as testing laboratories. They are responsible for the sampling plan, sampling and analysis of fuel (analysis is undertaken in testing laboratories accredited in accordance with EN ISO/IEC 17025:2005), and collecting and processing the data. The Slovenian Environment Agency receives quarterly and annual reports from two independent inspection bodies. The samples of petrol fuels, diesel fuel and gas oil are taken each month throughout the year at refuelling stations and depots.

Fuel quality monitoring system administration

Legislation, implementation and reporting is exercised by the Ministry of the Environment and Spatial Planning, and within this by the Slovenian Environment Agency. Control of non-compliant samples and other discrepancies is exercised by the Inspectorate for the Environment and Spatial Planning and by the Slovenian Maritime Administration, under the Ministry of Infrastructure.

Slovenia is a small sized country, where the FQMS is based on statistical model C. The whole country is considered one region.

National legislation that transposed the Fuel Quality Directive

The FQD was transposed into national law by the Environmental Protection Act and the following regulations: Decree on the physical and chemical properties of liquid fuels; Decree amending the Decree on the physical and chemical properties of liquid fuels; Rules on the monitoring of physical and chemical properties of liquid fuels; and Rules amending the Rules on the monitoring of physical and chemical properties of liquid fuels.

Reporting periods

Seasonal periods in Slovenia are as follows:

- summer: from 1 May to 30 September;
- winter: from 1 October to 30 April.

There are no transition periods.

6.25.3 Sales

Table 6.25.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum 95 ≤ RON < 98) E10 (NBM 95)	5.0	496 839 930	375 114	50	58	19 of 19
Unleaded petrol (minimum RON ≥ 98) E10 (NBM 98/100)	5.0	47 602 575	35 940	10	12	18 of 19
Total petrol		544 442 505	411 054	60	70	
Diesel fuel B7 (B7)	7.0	1 794 888 899	1 516 681	71	82	6 of 7
Total diesel		1 794 888 899	1 516 681	71	82	

6.25.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

Table 6.25.2 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.25.2 Diesel fuel B7 (B7)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	2.8	13.4	1	153
Fatty acid methyl ester content	% v/v	< 7 (4)	0.05	7.29	1	153

6.26 Spain

6.26.1 Country details

Responsible organisation:	Ministerio para la Transicion Ecologica
Country size:	Large
Summer period:	1 May to 30 September
FQMS used:	EN 14274 statistical model A
Location of sampling:	Refuelling stations and terminals

6.26.2 Fuel quality monitoring service

Sampling

Samples were taken at terminals and at service stations (point of delivery to final consumers).

- Terminals: samples were taken from approximately 30 terminals covering the whole country. Samples are taken from storage tanks at atmospheric pressure in accordance with ISO 3170:2004, or near atmospheric pressure.
- Refuelling stations: samples were taken from service stations from different regions of the country.

Fuel quality monitoring system administration

Spain is defined as a large sized country regarding fuel sales, which uses statistical model A to monitor fuel quality. The country is divided into regions considering the refineries and the terminals. There are nine refineries in the country. Samples were collected from more than 30 terminals, covering the whole country and including samples from every refinery. Samples taken from service stations cover most of the country. The service stations from which samples have been taken cover the whole Spanish territory.

National legislation that transposed the Fuel Quality Directive

Fuel quality specifications were transposed into Spanish law in Royal Decree RD 61/2006 and RD 1088/2010. Sampling and analysis specifications were transposed in Article 7 of RD 61/2006.

Reporting periods

Seasonal periods in Spain are as follows:

- summer: petrol from 1 May to 30 September; diesel from 1 April to 30 September;
- winter: petrol from 1 October to 30 April; diesel from 1 October to 30 March.

A Vapour Pressure Waiver has been granted to Spain. Samples were taken and tested during transition periods.

