Evaluation of Directive 98/70/EC of 13 October 1998 relating to the quality of petrol and diesel fuels as amended

Final Report

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Executive summary

Scope and aims of the study

This report presents the findings of an evaluation study contracted by the European Commission concerning Directive 98/70/EC relating to the quality of petrol and diesel fuels[1] (the Fuel Quality Directive (FQD)). Work on this contract was undertaken by Amec Foster Wheeler with CE Delft and TNO.

The aim of the study is to carry out an evaluation on a number of specific Articles of the FQD, assessing their effectiveness, efficiency, coherence, relevance and EU added value.

The two main aims of the FQD are to ensure a single market for fuel in the EU, and to ensure high minimum levels of environmental and health protection in relation to fuel use. The legal underpinning for this is in Article 100a[2] of the Treaty, establishing the European Community, which relates to measures with the aim of establishing or ensuring the functioning of the internal market. This Article also envisages that Commission proposals in this area, which concern health, safety, environmental protection and consumer protection, will take as a base a high level of protection, and that the European Parliament and the Council will seek to achieve the same objective.

The FQD includes rules that ban petrol with lead and limit the amount of sulphur in diesel fuels in order to improve air quality and includes targets to reduce greenhouse gas (GHG) emissions and, alongside the amending acts, establishes technical specifications to be applied to petrol, diesel and biofuels used in road transport, as well as to gas oils used in non-road mobile machinery (NRMM).

This evaluation focuses on the following Articles of the Directive:

- **Article 1** concerning scope;
- **Article 2** concerning definitions;
- **Article 3** concerning petrol specifications;
- **Article 4** concerning diesel specifications;
- **Article 5** concerning the free circulation of compliant fuels;
- **Article 6** concerning the marketing of fuels that comply with more stringent environmental specifications;
- **Article 7** concerning disruptions of fuel supply due to an exceptional event.
- **Article 8** concerning the monitoring and reporting requirements of both member states and Commission.
- **Article 8a** concerning the use of metallic additives such as MMT (Methylcyclopentadienyl manganese tricarbonyl);
- **Article 9** concerning Commission reports on the functioning of the FQD; and
- **Article 9a** concerning Member State penalties.

[1] OJ L 350, 28.12.1998, p.58

[2] Opinion of the European Parliament of 10 April 1997 (OJ C 132, 28.4.1997, p. 170), Council Common Position of 7 October 1997 (OJ C 351, 19.11.1997, p. 1) and Decision of the European Parliament of 18 February 1998 (OJ C 80, 16.3.1998, p.92). Decision of the European Parliament of 15 September 1998 (OJ C313, 12.19.1998). Decision of the Council of 17 September 1998.

Articles 7a-7e concerning GHG intensity of transport fuels are implemented through Council Directive (EU) 2015/652[3] of 20 April 2015, which has to be transposed by Member States by 21 April 2017. They are consequently outside of the scope of this evaluation exercise. However, the related fuels specifications set out in Articles 3 and 4 of the FQD (e.g. the blend limits of FAME and ethanol) are in scope.

With regard to petrol

- EU Member States can only place on the market petrol that complies with the petrol specifications that are used when marketing petrol sold in the EU (listed in Annex I of the FQD).
- EU Member States can market petrol with very small quantities of lead for use only by old vehicles. The lead content can be no higher than 0.15g/l, and can only constitute a maximum of 0.03 % to be used by old vehicles of a characteristic nature and to be distributed through special interest groups.
- EU Member States with low summer temperatures have the option of placing on the market petrol with higher vapour pressure under specific conditions during the summer. EU Member States may also permit the placing on to the market of petrol with higher vapour pressure in the case of higher blends of ethanol in the petrol (which results in lower vapour pressure). The European Commission must assess the duration and desirability of these exceptions.

With regard to diesel

- EU Member States can only place on the market diesel that complies with the specifications set out in Annex II. Annex II lists a number of specifications that are used when marketing diesel sold in the EU.
- The content of fatty-acid methyl esters (FAME) in diesel is generally limited to 7% according to Annex II. However, EU Member States can introduce diesel with higher FAME than the maximum level indicated in Annex II, if all other requirements in Annex II are met.
- The sulphur content of diesel must not exceed 10mg/kg.
- Some exceptions to these rules are possible for remote regions.

With regard to reporting

- Each year, by 31 August[4], EU Member States must submit information regarding their national fuel quality in a report that collects all the data from the previous calendar year. The data must be collected from a fuel quality monitoring system in line with relevant EU standards.

With regard to GHG emissions

The following provisions on GHG reductions are included in the Directive, Articles 7a-7e, however these aspects are outside of the scope of this evaluation.

- EU Member States designate the responsibility to fuel suppliers for annual monitoring and reporting on GHG life-cycle emissions from fuel.
- Fuel suppliers must as gradually as possible reduce life cycle GHG emissions by 6 to 10 % by 31 December 2020.

[4] Prior to 2015 the reporting deadline was 30 June.

— Each year, by 31 December, Member States must report on the greenhouse gas intensity of fuels supplied to the market.

Methodology

In order to carry out the evaluation, an intervention logic and an analytical framework were developed, including a set of specific evaluation questions. Data collection methods included a stakeholder consultation (comprising online survey questionnaire and follow-up interviews), literature review and analysis of available quantitative data (Section 3).

In this evaluation, particular attention is paid to the amendments introduced by Directive 2009/30, which tightened a number of existing fuel specifications of the FQD, including lowering the permitted level of sulphur in fuel to 10ppm.

Evaluation conclusions

The two main aims of the FQD are to ensure a single market for fuel in the EU, and to ensure minimum levels of environmental and health protection in relation to fuel use. Recital 1 of the FQD set out the overall objective as avoiding disparity between measures on fuel specifications adopted by Member States which would create barriers to intra-EU trade and would directly affect the functioning of the internal market, and the international competitiveness of the EU vehicle and fuel refining industries. Several other Recitals (2, 3, 4 and others) refer to the environmental and health objectives of the legislation.

Effectiveness

Single market

- Minimum fuel requirement obligations are an important driver towards the delivery of a single market (EQ 1.1)[5]. In this regard the Directive is succeeding, given that currently the vast majority of the fuel placed on the EU market is compliant with the FQD specifications as evidenced in the summary FQD annual reports and Member States Fuel Quality Monitoring annual reports (comprehensively described under EQ 1.6 and 1.8). Member States view the FQD positively in this regard.
- As Annex I and II of the FDQ only have an upper limit this creates the legal possibility that fuels with different levels of bio content are compliant with the FQD. According to the fossil fuel and biofuel producers and suppliers, this range of permissible bio content may have led to a fragmentation of biofuel blends that are supplied across Member States.
- Biofuel blends are supplied unevenly across the EU, principally due to bioethanol blends levels (E0, E5, and E10)[6] (see EQ 1.3). This range of biofuel blends is in line with the specifications for biofuel components according to Annex I, which specifies an upper limit of 10% bioethanol. This also reflects the different policies put in place by Member States with regards to biofuels. Fuel suppliers have indicated that there are possible additional costs associated with the provision of multiple fuel blends, however they have been unable to supply an estimation of these costs.

[5] For further analysis of each of the summarised issues refer to the sections of this report as cross referenced with the relevant evaluation question (EQ) number.
[6] Where 'E' denotes bioethanol and the number denotes the maximum percentage content in a petrol blend.

- For FAME, while Annex II sets an upper limit of 7% in diesel fuel, Article 4 also indicates that FAME levels greater than 7% may be permitted. This flexibility provided by the FQD was only utilised to date by two Member States (France and the Netherlands) establishing a legal framework permitting the placing on the market of diesel with >7% FAME levels.
- Certain Member States' national legislation transposing the FQD aligns with the minimal requirements set out by the Directive, whereas other Member States additionally include mandatory application of CEN standards EN228 and EN590.
- It was suggested by some Member States that the possible transposition of the full requirements of both CEN standards EN 228 and EN 590 into the FQD would be a positive step towards greater harmonisation of the single market for fuel. However, under the current scope of the Directive it would be difficult to justify such a change as this would not lead to clear, additional health and environmental benefits because the further specifications within the CEN standards relate to aspects not associated with pollutant emissions. Also, the economic impact of the unequal application of the CEN standards has not yet been fully demonstrated.
- There is a possible issue in relation to other fuel quality parameters where multiple blends are permissible, for example RON. This could in theory lead to inconsistencies in relation to the single market, however this has not been observed or reported to date.

Environmental and health protection

- The FQD has been effective in reducing emissions from transport. Historic data series available from the EEA show a reduction in emissions of SO_X, lead, NO_X, PM and PAH (EQ 1.2). These reductions can be linked to the FQD, either directly in the case of SO_X or indirectly for NO_X and PM. In the case of SO_X emissions the observed reductions correlate directly to the progressive lower sulphur limits permitted in fuels. For NO_X and PM emissions the historic observed reduction in emissions of NO_X and PM is not directly attributable to the FQD, however it could not have occurred in the absence of the FQD, since sulphur content in fuel inhibits the performance of catalytic converters which remove NO_X from tailpipe emissions, and also damage Particulate Diesel Filters which reduce PM. Therefore, both the FQD and vehicle emissions standard together have been responsible for this reduction. The introduction of Euro-6 and Euro-VI vehicles was only possible after the coming into force of petrol and diesel specifications of Directive 2009/30/EC.
- The improvements in health and environmental impacts arising from the FQD are due to the specifications for petrol and diesel fuel set out in Annex I and II. The high rate of compliance with the FQD specifications (in regards to minimum fuel quality standards) (EQ 1.6, 1.8) are supported by the monitoring and reporting requirements for Member States specified in Article 8 (EQ 1.14) and by the penalties regime stipulated in Article 9a (EQ 1.17).

Efficiency

Overall the Directive is efficiently delivering health and environmental protection.

- The main costs for Member States in relation to implementing the FQD arise from the monitoring and reporting requirements, including requirements for fuel sampling. Costs vary significantly across Member States, with reported costs for overall fuel sampling and monitoring costs ranging from €173,000-€650,000 annually per Member State (EQ 2.11).
- The main costs arising from compliance with the FQD for fuel manufacturers are in relation to desulphurisation of fuel as required by the FQD and in meeting the

vapour pressure limits (see EQ 2.3, EQ 2.4, and EQ 2.5). These costs were estimated to be in the region of €202 million cumulative costs per refinery for the time period 2001-2011. Of the €202 million cost, 51% corresponds to investment costs and 49% to operational costs[7]. Some additional costs to fossil fuel manufactures and suppliers arise from limits for ethanol blending (EQ 2.6) and the increased number of fuel grades to be supplied (EQ 2.3).

- All of these costs are outweighed by the significant benefits delivered through the FQD (detailed in EQ 2.3, 2.4, 2.5). The FQD has led to a decrease in fuel related emissions from transport and the associated health benefits of avoided health impacts are quantified using damage cost functions (detailed in EQ 2.3, 2.4, 2.5).
- The benefits arising from desulphurisation have been estimated as being €197 million[8] per average EU-28 refinery during the 2001-2011 period (EQ 2.4). Project calculations carried out using EEA data on historic emission trends estimated the benefits of avoided damage cost associated with reduced EU road transport and NRMM emissions, at **€ 695 million** for reduction in SO_X, and **€8,611** million for reduction in NO_X for the period 2009-2013 for the EU 28.
- The FQD does not operate in isolation and the above benefits arising from reduction in road transport and NRMM emissions are therefore not entirely attributable to the FQD. The observed historic reduction in SO_2 emissions is directly attributable to the FQD, whereas the reduction in emissions of NO_X and PM are indirect. Other factors include the influence of vehicle emissions standards and the economic recession in 2009, amongst others (EQ 1.2).
- In addition, the FQD has also delivered benefits in relation to engine and emissions abatement performance due to improved fuel specifications, which are compatible with advanced engine standards. For example, the application of particulate filters in modern diesel engines was only possible after the introduction of low sulphur content fuels (EQ 1.2, 1.4, EQ 2.4).
- There is uncertainty regarding the additional costs incurred by fuel suppliers in relation to the costs of supplying multiple fuel blends. Since E5 and E10 (the two predominant petrol blends) require the same base petrol blend, additional costs in relation to the provision of these two blends are possibly not significant. Fuel suppliers stated that they incurred additional costs due to the provision of multiple fuel blends but were unable to provide data to support this (EQ 1.3).

Coherence

Generally, the FQD is found to be coherent with the remainder of the environmental policy acquis. Certain issues have been raised with regards to biofuels, concerning provisions within the FQD itself and in relation to the Renewable Energy Directive (RED).

[7] These are estimates from the EU Refineries Fitness Check (JRC, 2015) report.

[8] This value is a cumulative estimate for the period 2001-2011, not for a single year. These estimates are calculated using EEA damage cost values on the benefits of decreasing SO_2 intensities, and represent the difference between a baseline situation where the average sulphur content in gasoline and diesel would have remained at the level determined by the FQD in 2000 (150ppm for gasoline and 350ppm for diesel), against the actual reported sulphur levels in fuel (as illustrated in Figure 4.19 below) (source JRC, 2015).

Coherence with other legislation

- The use of derogations under Articles 3 and 4, is coherent with the overall approach of the FQD and of other environmental legislation to ensure that no Member State is unduly penalised due to exceptional circumstances beyond their control (e.g. Outermost Regions, countries with low summer ambient temperatures) (EQ 3.10).
- Also coherent with the environmental policy acquis are the FQD's approach to monitoring and reporting requirements for Member States in Article 8 (EQ 3.13), the provision of a safeguard under Article 7 in case of exceptional circumstances disrupting supply of crude oil (EQ 3.12), and the approach to penalties set out in Article 9a (EQ 3.15).
- The RED sets a target of 10% for the share of energy from renewable sources in transport by 2020 for each Member State. The FQD sets upper limits for bioethanol (10%) and FAME (7%) (Articles 3 and 4, Annexes I and II). Some Member States claim that it is not possible to meet the 2020 RED target through the use of these biofuels alone and that they will need to implement additional measures (e.g. use of Hydrotreated Vegetable Oil (HVO) which is not included in the 7% limit for FAME, using advanced biofuels that can be double-counted, or the electrification of transport). There is however no evidence to suggest that the blend walls for bio components in fuel established by the FQD would hamper meeting the RED target. In particular, currently Member States are still far from reaching full implementation of the upper limits set in the FQD (ICF et al 2015, EQ 3.5).

Internal coherence

- The FQD incentivises fuel suppliers to the use of biofuels, amongst other contributions, as a means to lower the GHG intensity. At the same time, fuel specifications for higher blends of biofuel are out of the scope of the Directive (EQ 3.2). Article 2 refers to CN codes for petrol and diesel, which state that fuels must contain a minimum of 70% mineral oil in order to be classified as such. Therefore, a gap in the legislative framework exists, as higher (>30%) biofuel blends such as E85 or B90 which are out of the scope of the definition of the CN codes are outside the scope of the Directive. This leaves the internal market for higher blends unregulated. At present, however, these fuels represent a negligible share[9] of the total EU fuel market.
- The use of CN codes in Article 2 defining a minimum of 70% mineral oil, together with Article 4 which permits placing on the market of diesel containing greater than 7% FAME, would theoretically allow a FAME content in diesel of between 0% and 30% to fall within the scope of the Directive (higher blends could be marketed as well but are outside of the scope of the Directive). Since Article 3 does not allow an equivalent flexibility for the bioethanol content of petrol to exceed 10%, this represents a theoretical incoherence, which, however, is not of any practical implication.
- In practice, the flexibility provided by Article 4 is implemented in a very limited way. Only two Member States (France and the Netherlands) have transposed the flexibility provided for in Article 4 into their national legislation. Biodiesel with a FAME content up to 8% is currently placed on the market only in one Member State (France). In consultation for this evaluation, France indicated that one of the reasons for transposing this flexibility was to allow such an option as a possible

[9] Being out of scope of the FQD there is no obligation for reporting these fuels and so data on the precise share are not available

means to achieve the RED targets, and Spain indicated it may consider taking a similar approach.

Relevance

The Directive overall is still considered to be relevant and no articles are considered not to be relevant. The limitations placed upon petrol and diesel fuels by the FQD are still relevant to ensuring the health and environmental benefits of the FQD as well as promoting a single market for fuels within scope.

- The FQD contains a significant number of derogations. Part of this assessment was to evaluate whether these derogations are still relevant at present. These derogations range from derogations for the fuel quality for the Outermost Regions of the EU (EQ 4.6, EQ 4.8) to more lenient specifications in the event of disruptions of supply (EQ 4.12).
- The derogation for Outermost Regions has been applied by Mayotte to date. France states that the derogation is still relevant and is allowing fuel supply to Mayotte to continue without incurring significant additional costs which would hamper the local economy (EQ 4.6, 4.8, 4.12).
- The derogation for vapour pressure is considered to still be relevant on the basis of the high number of applications to apply this derogation in recent years, and the supporting data included in the derogations which outlines the avoided costs to Member States (EQ 4.6).
- No Member State nor any of the other stakeholders contacted during this study proposes to delete or repeal the derogations on grounds of administrative or legislative burden or single market considerations (EQ 4.4, 4.5, 4.7, 4.9, 4.10, 1.7).
- **Article 8a** on the use of metallic additives is considered to still be relevant. Although Member States indicate that MMT would not be used even in the absence of the Article, the Article remains relevant as a safeguard.
- In relation to **Article 9a** on the setting of penalties, some Member States query whether it is necessary to have an Article at the EU level, considering that penalties could be dealt with at a national level. However its removal could contribute to competitive distortion across Member States, since there would be no driver to ensure the level of penalty setting is equivalent among them (EQ 4.16).

EU-added value

- Member States consistently state that a single market could not be delivered in the absence of the Directive (EQ 5.2), and, therefore, the directive maintains EU–added value.
- The introduction of harmonised fuel specifications creates a strong intra-EU market for fuel suppliers and vehicle manufacturers. The harmonisation of fuel specifications has reduced the barriers to entry for EU and non-EU fuel suppliers, who can dedicate (part of) their plants to the refining of EU-specification compliant fuel or manufacturing of compatible vehicles, rather than focusing on one country or needing to comply with multiple specifications across different Member States (this excludes the issue of different biofuel blends which is discussed above).
- Some stakeholders have called for more harmonisation which they consider would increase the overall EU-added value of the legislation Directive in relation to delivery of a single market.

Areas for further consideration

Some points have been identified in the literature and through the stakeholder consultation which deserve further consideration. These relate to the functioning of the internal market.

The FQD does not harmonise all aspects of the internal transport fuel market and it allows certain margin for national measures. In principle, options towards greater harmonisation would include the following measures:

- Including higher blends of biofuels into the scope of the FQD;
- Introducing a protection grade for biodiesel;
- Introducing relevant CEN standards into the FQD.

However, there is currently no compelling evidence that national flexibilities provided by the FQD have led to severe market disruptions. In particular, higher blends of biofuels are produced for niche markets and limited to a few Member States. Also, limited improvement is expected by a potential inclusion of CEN standards into the FQD.

Further monitoring of the development of the internal transport fuels market should therefore be considered.

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1. Introduction

1.1 Purpose and structure of this report

This report concerns a contract between the European Commission and Amec Foster Wheeler Environment and Infrastructure UK Limited ('Amec Foster Wheeler'), which relates to "supporting the evaluation of Directive 98/70/EC on Fuel Quality". The work on this contract is being undertaken in association with CE Delft and TNO.

This is the Final Report for this study. It presents information gathered from a stakeholder consultation exercise with Member States and industry stakeholders (including a questionnaire and follow-up interviews with selected stakeholders), from a literature review and data analysis of numeric data sources.

The report is structured as follows:

- **Section 2** provides the policy context for the Directive.
- **Section 3** describes the methodology followed in collecting data to date.
- **Section 4** summarises the evaluation carried out to date.
- **Section 5** sets out next steps in this project.
- **Section 6** presents conclusions and recommendations.

The evaluation of the Fuel Quality Directive (hereafter referred to as the FQD) is part of the Commission's Regulatory Fitness and Performance Programme (REFIT)[10] which aims at reviewing the entire stock of EU legislation to make EU law lighter, simpler and less costly.

The overall aim of this evaluation study is to present key findings and conclusions and to serve as evidence to the European Commission on the process of implementation of the Directive and for further planning. The outputs will be used by the Commission in their evaluation report to the European Parliament and the Council.

1.2 Objectives and scope of the report

The objective of the study is to provide an **evaluation** of the performance of the Directive compared to initial expectations. The evaluation focuses on assessing the following evaluation criteria:

- **Effectiveness:** To what extent did the Directive lead to the changes it set out to achieve? To what extent can these changes/effects be credited to the Directive? To what extent do the observed effects correspond to the objectives?
- **Efficiency:** Were the costs involved justified, given the changes/effects which have been achieved? What factors influenced the achievements observed?
- **Coherence:** To what extent is the Directive coherent with other interventions which have similar objectives? To what extent is the Directive coherent internally?
- **Relevance:** To what extent do the objectives of the Directive correspond to the needs within the EU?
- **EU added value:** What is the additional value resulting from the Directive, compared to what could be achieved by Member States at national and/or regional levels?

[10] http://ec.europa.eu/smart-regulation/refit/index_en.htm

Articles of the Directive within the scope of this project

The focus of this project and this report is only on the following Articles of the Directive (Articles 1 to 7, 8, 8a, 9 and 9a of the FQD[11]):

- **Article 1** which confirms the scope of the Directive and its objectives;
- **Article 2** sets out the definitions used in the Directive
- **Article 3** sets out the specifications to be met by petrol fuel under the Directive,
- **Article 4** sets out the specifications to be met by diesel fuel under the Directive,
- **Article 5** ensures the free circulation of fuels which comply with the FQD specifications.
- **Article 6** enables the marketing of fuels that comply with more stringent environmental specifications, but only with a view to protecting the health of the population in a specific agglomeration or the environment in a sensitive area.
- **Article 7** is a general safeguard to prevent any disruptions of fuel supply to the transportation sector in case refineries cannot comply with the fuel specification due to an exceptional event.
- **Article 8** sets out the monitoring and reporting requirements of both member states and Commission.
- **Article 8a** limits the use of metallic additive MMT (Methylcyclopentadienyl manganese tricarbonyl) and requires labelling in case MMT or any other metallic additive is applied.
- **Article 9** contains the Commission's obligation to submit every three years a report to Parliament and Council on the functioning of the FQD.
- **Article 9a** requires Member States to set penalties for the breach of the provisions of the FQD.