6.26.3 Sales

Table 6.26.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (*Gasolina* 95)	4.2	5 950 373 670	4 474 681	100	100	19 of 19
Unleaded petrol (minimum RON ≥ 98) (*Gasolina* 98)	5.5	516 996 011	388 781	100	100	19 of 19
Total petrol		6 467 369 681	4 863 462	200	200	
Diesel fuel B7 (*Gasóleo* A)	3.5	27 309 615 385	23 076 625	100	100	7 of 7
Total diesel		27 309 615 385	23 076 625	100	100	

6.26.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.26.2 and Table 6.26.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.24.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.26.2 Unleaded petrol (minimum RON = 95) E5 (*Gasolina* 95)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% (m/m)	< 2.7	1.24	3.1	1	200

Table 6.26.3 Unleaded petrol (minimum RON ≥ 98) (*Gasolina* 98)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% (m/m)	< 2.7	1.48	3	2	200

Table 6.26.4 Diesel fuel B7 (*Gasóleo* A)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	3.9	14.2	2	188

6.27 Sweden

6.27.1 Country details

Responsible organisation:	Swedish Transport Agency
Country size:	Small
Summer period:	1 May to 15 September in south Sweden; 16 May to 31 August in north Sweden
FQMS used:	National system
Location of sampling:	Terminals

6.27.2 Fuel quality monitoring service

Sampling

The Swedish fuel quality model is based on a National system. The Swedish Petroleum and Biofuels Institute compiles the data at the terminals for this annual fuel quality monitoring report on behalf of the Swedish Transport Agency. The quality assessment system at the terminals consists of compiling quality data for all batches produced in Sweden and for all import batches for the Swedish market. In 2017, there were 739 samples of unleaded petrol 95, 76 samples of unleaded petrol 98 and 847 samples of diesel taken at the terminals. Unleaded petrol 98 represents only about 3.3 % of the total sales of petrol in Sweden. The data reported from the terminals represents more than 98 % of the sales of petrol and diesel in Sweden.

In 2017 (representing summer quality), the Swedish Transport Agency, as an assessment of the national monitoring system's equivalency to the CEN system (cross-checking), carried out sampling at actual refuelling stations with the help of an accredited test laboratory. Five samples of unleaded petrol 95 and five samples of diesel were taken at five refuelling stations in five cities distributed across Sweden. In Sweden other types of fuels are also on the market, but only diesel and petrol are included in the quality control. Other fuels on the market are E85, methane gas for vehicles, HVO100 and FAME100. The cities were (from north to south) *Gävle*, *Linköping*, *Vara*, *Falkenberg* and *Lund*. The refuelling stations also represented five different fuel companies. The samples were then analysed using the test methods in the FQD template and to the standards required in SS-EN 14274:2003 and SS-EN 14275:2003. The samples from the refuelling stations showed good equivalency for both petrol and diesel with this report, based upon quality data for the deliveries to the terminals. The report on the results of the cross-checking at refuelling stations in 2017 is available from the Swedish Transport Agency upon request. The same goes for the analysis reports from 2012 to 2016. The Swedish Transport Agency made similar cross-checks at refuelling stations in the summer of 2018, to verify the upcoming 2019 FQMS report.

Fuel quality monitoring system administration

The Swedish Transport Agency verified the reliability of the Swedish Petroleum and Biofuels Institute's compilation of quality data from the terminals for the 2018 fuel quality report. The data from the terminals showed good conformity with the sampling at the actual refuelling stations in 2017 (representing summer quality), for both petrol and diesel.

The main reason for Sweden choosing this national system is the considerable costs associated with extensive sampling in a large, sparsely populated Member State with long geographical distances. There are also substantial annual costs associated with the analysis of the large number of samples per fuel grade required by the statistical model used by European Standard EN 14274:2003. This was agreed between the European Commission, the Directorate-General for Climate Action and the Swedish Ministry of the Environment and Energy in October 2014, by means of EU-pilot 6321/14/CLIM.

There are three national refineries in Sweden producing automotive fuels and 32 distribution terminals.