The remaining Articles relate to final provisions on adaptation of the Directive to technical progress, Committee procedure, repeals and amendments, transposition deadlines and entry into force and are not considered further in this evaluation.

[11] In line with page 10 of the original Terms of Reference issued by the European Commission the role of Articles 7a-7e directly addressing GHG intensity of transport fuels will be analysed in a later evaluation, once sufficient experience has been gathered on implementing that aspect of the FQD. These Articles are implemented through Council Directive (EU) 2015/652 in April 2015, and due to be transposed by Member States by 21 April 2017. They are consequently outside of the scope of this evaluation exercise. However, the related fuels specification issues arising from the existence of Article 7a (e.g. in relation to blend limits of FAME and ethanol) are in scope as these are regulated in Articles 3 and 4 of the FQD.

2. The policy context in which the Directive operates

2.1 General background

The primary aims of the Directive 98/70/EC relating to the quality of petrol and diesel fuels[12] (commonly referred to as the Fuel Quality Directive (and hereinafter FQD)) are two-fold: to ensure a single market for fuels used in the EU in road vehicles and non-road mobile machinery, and to ensure high minimum levels of environmental and health protection in relation to use of these fuels.

These aims are in the context of the following considerations:

- requests from vehicle and machinery manufacturers to improve fuel quality;
- the burden arising for refineries and the fuel supply sector in relation to meeting more stringent fuel requirements;
- environmental and health impacts;
- security of energy supply; and
- resource efficiency.

Single Market

Promotion of a single market across Member States is one of the core objectives of the European Union. The Single European Act 1986 initiated the creation of the single market enabling legislation to be passed to introduce common laws for the EU. The single market refers to the EU as one territory without internal borders or regulatory obstacles to the free movement of goods and services. A functioning single market intends to stimulate competition and trade, improves efficiency, raises quality and helps cut prices.

The Commission has a role in:

- monitoring legislation implemented by EU Member States to ensure that it does not create unjustified technical barriers to trade; and
- working at completing the single market by tackling gaps in legislation and administrative obstacles.

The FQD is intended to facilitate the single market for selected fuels and enable the Commission to monitor this. Benefits of a single market for fuels include:

- Providing an efficient market for fuel suppliers across the EU;
- Facilitating engine and emission abatement technology design and manufacture by providing consistent minimum standards of fuel quality across the EU;
- Enabling consumers to access fuels across the EU with minimum standards for fuel quality consistent with warranties for vehicles sold across the EU; and
- Ensuring that vehicles within the EU can be refuelled across different Member States without compromising environmental performance.

[12] OJ L 350, 28.12.1998, p.58

Environment

With regards to the environmental protection aim in particular, the FQD does not operate in isolation, rather it is part of the wider EU environmental policy framework on air quality and greenhouse gas emissions.

Air quality is determined by the presence in the atmosphere of polluting substances which impact upon welfare, health or the environment. Emissions of greenhouse gases are of concern due to the association with climate change. The subject is complex considering the different types of substances emitted and emission sources (natural and man-made), the chemical reactions that can occur in the atmosphere and the transboundary nature of air pollution and impacts.

The improvement of air quality in particular has been one of Europe's main political concerns since the late 1970s, and in more recent years Europe has been at the forefront of international efforts to reduce emissions of greenhouse gases. Transport is a significant source of emissions and a sector which has seen a steady growth in activity levels. Therefore controlling the environmental impact of road and non-road vehicles is an important part of achieving Europe's wider environmental goals.

International commitments have been key in driving and shaping air quality policy in the European Union. The overarching policy instruments on air pollution within the EU include Directive 2001/81/EC on National Emission Ceilings (NECD)[13] and Directive 2008/50/EC on ambient air quality (AQD)[14]. These are complemented by specific legislation regulating different sources of air pollution, including the FQD among others.

At EU level, in December 2013 the Commission completed a comprehensive review of EU air quality policy, building on the 2005 Thematic Strategy on Air Pollution[15], which resulted in the publication of the Clean Air Policy Package[16]. The review concluded that, although the existing policy framework enabled a significant reduction in air pollution, important challenges remained to be tackled, including ground level ozone pollution, to which vehicle emissions contribute. It was noted in this review that meeting the air quality targets set out in the legislation relies on the full implementation of the existing associated legislation. The review also suggests that Member States may have to take additional measures.

The FQD also contributes to other high level programmes for the reduction of greenhouse gas emissions and energy security, namely the European Energy Union, 2030 climate and energy framework and EU 2020 strategy.

The table below illustrates the most relevant EU Directives which interact with the objectives of the Fuel Quality Directive.

[13] OJ L 309, 27.11.2001, p.22 http://ec.europa.eu/environment/air/pollutants/ceilings.htm
[14] OJ 152, 11.06.2008, p. 1
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32008L0050
[15] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52005DC0446
[16] http://ec.europa.eu/environment/air/clean_air_policy.htm

Table 2.1: Relevant Directives

Abbreviation	Instrument	Relevance to the Fuel Quality Directive
Euro 5–6 regulations	Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (Euro 5&6)[17].	Restrict emissions of NO_X, PM and hydrocarbons (HCs) from vehicles (petrol-powered and diesel-powered) and their specific replacement parts. It covers tailpipe emissions, evaporative emissions and crankcase emissions. FQD specifications enable fuel composition to contribute towards achievement of the standards along with technological solutions.
Euro V–IV regulations	Regulation 595/2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information (Euro VI HDV)[18].	
L-Category vehicles Regulation	Regulation (EU) No 168/2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles[19].	Restrict emissions of NO_X, PM and hydrocarbons (HCs) from vehicles (petrol-powered and diesel-powered) and their specific replacement parts. It covers tailpipe emissions, evaporative emissions and crankcase emissions. FQD specifications enable fuel composition to contribute towards achievement of the standards along with technological solutions.
NRMMD	Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery (NRMMD)[20]	
VOC-I Directive	Directive 1994/63/EC on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations (VOC-I Directive)	Intended to prevent emissions to the atmosphere of VOC during the storage of petrol at terminals and subsequent distribution to service stations. Implementation was obligatory from 31 December 1995. The vapour pressure limit in the FQD affects the likelihood of emissions from petrol during storage.
VOC-II Directive	Directive 2009/126/EC on Stage II Petrol Vapour Recovery during refuelling of motor vehicles at service stations (VOC-II Directive)	Aims to ensure the recovery of petrol vapour that would otherwise be emitted to the air during the refuelling of vehicles at service stations. Member States had until 31 December 2011 to transpose the directive into national law. The vapour pressure limit in the FQD affects the likelihood of emissions from petrol during

[17] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2007R0715:20080731:EN:PDF
[18] http://ec.europa.eu/enterprise/sectors/automotive/environment/eurovi/index_en.htm
[19] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:060:0052:0128:EN:PDF
[20] OJ L59, 27.02.98, p. 1. http://eur-lex.europa.eu/legal-content/GA/TXT/?uri=celex:31997L0068 and http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/emissions-non-road/index_en.htm

Abbreviation	Instrument	Relevance to the Fuel Quality Directive
		refuelling.
RED	Renewable Energy Directive	Sets biofuels targets which interact with the FQD specifications regarding biofuel content in petrol and diesel
ILUC	Indirect Land Use Change Directive[21]	Amends the RED and FQD to reduce the risk of indirect land use change and to prepare the transition towards advanced biofuels. Includes a number of additional reporting obligations for the fuel providers, EU Member States and the European Commission.
SCLFD **SCMFD**	Sulphur Content of Liquid Fuels Directive *and* Sulphur Content of Marine Fuels Directive	Impose limits on the sulphur content resulting from the combustion of certain types of liquid fuels used in stationary applications or marine vessels. Along with the FQD these Directives oblige refineries to restrict the sulphur content in a portion of refinery products.
Energy Taxation Directive	Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity22	Establishes a financial mechanism to promote the use of less polluting fuels and increases incentives to use energy more efficiently. Establishes minimum taxes on motor fuels, heating fuels and electricity, depending on the energy content of the product and the amount of CO_2 it emits.
AQD	Directive 2008/50/EC on ambient air quality and cleaner air for Europe	Sets local air quality targets for ground-level ozone and limits for benzene (amongst other pollutants) which may not be exceeded anywhere in the EU. Restrictions in the FQD control emissions from road transport and NRMM to contribute towards achieving these targets.
NECD	Directive 2001/81/EC on National Emission Ceilings for certain pollutants	Lays down limits on total national emissions for NO_X, SO_2, NH_3 and VOC which contribute to the formation of ground-level ozone, to eutrophication and to acidification. Ceilings had to be met from 2010 onwards for each Member State. Under the Clean Air Policy Package the Commission presented a proposal for a revised Directive which includes national emission reduction commitments for 2020 and 2030, including for $PM_{2.5}$. The Gothenburg Protocol is relevant in this context, setting emission ceilings for 2020.

[21] OJ L 239, 15.09.2015 p 1

[22] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF

Abbreviation	Instrument	Relevance to the Fuel Quality Directive
		Restrictions in the FQD control emissions from road transport and NRMM to contribute towards achieving these targets.
ESD	Effort Sharing Decision	Sets national greenhouse gas emissions reduction targets for Member States from non-ETS sectors. FQD requirements relating to biofuels influence the contribution from road transport and NRMM towards achieving these targets.
MMR	Monitoring Mechanism Regulation	Requires MSs to report on policies, measures and strategies to cut greenhouse emissions, amongst other aspects. FQD requirements relating to biofuels influence the contribution from road transport and NRMM within such strategies.

2.2 Background and evolution of the Directive 98/70/EC

Evolution of the Directive

Fuel quality legislation has a long standing history in European policy. The objectives of the Fuel Quality Directive are to ensure a single market for fuel for road transport and non-road mobile machinery while ensuring respect for minimum levels of environmental protection from use of this fuel.

When adopted, the aim of the FQD was to secure the proper functioning of the engines of road vehicles, reduce their direct tailpipe and evaporative emissions, while establishing a single fuel market across the EU and improving the security of European energy supply. To reach these objectives, the Directive set a range of minimum technical specifications on health and environmental grounds, for petrol and diesel fuels used in vehicles. An amendment of the Directive in 2003 (Directive 2003/17/EC[23]) made 'sulphur-free' petrol and diesel mandatory from 2009. This Directive also introduced the requirement that Member States monitor their compliance with the fuel quality standards through fuel quality monitoring systems.