National legislation that transposed the Fuel Quality Directive

The legislation regarding fuel quality has been transposed into the national law *Drivmedelslag* (2011:319), the national regulation

Drivmedelsförordning (2011:346) and regulations adopted by the Swedish Transport Agency. The regulations require appropriate information to be supplied to consumers concerning the biofuel content, and in particular the fatty acid methyl ester (FAME) content, of diesel fuel in accordance with Article 4(1) of the FQD. This is in accordance with EU-pilot 6321/14/CLIM. In addition, TSFS 2011:66 and TSFS 2015:14 contain a demand for information to customers about other additives (ethanol content in Article 3.3 and metallic additives in Article 8(a) of the FQD). The law *Drivmedelslag* (2011:319) was also amended to incorporate the limit of 2 mg per litre of methylcyclopentadienyl manganese tricarbonyl (MMT) in diesel fuel. This is in accordance with Article 8(a)2 of Directive 98/70/EC.

Drivmedelslag (2011:319) contains, among other things, the fuel specifications (Articles 3 and 4 of the FQD) and standard references, among them SS EN 228. The environmental classes for petrol (*benzine*) can be found in Sections 4-6. There are two environmental classes for petrol in Sweden. Petrol environmental class 1, in the law, equates to the former national standard SS 155422. This standard is now included as a national appendix of EN 228. Petrol in environmental class 2, known as *Bensin i miljöklass* 2, equates to EN 228 and Annex 1 of the FQD. There are also three environmental classes for diesel in Sweden. Environmental classes 1 and 2 for diesel equate to the national standard SS 155435.

The environmental classes for diesel can be found in Sections 8-10. Diesel environmental class 3 equates to EN 590 and Annex 2 of the FQD. Environmental class 1 for both petrol and diesel represents the largest volumes of those fuels sold on the Swedish market.

The specific regulation on annual FQMS reporting, Article 8 of the FQD, is found in Section 19 of the national law *Drivmedelslag* (2011:319) and in Sections 7-8 of the national regulation *Drivmedelsförordning* (2011:346).

Reporting periods

Seasonal periods in Sweden are as follows:

- summer: from 1 May to 15 September in the south and from 16 May to 31 August in the north;
- winter: from 1 November to 15 March in the south and from 16 October to 31 March in the north.

A Vapour Pressure Waiver has been granted, as Sweden has low ambient summer temperatures.

Transition periods between summer and winter grades of petrol vary between the northern and the southern parts of Sweden. The transition periods for the south are 16 September to 31 October and 16 March to 30 April. For northern Sweden, the transition periods are 1 September to 15 October and 1 April to 15 May.

6.27.3 Sales

Table 6.27.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (*Blyfri* 95 MK1)	5.0	3 058 792 159	2 294 094	367	372	13 of 19
Unleaded petrol (minimum RON ≥ 98) E5 (*Blyfri* 98 MK1)	5.0	104 384 841	78 289	54	22	13 of 19
Total petrol		3 163 177 000	2 372 383	421	394	
Diesel fuel B7 (Diesel MK1)	7.0	5 664 430 000	4 610 846	416	431	6 of 7
Total diesel		5 664 430 000	4 610 846	416	431	

6.27.4 Exceedances of the fuel quality limits

Petrol fuel grades

No exceedances of the petrol fuel quality limits were reported.

Diesel fuel grades

No exceedances of the diesel fuel quality limits were reported.

6.28 United Kingdom

6.28.1 Count

Responsible organisation:	Department for Transport
Country size:	Large
Summer period:	1 June to 31 August
FQMS used:	National system
Location of sampling:	Refineries, terminals and refuelling stations

6.28.2 Fuel quality monitoring service

Sampling

Sampling is done at refineries, terminals and refuelling stations. Samples are taken routinely throughout the year and across all regions of the United Kingdom (UK); the numbers for each month are shown in the petrol and diesel sheets showing the test results. For unleaded petrol and diesel, the number of samples taken from retail stations is greater than the largest number required by any of the statistical models of EN 14274. Super unleaded petrol is only just short of this but, as it sells in smaller volumes, this is more than adequate. The addition of the sample results from refineries and terminals adds over 3 000 extra results that increases the certainty about the fuel being supplied and as such, provides an approach with an equivalent, or greater, degree of confidence to EN 14274. The test methods used for each parameter are in accordance with the current EN 228 and EN 590 standards and are performed by certified laboratories of refiners or independent test labs.

Fuel quality monitoring system administration

The Department for Transport has responsibility in the UK for implementing the FQD and oversees, the FQMS. The UK is a large sized country with regard to fuel sales, and it uses a national system to monitor fuel quality. The UK fuel quality monitoring system makes use of industry quality analyses on batches of fuel produced in, or imported into, the UK, plus samples taken at distribution terminals and service stations (to check for contamination in the distribution network). The national system has been operating for a number of years and takes into account a very large number of samples from across the year and across the UK to provide, with a suitable degree of confidence, a view of the quality of the fuel being supplied to the UK market. There are six operational fuel refineries within the UK and approximately 50 distribution terminals.

National legislation that transposed the Fuel Quality Directive

The FQD has been transposed into United Kingdom law under the Motor Fuel (Composition and Content) Regulations 1999 (SI No 3107) with amendments in 2001, 2003, 2007, 2010, 2012, 2013 and 2015.

Reporting periods

Seasonal periods in the UK are as follows:

- summer: from 1 June to 31 August;
- winter: from 1 September to 31 April.

The United Kingdom has been granted a Vapour Pressure Waiver in petrol during the summer period. The transition period is the month of May. Vapour pressure samples are taken during the transitional period but are excluded from the fuel quality report because they are transitional.

6.28.3 Sales

Table 6.28.1 Total sales and sample number

Fuel grade (name)	Biofuel content (% v/v)	Total sales		Samples		Parameters measured
		Litres	Tonnes	Summer	Winter	
Unleaded petrol (minimum RON = 95) E5 (Unleaded 95 RON)	5.0	14 915 106 681	10 949 131	366	669	19 of 19
Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Super 7+RON)	5.0	1 082 787 327	796 753	102	205	19 of 19
Total petrol		15 997 894 008	11 745 884	468	874	
Diesel fuel B7 (Diesel)	7.0	29 718 719 209	24 910 913	1 547	1 214	7 of 7
Total diesel		29 718 719 209	24 910 913	1 547	1 214	

6.28.4 Exceedances of the fuel quality limits

Petrol fuel grades

Table 6.28.2 and Table 6.28.3 summarise the parameters for which exceedances were reported for the petrol fuel grades measured.

Diesel fuel grades

Table 6.28.4 summarises the parameters for which exceedances were reported for the diesel fuel grades measured.

Table 6.28.2 Unleaded petrol (minimum RON = 95) E5 (Unleaded 95 RON)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Research octane number	-	> 95 (2)	93.2	99	2	1 025
Vapour pressure, DVPE	kPa	< 60	55.8	72.6	6	365
Aromatics	% v/v	< 35	16.6	37	4	1 024

Table 6.28.3 Unleaded petrol (minimum 95 ≤ RON < 98) E5 (Super 97+RON)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Vapour pressure, DVPE	kPa	< 60	54.2	77.8	9	100
Aromatics	% v/v	< 35	14.2	39.6	18	285
Oxygen content (petrol with 5 % (v/v) or less ethanol content)	% m/m	< 2.7	0	3.01	4	272

Table 6.28.4 Diesel fuel B7 (Diesel)

Parameter	Unit	Limit value	Minimum value measured	Maximum value measured	Number of samples outside tolerance limit	Total number of samples
Sulphur content	mg/kg	< 10	0.1	13	1	2 753
FAME content	% v/v	< 7 (4)	0	7.4	2	1 963

Abbreviations, symbols and units

% m/m	Percentage mass/mass
% v/v	Percentage volume/volume
API	American Petroleum Institute
B+	Diesel fuel with > 7 % (v/v) biodiesel content
B0	Diesel with no biodiesel content
B7	Diesel fuel with up to 7 % (v/v) biodiesel content
CEN	European Committee for Standardization
CHP	Combined heat and power
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DVPE	Dry vapour pressure equivalent
E+	Petrol with > 10 % ethanol content
E0	Petrol with no ethanol content
E10	Petrol with up to 10 % ethanol content
E5	Petrol with up to 5 % (v/v) ethanol content
EEA	European Environment Agency
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
FAME	Fatty acid methyl esters
FFV	Flexi-fuel vehicles