Technological developments and more stringent environmental legislation have led over the years to the introduction of significantly more complicated engines and of more advanced exhaust after treatment systems. However, both of these (and in particular the exhaust treatment systems) are vulnerable to fuel quality. These tighter specifications introduced by the FQD were necessary to enable the use of the more advanced emissions abatement technologies in vehicles. Consequently the fuel quality standards have been strengthened, resulting in the EU wide introduction of sulphur free petrol and diesel. This has in turn led to the dramatic reduction of the share of emissions of lead and sulphur oxide from transport.

In addition to engine functioning, increased health concerns was the motivation to support the introduction of provisions on the limitation of metal additives to motor fuels.

[23] OJ L 76, 22.3.2003, p.10

With Directive 2009/30/EC[24], the scope of the FQD was extended to include non-road mobile machinery (NRMM), agricultural and forestry tractors and recreational craft when not at sea. The Directive also revised environmental quality standards for some fuel parameters so that ethanol can be use more widely in petrol. In addition, one of the main additions of this Directive is the introduction of the requirement that fuel suppliers reduce progressively the full life-cycle carbon levels in road fuels by 6% by 2020.

The latest developments in European fuel standards reflect the need for the FQD to support and facilitate European policy in the fields of alternative fuels and greenhouse gas emission reduction. In particular the harmonisation of fuel standards and biofuels policy stemming from Directive 2009/28/EC on the promotion of the use of energy from renewable sources[25] (commonly referred to as the renewable energy Directive (RED)), Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport[26] (commonly referred to as the Biofuels Directive) and their relation with the FQD Article 7a, in particular in relation to the GHG emissions of biofuels, while maintaining a single European fuel market are clearly important. These aspects were considered in 2009/30/EC. It was recognised that further updates of the FQD in this respect would be required to support longer term climate change and alternative fuel ambitions.

Amendments to the FQD in Directive 2011/63/EU[27] amends fuel standards to facilitate the introduction of Euro 6/VI vehicles.

In addition, Directive 2014/77/EC[28] amended the FQD to reflect the updated CEN (Committee for European Standardisation) analytical standards available, updating the references to these standards in Annexes I and II of the 98/70/EC Directive. The FQD is now a complementary and challenging part of the EU's transport and environmental and climate acquis.

Summary of the Articles

The FQD sets fuel quality standards for the fuels industry on the grounds of environmental and health benefits. Below is a brief description of the aim of each of the Articles within the scope of this evaluation:

- **Article 1** of the FQD confirms the Directive's objectives and clearly indicates that the scope of the FQD is not limited to road vehicles, but also includes non-road mobile machines, inland waterway vessels (when not at sea), recreational crafts and tractors. Fuels used by sea going ships (regulated under Directive 1999/32/EC and its amendments) and aviation are not covered by the FQD.
- The definitions in **Article 2** support establishing a harmonized single fuel market.
- **Article 3** ensures that petrol in the EU is generally lead free and sulphur free (<10 ppm). Fuel may contain up to 10% v/v ethanol and up to 3.7 % m/m oxygen content and fulfils octane, vapour pressure, distillation and specific hydrocarbon requirements. Special derogations were introduced to facilitate the introduction of this petrol standard: for outermost regions, for Member States with low ambient summer temperatures, for very limited quantities of leaded fuel and an ethanol vapour pressure waiver. Most derogations are accompanied by additional conditions and notification obligations.

[24] OJ L 140, 5.6.2009, p.88
[25] OJ L 140, 5.6.2009, p.16
[26] OJ L 123, 17.5.2003, p.42
[27] OJ L 147, 2.6.2011, p.15
[28] OJ L 170, 11.6.2014, p62

As some older vehicles are not capable of handling petrol with up to 10% ethanol (E10), the continued supply of petrol with up to 5% ethanol (E5) was ensured for a transitional period with an appropriate geographical coverage. The transitional period was originally foreseen to end in 2013, with the possibility of extension. E5 and E10 are to be marked adequately.

- **Article 4** ensures that diesel for road vehicles in the EU is generally sulphur free (<10 ppm), may contain up to 8% m/m polycyclic aromatic hydrocarbons and fulfils cetane, distillation and density requirements. Regarding the permitted upper limit of FAME (Fatty Acid Methyl Esters), Article 4 allows Member States to introduce levels of FAME higher than 7%, even though Annex II, which sets out the specifications for diesel fuel specifies an upper limit of 7% FAME in diesel. For the outermost regions and Member States with severe winter conditions special derogations apply. As of the end of 2011 all transitional periods have expired and gas oil for use in non-road mobile machinery (NRMM), inland waterway vessels, tractors and recreational crafts should be sulphur free. The CN code and the sulphur content are the only requirements for gas oil in the FQD.
- **Article 5** ensures the free circulation of fuels which comply with the FQD specifications.
- **Article 6** enables the marketing of fuels that comply with more stringent environmental specifications, but only with a view to protecting the health of the population in a specific agglomeration or the environment in a sensitive area.
- **Article 7** is a general safeguard to prevent any disruptions of fuel supply to the transportation sector in case refineries cannot comply with the fuel specification due to an exceptional event.
- **Article 8** is on the monitoring and reporting requirements of both member states and Commission. The annual reports are a valuable source of information on the implementation and achievements of the FQD.
- **Article 8a** limits the use of metallic additive MMT (Methylcyclopentadienyl manganese tricarbonyl) and requires labelling in case MMT or any other metallic additive is applied.
- **Article 9** contains the Commission's obligation to submit every three years a report to Parliament and Council on the functioning of the FQD. Continuing technical progress in the fields of automotive and fuel technology coupled with the continuing desire to ensure that the level of environmental and health protection is optimised necessitate periodic review of the fuel specifications based upon further studies and analyses of the impact of additives and biofuel components on pollutant emissions.
- **Article 9a** requires Member States to set penalties for the breach of the provisions of the FQD.

The remaining Articles relate to final provisions on adaptation of the Directive to technical progress, Committee procedure, repeals and amendments, transposition deadlines and entry into force and are not considered further in this evaluation.

Baseline for this project

In order to evaluate the FQD, a baseline counterfactual has been defined, against which the project team can carry out the evaluation of the relevant Articles.

At the inception meeting it was agreed that the primary baseline should be the situation before the amendments included in Directive 2009/30 had taken effect and

that the accompanying Impact Assessment[29] could be used to inform that baseline. Seeking to establish a counterfactual based on an earlier iteration of the Directive, or a scenario without the Directive, would provide a very uncertain basis for comparison. In the following table the selected baseline for substantial provisions of Directive 2009/30 are specified.

[29] https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp

Table 2.2: Definition of baseline for the evaluation analysis of the FQD

Important amendments introduced by directive 2009/30/EC	Selected baseline
Confirmation of: • maximum 10 ppm sulphur content petrol and diesel • maximum aromatics content petrol: 35%	• Maximum 50 ppm sulphur content petrol and diesel • Maximum aromatics content petrol: 42% Directive 2003/17/EC established a limit value of 10 ppm sulphur and as per 1 January 2009 subject to a review.
For clarity and legal certainty: fuels for inland waterway vessels and recreational crafts covered by FQD only.	Gas oil for inland waterway vessels covered by both Directive 1999/32/EC and FQD No clarity on fuel for recreational crafts
New elements: • Introduction E10 and in transitional period secure availability of both E5 and E10 • Introduction of a 7% limit for FAME in diesel (B7) • Introduction of a vapour pressure waiver • Derogation small amounts leaded petrol	• Only E5 available, as 5% ethanol content (and comparable other oxygenates) was limit under Directive 2003/17/EC • No FAME limit • No vapour pressure waiver • No leaded petrol derogation
Strengthening existing provisions: • Maximum 10 ppm sulphur content gas oil • Maximum polycyclic aromatic hydrocarbons content diesel: 8%	Levels according to Directive 2003/17/EC • Maximum 1000 ppm sulphur (as per 2008) • Maximum polycyclic aromatic hydrocarbons content diesel: 11%

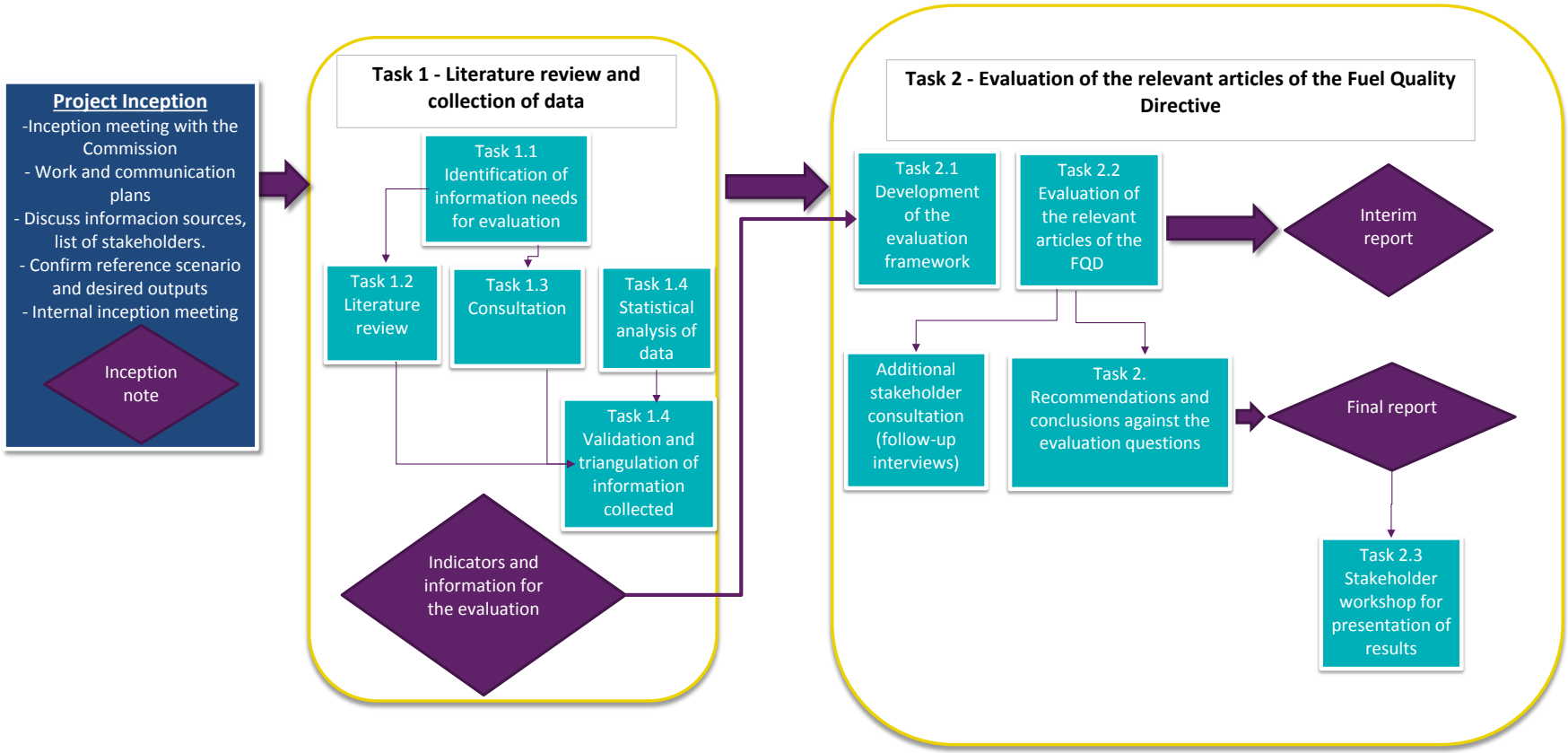
3. Methodology

This section describes the overall methodology for the project. It sets out the intervention logic and the analytical framework. It also details the research and data gathering activities.