FQD	Fuel Quality Directive
FQMS	Fuel quality monitoring system
FTN	Feedstock trade name
GHG	Greenhouse gas
GJ	Gigajoule
HVO	Hydrotreated vegetable oil
ILUC	Indirect land use change
ISO	International Organization for Standardization
JRC	Joint Research Centre
kPa	Kilopascal
LNG	Liquefied natural gas
LPG	Liquid petroleum gas
MJ	Megajoule
MMT	Methylcyclopentadienyl manganese tricarbonyl
MON	Motor Octane Number
MTBE	Methyl tert-butyl ether
NO_x	Nitrogen oxides
PAH	Polyaromatic hydrocarbon
PJ	Petajoule
PM	Particulate Matter
QA/QC	Quality assurance/quality control
RON	Research Octane Number
SO_2	Sulphur dioxide
SO_4	Sulphate particles
SO_x	Sulphur oxides
TAEE	Tert-amyl ethyl ether
TJ	Terajoule
TL	Tolerance limit
UER	Upstream emission reductions

UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compound

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Annex 1

Table A1.1 EU-28 Feedstock Trade Name list

Arzew
Asgard
Automotive Gas oil B7
Barents
Belarus Miscellaneous
Belayim
Bombay High
Bonga
Brass River
Calv
CPC Blend
Dubai (Fateh)
Ekofisk
El Borma
El Sharara
Escravos
EU
Gas oil
Goliat
Gullfaks
Hungary
Kirkuk (Pers. Gulf)
Kirkuk Blend (Turkey)
Knarr
LPG
Miskar
Natural gas
Non-EU
Novyport
Nyersolaj
Okwori
Oseberg
Other
Rantau
REBCO
Russian Export Blend
Texas WTI
Turkish Miscellaneous
Ukraine Miscellaneous

Table A1.1 EU-28 Feedstock Trade Name list (cont.)

Unleaded Gasoline 95 E5
Urals

Table A1.2 Greenhouse gas (GHG) intensity per fossil fuel type

Fuel or energy type	GHG intensity gCO_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	N/A

Table A1.3 Average reported greenhouse gas (GHG) intensity per biofuel type

Fuel or energy type	GHG intensity gCO_2e/MJ
Biodiesel	55
Bio-ethyl tert-butyl ether	12
Bioethanol	12
Biofuel oil	N/A
Biogas	N/A
Biomethanol	N/A
Bio-methyl tert-butyl ether	12
Biopetrol	55
Bio-tert-amyl ethyl ether	12
Hydrotreated vegetable oil (HVO)	55
Other (bio gasoline)	22
Other (bio naphtha)	28
Other (bio-liquid petroleum gas)	22
Other (corn bioethanol)	27
Other (palm oil biodiesel)	35
Other (soybean biodiesel)	41.5
Other (triticale bioethanol)	28.3
Pure vegetable oil	30.09

Table A1.4 Feedstocks used for biofuels

Acid oil from used cooking oil
Animal fats classified as categories 1 and 2
Animal manure and sewage sludge
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
Farmed wood
Grape marcs and wine lees
Husks
N/A
Other
Other cereals
Other oil crops
Palm oil
Palm oil mill effluent
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
Turkish Miscellaneous

Table A1. 5 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
ETBE renewable component, Community produced (process not specified)
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
Methyl tert-butyl ether (MTBE) renewable component
N/A
Other
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
Waste wood methanol
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 (natural gas as process fuel in conventional plant)
Wheat ethanol (process fuel not specified)
Wheat straw ethanol
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
Turkish Miscellaneous

Table A1.1 EU-28 Feedstock Trade Name list

	Biodiesel	Bio-ETBE	Bioethanol	Biofuel oil	Biogas	Biomethanol	Bio-MTBE	Biopetrol	Bio-TAEE	Hydrotreated vegetable oil (HVO)	Pure vegetable oil	Other biofuels	Total per pathway (TJ)
Acid oil from used cooking oil	2 746	-	-	0	-	-	-	-	-	237	-	-	2 983
Animal fats classified as categories 1 and 2	14 464	0	2	1	-	-	-	65	0	654	-	-	15 186
Animal manure and sewage sludge	0	-	-	-	2 052	296	-	-	-	-	-	-	2 348
Barley	-	-	1 705	-	39	-	-	-	-	-	-	-	1 744
Biomass fraction of industrial waste	19	-	1	-	1 200	-	-	-	-	20 187	-	-	21 408
Biomass fraction of mixed municipal waste	-	-	-	-	2 036	-	-	-	-	-	-	-	2 036
Biomass fraction of wastes and residues from forestry and forest-based industries	-	-	13	-	-	-	-	-	-	5 986	-	258	6 258
Bio-waste	32 228	-	745	-	1 771	362	-	-	-	80	-	-	35 186
Brown grease	708	-	226	-	-	-	-	-	-	-	-	-	934
Cobs cleaned of kernels of corn	-	-	-	-	6	7	-	-	-	-	-	-	14
Corn (maize)	80	1 970	30 164	-	82	-	191	-	0	322	-	1	32 809
Crude glycerine	30	-	-	-	-	129	-	-	-	-	-	-	159
Farmed wood	-	-	11	-	-	-	-	-	-	-	-	-	11
Grape marcs and wine lees	-	-	208	-	-	-	-	-	-	-	-	-	208
Husks	-	-	-	-	13	-	-	-	-	-	-	-	13
Other feedstock	22 066	0	291	-	72	-	-	9	0	20 323	-	502	32 809
Other cereals	0	4	4 551	-	5	-	-	-	-	-	-	0	4 561
Other oil crops	231	-	-	-	-	-	-	-	-	-	-	-	231
Palm oil	26 595	-	-	-	-	-	-	-	-	9 742	-	509	36 846
Palm oil mill effluent	254	-	-	-	-	-	-	-	-	83	-	-	337
Rapeseed	106 858	-	13	-	-	-	-	-	-	1 369	26	-	108 265
Soapstock acid oil contaminated with sulphur	527	-	-	-	-	-	-	-	-	-	-	-	527
Soybeans	5 162	-	-	-	-	-	-	-	-	-	-	10	5 172
Spent bleached earth	419	-	-	-	-	-	-	-	-	1	-	-	419
Starch slurry	-	-	4 073	-	-	-	-	-	-	-	-	-	4 073
Straw	-	-	7	-	1	14	-	-	-	-	-	-	21
Sugar beet	-	876	6 086	-	36	240	34	-	-	-	-	-	7 271
Sugar cane	-	137	2 387	-	-	-	-	-	-	-	-	-	2 524
Sunflower seed	7 203	-	-	-	-	-	-	-	-	65	-	-	7 268

Table A1.1 EU-28 Feedstock Trade Name list (cont.)

	Biodiesel	Bio-ETBE	Bioethanol	Biofuel oil	Biogas	Biomethanol	Bio-MTBE	Biopetrol	Bio-TAEE	Hydrotreated vegetable oil (HVO)	Pure vegetable oil	Other biofuels	Total per pathway (TJ)
Tall oil pitch	473	-	-	7	-	-	-	161	-	-	-	-	641
Tallow — category 3 or unknown	1 884	-	-	-	-	0	-	-	-	1	-	-	1 885
Used cooking oil	43 856	-	-	-	-	-	-	151	-	197	-	7	44 211
Waste pressings from production of vegetable oils	323	0	126	39	-	-	-	200	-	11 417	-	-	12 105
Waste vegetable or animal oils	353	-	82	-	3	-	-	1	-	268	-	-	707
Waste wood	-	-	163	-	-	37	-	-	-	-	-	-	200
Wheat	-	1 819	24 024	-	92	-	14	-	0	-	-	-	25 949
Total per biofuel (TJ)	266 477	4 806	74 880	47	7 411	1 084	239	588	0	70 932	26	1 287	

Notes: ETBE, ethyl tert-butyl ether; MTBE, methyl tert-butyl ether; TAEE, tert-amyl ethyl ether.