3.1 Overview

The figure below illustrates the project task workflow for this project.

Figure 3.1: Project tasks overview



3.2 Methodological approach to the evaluation

Intervention logic

The starting point of this evaluation has been to consider the logic of the EU intervention when introducing the 2009/30 amendments to the FQD through the 'intervention logic' diagram. The aim of the evaluation is to judge whether the Directive has met, through its specific objectives and the actions performed by the parties involved, the general objectives and needs it was intended to address and whether it has achieved the expected effects (i.e. consequences, results, impacts). It involves assessing the extent to which the Directive has led to changes (including those that were unintended or unexpected), as well as measuring the level of influence that other external factors might have had on these changes.

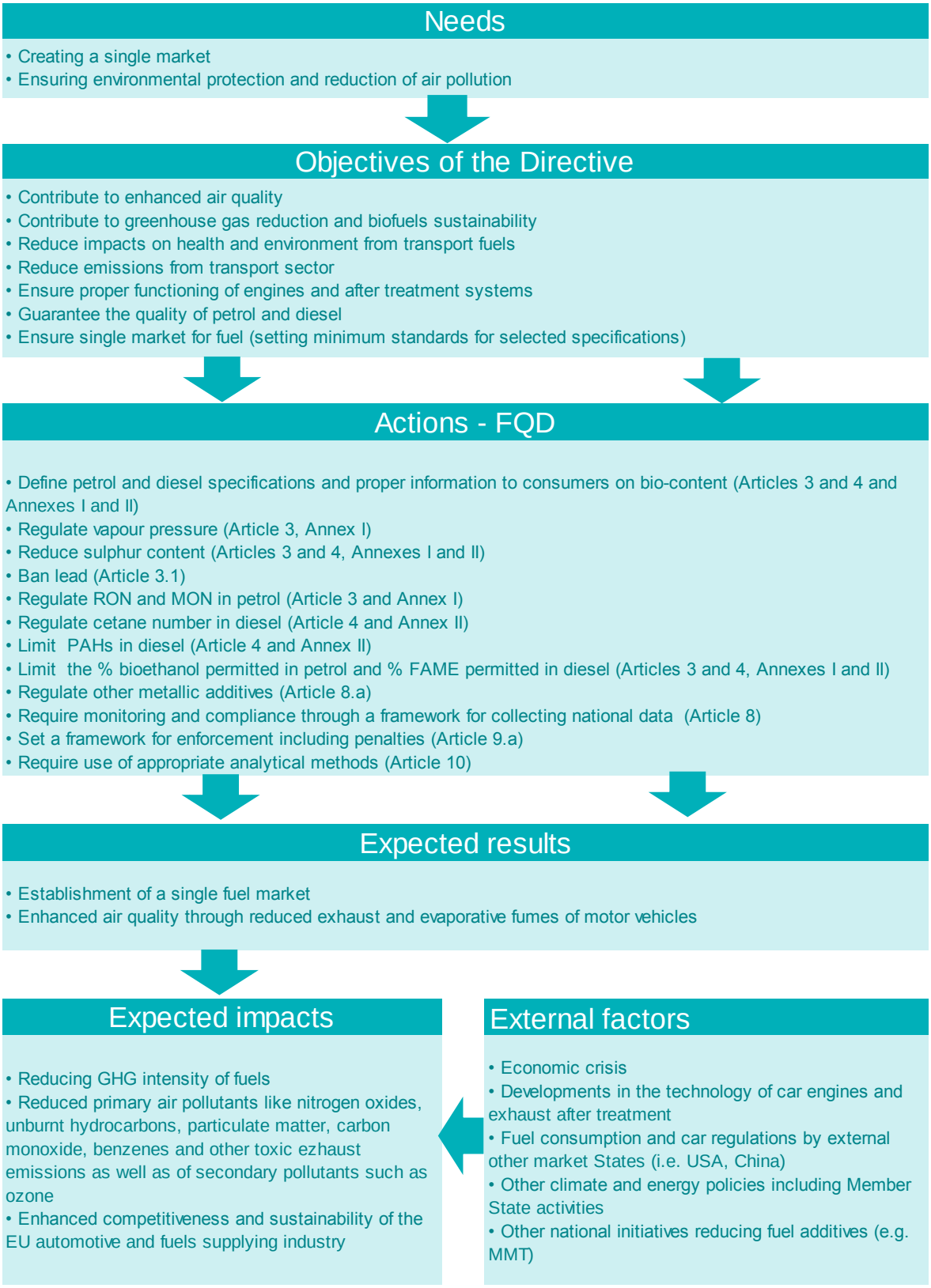
The intervention logic is set out in Figure 3.2 and illustrates how the different components to be assessed are linked together.

The intervention logic serves as the basis for the analytical framework by providing an overview of the key areas, objectives, actions, expected outputs and impacts of the Directive that need to be considered during the evaluation. The starting point of the evaluation methodology is the "needs" that have led to the adoption of the Directive. This looks back to the reasoning behind the adoption of the Directive (i.e. the need to ensure a single market and protecting the environment), but it also looks forward to whether the Directive addresses current needs. The overall objective of the Directive is to ensure a single market for fuels by setting a minimum specification for these to be marketed based on environmental and health grounds. However, more precise objectives can be derived from the understanding of the needs and include, for example: contributing to enhanced air quality; reducing impacts on health by ensuring emissions of lead, NO_X and particulate matter (PM) from petrol and diesel are reduced, reducing impacts on the environment by reducing emissions of a range of substances (NO_X, SO_X, PM) from transport fuels; and facilitation of a single market for fuel using CN codes.

The objectives are translated into "actions" which are the specific requirements contained in the Directive's articles which state obligations for fuel manufacturers, Member States, and EU institutions. One important part of the evaluation is to understand whether the totality of the actions deliver the objectives of the Directive. There are also questions of efficiency, cost and coherence of these actions that need to be considered. The consequences of actions lead to expected results and impacts.

Overall, the results should match the needs and have minimal unintended or undesirable consequences; understanding this relationship is critical to the evaluation process. The impacts are broader than the results and include effects from the intervention. Finally, in meeting the objectives of the Directive, a range of external factors (e.g. economic situation, technological development) enter into play which may benefit or hinder the delivery of the objectives and affect the impacts.

Figure 3.2: Intervention logic



Analytical framework

Evaluation questions have been established based on the intervention logic. These questions were also guided by the evaluation questions set up in the Commission's Evaluation Guidelines[30] for effectiveness, relevance, efficiency, coherence and EU added value. These evaluation questions are set out in the table below.

Table 3.1: Evaluation questions

Criteria	Evaluation questions
Effectiveness	EQ 1 How well does progress towards the objectives of the Fuel Quality Directive match the initial expectations for this directive? EQ 1.1 Has the FQD been effective in reducing transport emissions? EQ 1.2 Does the FQD ensure a single market? Are there potential improvements if the scope was changed? EQ 1.3 Does the FQD ensure the proper functioning of engines and emissions after treatment systems? EQ 1.4 Does the use of CN-codes contribute to establishing a single fuel market? Should additional definitions or codes be used? (Article 2) EQ 1.5 Is the petrol fuel placed on the market in compliance with the specifications of Annex I of the Directive? EQ 1.6 Have the derogations in Article 3 been effective? EQ 1.7 Is the diesel fuel placed on the market in compliance with the specifications of Annex II of the Directive? EQ 1.8 Were there any cases of MS States prohibiting, restricting or preventing marketing of fuels complying with the Directive? (Article 5) EQ 1.9 What environmental gains have been achieved by this Article (which allows MS to require some fuels to meet more stringent environmental specifications) (Article 6) EQ 1.10 Has the application of Article 7 ensured a supply of fuel following exceptional events which would otherwise have led to the loss of supply? (Article 7) EQ 1.11 Have Member States resumed compliance with lower limits after the 6 month derogation periods? (Article 7) EQ 1.12 What are the impact on health and the environment of this Article? (Article 7) EQ 1.13 Has the reporting of MS been useful to reduce health and environmental impacts from fuels used in transport? (Article 8) EQ 1.14 Would the use of MMT be any different without this Article, and which would be the impacts of this? (Article 8a) EQ 1.15 Has the reporting and proposal as required by this Article resulted in a better understanding of the impacts of the Directive and how it could be further developed?(Article 9) EQ 1.16 Have penalties for not meeting the Directive have been imposed by Member States? (Article 9a) EQ 1.17 Have penalties for not meeting the Directive have been imposed by Member States?
Efficiency	EQ 2.1 Has the Directive delivered its objectives in an efficient manner? EQ 2.2 Have the definitions contributed to the clear implementation of the FQD? EQ 2.3 What are the costs arising from the restrictions on petrol and diesel fuel that can be placed on the market? (Articles 3 and 4) EQ 2.4 What are the benefits arising from the restrictions on petrol and diesel fuel that can be placed on the market? (Articles 3 and 4) EQ 2.5 Are the costs arising from the restrictions of petrol and diesel fuel that can be placed on the

[30] The Commission published (in May 2015) a revised version of the 2004 Evaluation Guidelines. See Guidelines on evaluation and Fitness Checks

Criteria	Evaluation questions
	market justified in light of the benefits? (Articles 3 and 4)
	EQ 2.6 What are the costs arising from the application of the derogations? (Articles 3 and 4)
	EQ 2.7 What are the benefits arising from the application of derogations? (Articles 3 and 4)
	EQ 2.8 Have the costs outweighed the benefits in the application of derogations? In particular with regards to the derogation for the Outermost Regions? (Articles 3 and 4)
	EQ 2.8 Could the environmental gains achieved by this Article have been met against lower costs? (Article 6)
	EQ 2.10 Has the authorisation to use higher limits in case of change in supply of crude oils been justified in terms of costs? (Article 7)
	EQ 2.11 Are the monitoring and reporting obligations included in the FQD cost efficient? (Article 8)
	EQ 2.12 Could the Directive be effectively enforced against lower costs? (Article 9a)
Coherence	EQ 3.1 Is the Directive coherent with other Directives and EU policies? (General)
	EQ 3.2 Is the scope of the Directive clear? Is it coherent with other Directives in terms of fuels covered in each of them? (Article 1)
	EQ 3.3 Is the limitation to health and environment in the scope of the FQD coherent with long term ambition on climate policy and air quality?(Article 1)
	EQ 3.4 Are the definitions in line with those included in other legislation? (Article 2)
	EQ 3.5 Are the specifications in Annex I coherent with the rest of the Directive and with other legislation or standards in the EU and beyond? (Articles 3)
	EQ 3.6 Are there interactions between Annex I requirements and vehicle standards? (Article 3)
	EQ 3.7 Is the derogation for the Outermost Regions coherent with the approach taken by other Directives? (Article 3)
	EQ 3.8 Are the specifications in Annex II coherent with the rest of the Directive and with other legislation or standards in the EU and beyond? Article 4)
	EQ 3.9 Are there interactions between Annex II requirements and vehicle standards? (Article 4)
	EQ 3.10 Is the derogation for the Outermost Regions coherent with the approach taken by other Directives? (Article 4)
	EQ 3.11 Is the free circulation of fuel compliant with the requirements of the FQD coherent with other EU legislation?
	EQ 3.12 Is the provision of the Article coherent with the rest of the Directive? (Article 7)
	EQ 3.13 Are the monitoring and reporting obligations aligned with other related monitoring and reporting obligations? (Article 8)
	EQ 3.14 Do the requirements related to the review process contradict other legislation? (Article 9)
	EQ.15 Do the penalties established by the Article contradict or contribute to the objectives set by other legislation? (Article 9a)
Relevance	EQ 4.1 Is the FQD still relevant?
	EQ 4.2 Does the scope bring unwanted restrictions? If so, what should be changed? (Article 1)
	EQ 4.3 Are the definitions still adequate? (Article 2)
	EQ 4.4 Is the limitation of petrol fuel placed on the market still necessary? (Article 3)
	EQ 4.5 Are the specifications in Annex I adapted to the latest technical and scientific progress? (Article 3)
	EQ 4.6 Are the derogations still relevant? (Article 3)
	EQ 4.7 Is the limitation of diesel placed on the market still necessary? (Article 4)
	EQ 4.8 Are the derogations still relevant? (Article 4)
	EQ 4.9 In the absence of this Article, would any Member State prohibit, restrict or prevent marketing of fuels complying with the Directive? (Article 5)
	EQ 4.10 Have any Member States used this Article since 2009? (Article 6)
	EQ 4.11 Are more stringent environmental fuel specifications still relevant in some cases? (Article 6)
	EQ 4.12 Is the safeguard to prevent disruptions to fuel supply still necessary? How often were MS

Criteria	Evaluation questions
	authorised to use this Article? (Article 7) EQ 4.13 Is the use of metallic additives still regarded as relevant option? (Article 8a) EQ 4.14 Was this Article necessary for the reporting and preparation of a proposal by the EC? (Article 9) EQ 4.15 Are penalties necessary for meeting the objectives of the Directive? (Article 9a) EQ 4.16 Is this Article necessary for Member States to set penalties? (Article 9a)
EU Added Value	EQ 5.1 What is the overall perception of the Directive among stakeholders? (general) EQ 5.2 Could a single market by ensured by repeal of the FQD? (in the absence of the FQD) EQ 5.3 Does the scope as defined justify EU intervention? (Article 1) EQ 5.4 Does the FQD give the fuel and car industry a strong home-market? Does this bring competitive advantages over non-EU industries? (Article 1) EQ 5.5 Are the definitions chosen advantages to the EU industry? Would the EU benefit from adoption of definitions used in other regions? (Article 2) EQ 5.6 How has this Article been perceived by stakeholders? (Article 3 and 4) EQ 5.7 Has the fact that some Member States have stricter limits reduced the added value of the Directive? (Article 3 and 4) EQ 5.8 How has this Article been perceived by stakeholders? (Article 6) EQ 5.9 How has this Article been perceived by stakeholders? (Article 7) EQ 5.10 Is action at EU level still prescribed? (Article 7) EQ 5.11 How has this Article been perceived by stakeholders? (Article 8) EQ 5.12 Would MS monitor and centrally report this information without EU intervention? (Article 8) EQ 5.13, 5.14, 5.15 How have various Articles been perceived by stakeholders? (Articles 8a, 9, 9a)

The evaluation has been carried out following an analytical framework which maps the following elements by evaluation criterion:

- **Evaluation questions and/or sub-questions** that allow a focused and operational examination of the evaluation criteria.
- **Success/ judgment criteria** specifying what determines success or failure when evaluating a given question. This improves the transparency of the evaluation by making explicit how judgment is applied.
- **Qualitative and quantitative indicators** used to inform judgment on the questions and issues and assess success according to the judgement criterion chosen. Some indicators might be used to answer several evaluation questions. They determine the type of information to be collected and potential data sources.
- **Methods and tools** to be used to gather and assess the necessary evidence to respond to the evaluation questions, on the basis of the indicators identified. The input data for the indicators and criteria has been based on evidence collected via desk-based study and stakeholder consultation involving a range of organisations and individuals with experience of the directives.

The consolidated analytical table mapping each of the above elements per evaluation question is presented in Appendix F.

3.3 Data collection and analysis

Stakeholder consultation

Stakeholder consultation was a significant component of the data gathering efforts for this evaluation. It was anticipated from the inception stage of the project that published literature for a number of key areas would be scarce, in relation for example to some of the less publicised Articles and Articles which have not been applied to date, and for which there would therefore not be a body of published research. Also for the evaluation theme of EU-added value, information from stakeholders was considered to be vital.

The stakeholder consultation exercise comprised of two stakeholder questionnaires (one for Member State competent authorities, and one for other stakeholders). Questions were tailored for each set of stakeholders. In addition, follow-up telephone interviews were carried out with selected Member States and stakeholders in December 2015.

Consultation questionnaire

The questions were selected taking into account relevance to each of the two groups consulted and aimed to obtain information to inform the evaluation of the Directive against the five evaluation criteria. The questionnaires can be found in Appendix G and Appendix H of this report.

The consultation was launched on 25th August, with a closing date for submission of 24th September (4 weeks). A number of submissions were received after the 24th September which have been incorporated in this evaluation. The questionnaire was launched using an online platform. A wide range of relevant stakeholders were contacted directly to raise awareness of the survey and invite responses.

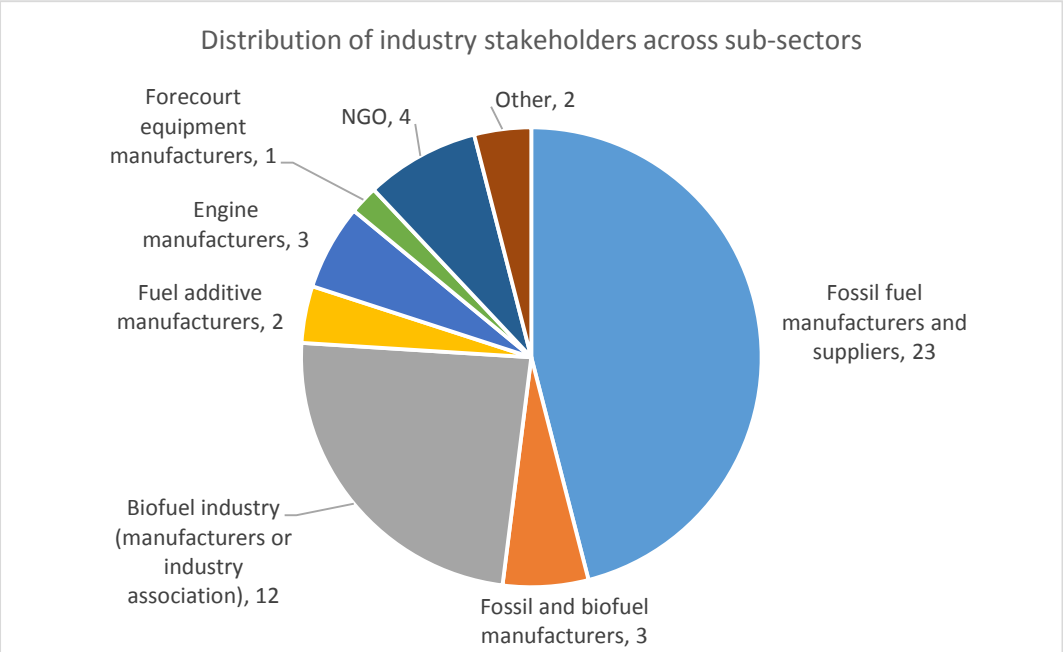
A total of 17 responses to the Member State authority questionnaire were received by the close of 2015 and are included in the analysis for this report[31] (Austria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Latvia, Luxembourg, Malta, the Netherlands, Romania, Slovakia, Slovenia, Sweden and the United Kingdom).

The general stakeholder questionnaire received responses from 50 stakeholders, including some late responses after the closure of the original deadline for submissions. The responding stakeholders included 23 fossil fuel manufacturers and suppliers (this includes private sector companies, the Fuels Europe industry association, the Union of European Petroleum independents (UPEI) and national oil industry associations from individual Member States), 12 biofuel industry stakeholders (manufacturers and industry associations), three fossil and biofuel manufacturers, three engine manufacturers, two fuel additive manufacturers, the Forecourt Equipment Federation (FEF), the Alliance for Synthetic Fuels in Europe (ASFE), Inland Navigation Europe (INE) and four environmental non-governmental organisations (NGOs). Two anonymous responses to the questionnaire were received. These remain anonymous throughout the report, however on the basis of their responses they have categorised within the relevant stakeholder segments (as one biofuel industry stakeholder and one fossil fuel supplier or manufacturer) listed above and included in the figure below. Full details of the responding stakeholders can be found in **Appendix A** to this report.

Figure 3.3 below illustrates the distribution of stakeholders across industry sub-sectors, NGOs and others. This is particularly relevant in the analysis of issues for which there are different drivers across the different industry sub-sectors, e.g. costs and benefits associated with implementation of the Directive impact engine manufacturers and fuel suppliers differently.