Table A1.7 Amount of energy consumed (TJ) per pathway

	Biodiesel	Bio-ETBE	Bioethanol	Biofuel oil	Biogas	Biomethanol	Bio-MTBE	Biopetrol	Bio-TAEE	Hydrotreated vegetable oil	Pure vegetable oil	Other biofuels	Total per pathway (TJ)
Biogas from dry manure as compressed natural gas	-	-	-	-	14	-	-	-	-	-	-	-	14
Biogas from municipal organic waste as compressed natural gas	-	-	-	-	112	-	-	-	-	-	-	-	112
Biogas from wet manure as compressed natural gas	-	-	-	-	63	-	-	-	-	-	-	-	63
ETBE renewable component, community produced (process not specified)	-	72	-	-	-	-	-	-	-	-	-	-	72
Farmed wood ethanol	-	-	11	-	-	-	-	-	-	-	-	-	11
Hydrotreated vegetable oil from palm oil (process not specified)	7	-	-	-	-	-	-	-	-	5 601	-	-	5 608
Hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	-	-	-	-	-	-	-	-	-	77	-	-	77
Hydrotreated vegetable oil from rape seed	98	-	-	-	-	-	-	-	-	1 029	-	-	1 127
Hydrotreated vegetable oil from sunflower	49	-	-	-	-	-	-	-	-	-	-	-	49
MTBE renewable component	-	-	8	-	-	-	-	-	-	-	-	-	8
Other production pathway	25 277	1 946	18 050	-	73	1 048	-	151	0	394	-	500	47 439
Palm oil biodiesel (process not specified)	8 096	-	-	-	-	-	-	-	-	104	-	3	8 203
Palm oil biodiesel (process with methane capture at oil mill)	265	-	-	-	-	-	-	-	-	9	-	-	274
Pure vegetable oil from rape seed	24	-	-	-	-	-	-	-	-	-	-	-	24
Rape seed biodiesel	68 090	-	4	-	-	-	-	-	-	0	-	-	68 094
Soybean biodiesel	5 100	-	-	-	-	-	-	-	-	-	-	10	5 110
Sugar beet ethanol	-	817	4 459	-	-	-	-	-	-	-	-	-	5 276
Sugar cane ethanol	-	137	404	-	-	-	-	-	-	-	-	-	542

Table A1.7 Amount of energy consumed (TJ) per pathway (cont.)

	Biodiesel	Bio-ETBE	Bioethanol	Biofuel oil	Biogas	Biomethanol	Bio-MTBE	Biopetrol	Bio-TAEE	Hydrotreated vegetable oil	Pure vegetable oil	Other biofuels	Total per pathway (TJ)
Sunflower biodiesel	5 585	-	-	-	-	-	-	-	-	65	-	-	5 650
Waste vegetable oil or animal fat biodiesel	44 388	-	-	-	3	-	-	-	-	67	-	7	44 465
Waste wood ethanol	-	-	63	-	-	-	-	-	-	-	-	-	63
Waste wood methanol	-	-	-	-	-	37	-	-	-	-	-	-	37
Wheat ethanol (lignite as process fuel in CHP plant)	-	-	62	-	-	-	-	-	-	-	-	-	62
Wheat ethanol (natural gas as process fuel in CHP plant)	-	-	3 552	-	-	-	-	-	-	-	-	-	3 552
Wheat ethanol (natural gas as process fuel in conventional boiler)	-	-	70	-	-	-	-	-	-	-	-	-	70
Wheat ethanol (natural gas as process fuel in conventional plant)	-	-	28	-	-	-	-	-	-	-	-	-	28
Wheat ethanol (process fuel not specified)	-	1 789	5 165	-	-	-	-	-	-	-	-	-	6 954
Wheat straw ethanol	-	-	7	-	-	-	-	-	-	-	-	-	7
Total per biofuel (TJ)	156 981	4 761	31 883	-	266	1 084	-	151	0	7 346	-	519	

Notes: ETBE, ethyl tert-butyl ether; CHP, combined heat and power; MTBE, methyl tert-butyl ether; TAEE, tert-amyl ethyl ether.

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