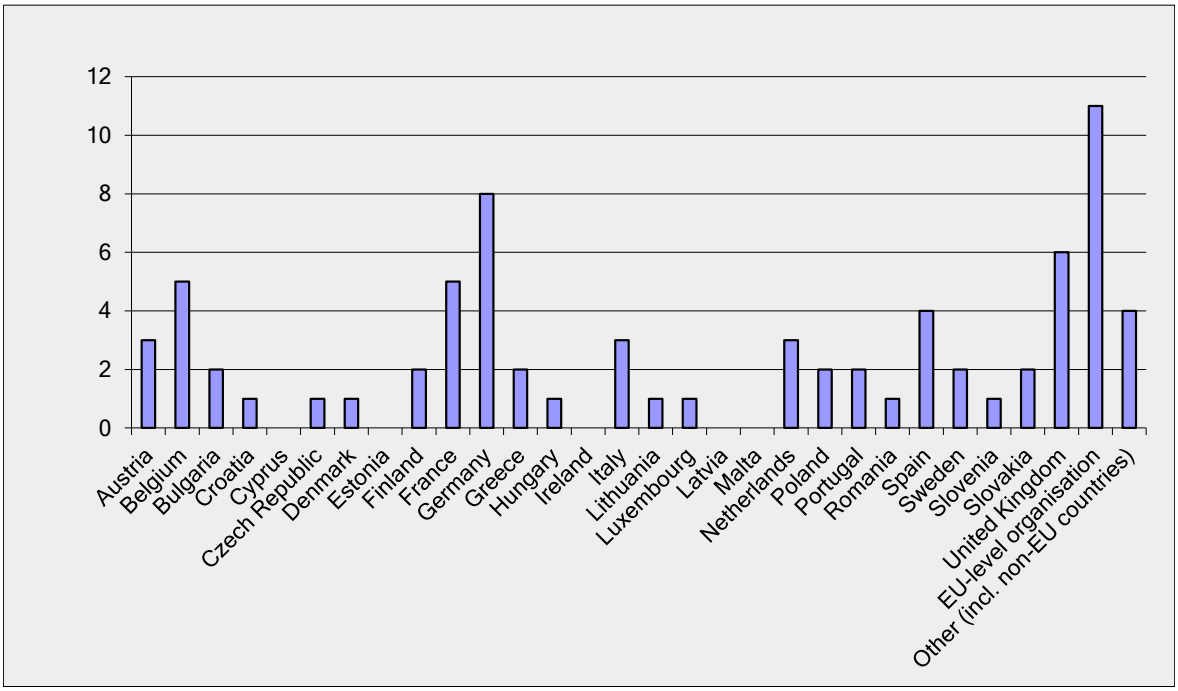
[31] One of the 17 responses received is from Croatia, for which the FQD only applied from 2013 onwards

Figure 3.3: Distribution of stakeholders by sub-sector



Responding stakeholders were based or operate in a wide range of EU Member States, with industry stakeholders from all Member States except Cyprus, Estonia, Ireland, Latvia and Malta responding. In addition, 12 indicated that they were EU-level organisations. Figure 3.4 illustrates the range of countries from which stakeholders responding to the questionnaire were based or operated in (each stakeholder may indicate multiple countries of operation).

Figure 3.4: Countries in which the stakeholder responding to the questionnaire are based and/or operate in (each stakeholder can select multiple countries).



A number of partial responses to the questionnaire were received for Member State and stakeholder questionnaires. These have been retained and included in the analysis, except where the respondent had not provided any specific answers[32]. This is reflected in the evaluation in section 4. For example, if for a particular question a chart indicates 35 industry responses were received, this means that 15 of the 50 industry stakeholders did not reply to that particular question.

Full details of the stakeholders which responded are available in Appendix A.

Additionally, the full list of stakeholders who were invited by email to participate in the questionnaire (but have not responded) is provided in Appendix B.

Limitations of the stakeholder consultation

In responding to the stakeholder questionnaire, some industry bodies have provided a single coordinated response on behalf of their members. However, both Fuels Europe and the European Biodiesel Board have discussed and coordinated responses to the questionnaire with their members, before the submission of individual responses by members, in addition to responses from Fuels Europe and European Biodiesel Board being received. This has meant that in some cases there are a number of verbatim identical or very similar responses submitted by the 12 national oil industries as well as Fuels Europe. If analysis of the numeric responses only were carried out, there would be the potential for such responses to bias the overall summary of responses. In order to avoid this we have indicated where this is the case, in particular where the detailed commentary responses received are common across a number of these organisations. However, responses from members of these industry organisations are not entirely identical, and in some cases certain organisations have provided additional more detailed commentary than that provided in the association response. For this reason the individual member responses have all been considered.

Follow-up interviews

Following analysis of the questionnaire responses, targeted follow-up interviews were carried out in December 2015 with a selection of Member States and other stakeholders as listed below. The dual aims of these follow-up interviews were:

- To increase the participation among Member States, in particular to ensure a better coverage of all geographic areas of the EU.
- To obtain more depth of response and analysis from a number of Member States and other stakeholders who had already responded to the questionnaire, where there were areas of particular interest for the evaluation.

Interviews with additional Member States

In order to increase the participation from Member States to the consultation exercise, follow-up interviews were carried out with Finland[33], Italy, Spain and Poland, all of which had not previously responded to the questionnaire. Follow-up with Spain was carried out by telephone, the remainder provided responses to a shorter list of targeted questions by email.

[32] This suggests stakeholders were trying to look through the online questionnaire without intending to respond at that time. Such responses (containing in excess of 90% blank responses) have therefore been excluded from the analysis.
[33] Finland then also took the opportunity to respond to the full questionnaire, hence is included in the analysis of responses for the full questionnaire also.

Follow-up interviews for further detail with Member States

Follow-up interviews were carried out with France, Sweden, the Netherlands and the UK (all by telephone). These Member States had already replied to the online questionnaire, however, there were additional areas of detail to explore as follows:

- France is the only Member State to have applied derogations in relation to the Outermost Regions for Articles 3 and 4 (specifically for Mayotte),
- The UK is the only Member State to have considered application of Article 7.
- It had been reported by certain industry stakeholders that Sweden had applied Article 6 – a follow-up interview was carried out to establish whether this was the case (it was not).
- The Netherlands were reported to have recently reviewed their transposition of the FQD and introduced a B+ grade without specifying an upper limit of biofuel content.

Due to scheduling constraints the follow-up interview with the Netherlands was carried out in January 2016.

Follow-up interviews for further detail with stakeholders

Follow-up interviews were carried out with Euromot, ACEA, Fuels Europe[34], ePure and T&E. These had all already replied to the questionnaire and the follow-up communications were carried out in order to obtain more depth and clarification to some responses.

Literature review

A literature review has been carried out, focussing on available information at the EU level, both published by the European Commission and by industry organisations. A summary of each source referenced in this report is presented in **Table 3.2** below.

For additional background, the bibliography in Appendix C includes all references which were reviewed during the course of this project, including those which were ultimately not referenced in the evaluation because they did not contain directly relevant information.

It is important to assess the relevance, reliance and independence of all data sources reviewed, therefore the team applied the following hierarchy to data sources:

A) The first source of data used has been the annual summary reports for the FQD prepared on behalf of the Commission, together with the individual Member State submissions under the reporting obligations of the FQD. The summary reports compile the fuel quality monitoring data collected for the last year and compare these with previous years. The most recent available summary report by Ricardo-AEA cover the reporting year 2013, in addition the European Environment Agency (EEA) has published a report on fuel quality monitoring for the 2014 year (EEA, 2015).

B) Reports commissioned by the EU (DGs and EEA) have been reviewed and have proved a good source of data in some cases, e.g. information on the impact on EU refineries of complying with the FQD (JRC 2015). They are a key high-quality input to this project.

[34] Initially both CONCAWE and FuelsEurope were invited to follow-up interviews, however following discussion they stated that the response from FuelsEurope is considered to include any necessary information from CONCAWE due to the close working relationship of the two organisations.

C) EU Communications in relation to e.g. derogations under the FQD have also been reviewed for relevant information.

D) General published information on the implementation of the FQD has also been explored. However, this information is very limited and a large proportion of the publicly available literature focuses on Article 7a which is out of the scope of this study. Therefore, this information has not been incorporated into this report.

E) The fifth category of information sources used includes publications and position papers from industry associations. These include published outputs from research funded by the associations, and also provide an indication of the industries' main concerns, which are especially relevant for the evaluation of the coherence and efficiency of specific articles within the Directive. Available information from the following associations has been included:

- ACEA (European Automobile Manufacturer's Association);
- Fuels Europe;
- CONCAWE (the European Oil Company Association for Environment. Health and Safety);
- EUROMOT (the European Association of Internal Combustion Engine Manufacturers);
- CLEPA (European Association of Automotive Suppliers);
- OICA (International Organisation of Motor Vehicle Manufacturers).

F) Information available in the Worldwide Fuel Charter was also analysed, since this document includes information on issues related to engine performance and interactions between engines and fuels. Finally, reports from ICCT (the International Council on Clean Transportation) have also been analysed. The ICCT publishes a wide range of studies on health impacts of the road transport sector, as well as costs of clean technology and the implementation of legislation.

A review of academic articles has not been carried out, since it was considered not to be the best use of the limited resources available for this study, and was unlikely to yield relevant information for this evaluation. Resources were instead focussed on searching for quantitative costs data through literature review and through the follow-up interviews.

Table 3.2: Review of all references used in the evaluation report t (excludes Commission publications such as Directives and Communications)

Source	Summary
Summary FQD reports	
EU Fuel Quality Monitoring – 2007 Summary Report (AEA, 2008)	This summarises annual reporting from Member States under the FQD for the reporting year 2007 (descriptions of Fuel Quality Monitoring Systems (FQMS) in place, compliance with sampling and reporting requirements, compliances with the Directive limits, sales of fuels per Member State). It provides an overview of fuel sales across the EU for the 2007 year (split between petrol and diesel, sulphur content of fuels). The report also presents an individual summary for each Member State, summarising fuel availability, fuel quality monitoring, temporal trends and key areas for improvement for each Member State.
EU Fuel Quality Monitoring – 2009 Summary Report (AEA, 2011)	As above but for the reporting year 2009. Indicates that Member States have transitioned fully to sulphur free fuel from

Source	Summary
	the 1st Jan 2009 as required by the FQD.
EU Fuel Quality Monitoring – 2011 Summary Report (Ricardo-AEA, 2013a)	As above but for the reporting year 2011 including distribution of petrol sales across the different bio blends.
EU Fuel Quality Monitoring – 2012 Summary Report (Ricardo-AEA, 2014a)	As above but for the 2012 year.
EU Fuel Quality Monitoring – 2013 Summary Report (Ricardo-AEA, 2014b)	As above but for the 2013 year.
EU fuel quality monitoring — 2014: Summary report. Technical report No 26/2015. (EEA, 2015)	As above but for the reporting year 2014, with the addition of information on the percentage of bio components used within petrol and diesel as sold, details of sampling carried, and details any exceedances recorded during monitoring (against FQD specifications).
Reports commissioned by the EU	
Fuel specification for non-road mobile machinery (Task 1). Support for the preparation of reports under Article 9.1 of Directive 98/70/EC on the quality of petrol and diesel fuels (AMEC, 2012 a)	This report concerns Directive 98/70/EC as amended by Directive 2009/30/EC. The project relates to the obligation on the Commission to provide a report by 31 December 2012, and every three years thereafter, to the Parliament and the Council, including a proposal for amendments where appropriate. Specifically, this report considers Article 9(1)(c): the costs and benefits of possibility of applying the requirements of Annex II for road diesel also to gas oil used in non-road mobile machinery (including inland waterways vessels), agricultural and forestry tractors and recreational craft (NRMM).
Permitted summer petrol vapour pressure (task 2). Support for the preparation of reports under Article 9.1 (c and j) of Directive 98/70/EC and on the quality of petrol and diesel fuels. (AMEC 2012b)	This report considers Article 9(1) (j): to provide analysis to inform the Commission view on the costs and benefits associated with a potential lowering of the maximum permitted summer vapour pressure for petrol set in the Directive.
Mid-term evaluation of the Renewable Energy Directive. A study in the context of the REFIT programme (CE Delft, Ecologic Institute, Ricardo-AEA, REKK & E-Bridge, 2015)	This mid-term evaluation of the Renewable Energy Directive (RED) aims to assess the effectiveness and efficiency so far of measures and actions laid down in the Directive. The RED came into force at the end of 2009, and set binding national renewable energy targets and a mandatory target for renewable energy use in transport for 2020, among a range of other provisions. The study also assesses the impact of the RED requirements for administrations and businesses (the administrative burden) at Member State (MS) level, in line with the requirements of the regulatory fitness programme (REFIT) of the European Commission.
Late lessons from early warnings: science, precaution, innovation. Report 1/2013. European Environment Agency (EEA, 2013)	This report is the second of its kind produced by the EEA in collaboration with a wide range of external experts and peer reviewers. The project aims to demonstrate the damages and costs of misusing the precautionary principle by presenting a series of case studies and an explanation of lessons learned. The JRC Refineries Fitness Check report referenced elsewhere applied the damage cost functions available in this report in order to calculate the benefits of reduced sulphur content in fuel in terms of reduced SO_2 emissions.
National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP	Statistics on air pollution based on the national emissions reported to the LRTAP Convention

Source	Summary
Convention (EEA, 2014)	
Driving renewable energy for transport: next generation policy instruments for renewable transport (RES-T-NEXT). (CE Delft, 2015)	Renewable energy sources in transport (RES-T) are crucial for mitigating climate change. As transport is currently almost entirely dependent on conventional fuels and, as such, has a significant share in global emissions, the transition to RES-T is an important aspect of broader climate policy. This transition requires changes in three dimensions: the vehicle fleet, energy infrastructure and energy carriers. The required changes depend on the technology pathway: battery-electric, hydrogen or biofuels. This study investigates the main barriers to each RES-T pathway and for all three dimensions, assesses individual policy instruments and defines an overall policy strategy to overcome these barriers. The main focus is on urban road transport
Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package. Version 2, corresponding to IIASA TSAP Report #11, Version 2a. (EMRC, 2014)	This report was prepared as part of the process to inform the revision of the EU's Thematic Strategy on Air Pollution. The general method follows that adopted for the development of the Strategy in 2005 under the Clean Air For Europe (CAFÉ). The report includes updated damage cost estimates for pollutant emissions from transport, taking into account new data published by the World Health Organisation (WHO) Health Risk of Air Pollution in Europe (HRAPIE project) on impact of pollutants including PM and NO_2. However, this report only included damage cost estimates for ozone and PM, because there was some evidence to suggest that double-counting could occur under the CAFÉ methodology if applying damage cost functions to both PM and NO_2. The report also identified the need for further research in order to update the damage cost value for NO_2 to include latest WHO research. On the basis of the damage cost functions, the report compared and quantified the health impacts of different scenarios including current legislation (CLE) and Maximum Technically Feasible Reduction (MTFR) scenario, and a series of intermediate scenario for 2025 and 2030.
Impact Assessment of a Proposal for a Directive of the European Parliament and of the Council modifying Directive 98/70/EC relating to the quality of petrol and diesel fuels. Commission staff working document. (European Commission, 2007)	Article 9 of Directive 98/70 requests the Commission to review the fuel specifications of Annexes III and IV of the Directive. The Commission has carried out an extensive review of the specifications during 2005. Based on this material and other material it was necessary to assess the need for any change to the Directive. The Commission's Work Programme for 2006 foresaw a proposal to amend the Directive. An Inter Service Group was established in April 2006 to prepare the Impact Assessment for this proposal. The Directorate Generals AGRI, ECFIN, ENTR, JRC, SG, SJ, TREN participated in the group. It held 4 meetings to prepare the draft final Impact Assessment. During the stakeholder process and building on the areas requested for consideration in the Directive, the following main areas have been identified for investigation: 1. World Wide Fuel Charter 2. Biodiesel limits in diesel 3. LPG, CNG and Biofuel specifications 4. Captive fleets 5. End date for sulphur in diesel 6. Review of Directive 99/96 7. Review of CO_2 and cars 8. Review of Directive 99/30 9. Polycyclic Aromatic Hydrocarbons 10. Non-road applications 11. Detergents 12. Metallic additives

Source	Summary
	13. Diesel density 14. Petrol ethanol ETBE and oxygenate content 15. Petrol vapour pressure 16. Lifecycle Greenhouse Gas emissions For each of these areas the impact assessment provides an assessment of the policy options.
Report from the Commission to the European Parliament and the Council Concerning Article 8a of Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (European Commission, 2013)	Report on the test methodology developed to assess the risk of MMT in terms of negative impacts on environment and health.
Impact of higher levels of bio components in transport fuels in the context of the Direction 98/70/EC of the European Parliament and of the Council of 13 October 1998, relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC. (ICF International, CE Delft, Ensys Energy & Vivid economics, 2015).	The overall objective of this study is to undertake an economic and environmental analysis of the impact of increasing the limits of the bio-content of petrol and diesel imposed by the FQD, and beyond 2020. In particular, for specific biofuel blends identified in the study, the assessment considers both their positive and negative impacts associated with: - Biofuels policies, market capacity, distribution of fuels, availability and origin of bio-content; - Vehicle technology, in particular engine efficiency, tail pipe emissions, biofuel compatibility and fuel use in existing and future vehicle fleets and possible evolution of automotive technology; - Air quality; - Greenhouse gas emissions; - Effect on the refinery sector; and - Any impact on the current market shares of the fuel mix (diesel vs. petrol) and possible induced changes in Europe. The findings of this work will provide input to the Commission when considering implications of increasing the bio-content level in transport fuels.
EU Petroleum Refinery Fitness Check: Impact of EU Legislation on Sectoral Economic Performance. Science for Policy Report (JRC, 2015)	The report assesses and quantifies the burden upon EU petroleum refineries arising from a number of pieces of legislation including the RED, the EU ETS, and others, including Fuel Quality legislation (Directive 2009/30/EC) as a category. It also assesses and quantifies the benefits arising from the different legislation. In relation to Fuel Quality legislation, the report charts the continuous decline in average sulphur content in road fuels in EU-27, and considers that this evidences an improvement in road fuel quality. The economic impact of the Fuel Quality legislation upon refineries is assessed and estimates of the cost of meeting the legislation are given. An estimate of the monetary benefits associated with the decrease in sulphur emissions is also provided. The report draws on three key sources of data. The source most extensively used throughout the report is a database of information on costs compiled by Solomon Associates. This cost information was self-reported by refineries across the EU. An additional source of data was data from IHS consulting on simulated costs, revenues and margins at a refinery level. Although the report quantifies both costs and benefits to the refineries in the EU, more focus, discussion and depth of detail is provided in relation to the costs. It should also be noted that the majority of the cost data was self-reported by the refineries industry.
Regulatory Fitness and Performance Programme (REFIT): State of Play and Outlook. Accompanying the	This report is the second edition of the REFIT scoreboard. It summarises the state of play in implementing 164 initiatives for simplification and regulatory burden reduction identified by the Commission, including initiatives launched in

Source	Summary
document: Better Regulation for Better Results – An EU Agenda. Commission staff working document. (European Commission, 2015c)	response to the "Top10" consultation of most burdensome EU legislative acts for SMEs and the initiatives covered by the Administrative Burden Reduction Plus Programme. The aim of the scoreboard is to track progress in the implementation of REFIT, provide information on the results and impact on the ground, and allow results to be measured against initial objectives and expectations. The report also provides an overview of smart regulation activities and simplification efforts for each policy area in 2014-2015.
Urban Access Regulation in Europe Database. http://urbanaccessregulations.eu/ (European Commission 2015d)	Website on urban access regulation in the EU. Many cities in Europe use Low Emission Zones, Urban Road Tolls, Traffic Limited Zones and Traffic Restrictions to improve air quality, reduce traffic congestion and make historic city centres attractive to tourists. This database answers questions on where it is allowed to drive in cities and towns in Europe, provide maps and whether stickers or permits are needed, the costs, the penalties are and much more.
Update of the Handbook on External Costs of Transport. Final report for the European Commission (Ricardo-AEA, 2014b)	This report updates a 2008 version of the Handbook of External Costs developed for DG MOVE. It provides quantifies estimates for a range of external costs arising from transport, including air pollution costs (relevant to this evaluation), as well as climate change costs, accident, noise and congestion costs. Within air pollution a specific category for health impacts is detailed. The report draws from a number of studies which have estimated damage costs functions for pollutants arising from transport such as NO_X, SO_X and PM. This includes the CAFÉ Cost Benefit Analysis (2005), updated in this report with more recent research by Preiss et al (2008). Key outputs of the above used in the quantification of benefits for this evaluation are the damage cost functions for emissions of SO_X and NO_X from transport, quantified in euro per tonne and updated for 2010 GDP values.
Information on the implementation to the EU FQD	
EU court confirms limits on fuel additive MMT. (ICIS, 2010)	News article on court case outcome
Judgement of the Court (Third Chamber) In Case C 517/07 Afton Chemical Limited v Commissioners for Her Majesty's Revenue and Customs (ECLI:EU:C:2008:751). (European Court of Justice, 2008)	Court case outcome about the use of MMT
Quality of petrol and diesel fuel used for road transport in the European Union: Twelfth annual report (Reporting year 2013). (European Commission, 2015a)	This report represents a consolidation of the twelfth year of Member States' submissions under Directive 98/70/EC1 (the "Directive"), summarising the quality of petrol and diesel used for road transport in the EU for 2013. Specifications for petrol and diesel sold for road transport in the EU are included in the Directive: the first specifications entered into force on 1 January 2000; the second on 1 January 2005 and the third on 1 January 2009 which limited the sulphur content of all automotive road fuels in the EU to 10 ppm. Additional requirements are defined in the European Standard for Fuel Quality Monitoring Systems ("FQMS"), EN 14274:2012, required from 2004.
According to Article 9 of the Directive 98/70/EC related to the quality of petrol and diesel fuels. Draft report to the European Parliament and the Council. (European Commission, 2015 b)	Draft report including the reporting obligations of the European Commission in accordance with Article 9 of the FQD.

Source	Summary
Publications from other (non-EU) governmental or independent sources	
BS EN 228:2012 (BSI, 2012)	Latest EN 228 standard applied in the UK
Schone lucht voor Amsterdam : herijking Amsterdamse maatregelen luchtkwaliteit. Amsterdam: Gemeente Amsterdam, Dienst Infrastructuur Verkeer en Vervoer (2011, DIVV).	Evaluation of air quality measures applied in Amsterdam written by the municipality of Amsterdam. Special attention is paid to the cost-effectiveness and efficiency.
Emission factors 2009: Report 5 – a review of the effects of fuel properties on road vehicle emissions. Published Project report PPR358 (Boulter & Latham, 2009)	This report was written by TRL for the Department of Transport in the UK, to review the methodology used by the National Atmospheric Inventory (NAEI) in the UK which is used for estimating emissions for road vehicles. The report assesses the impact of fuel properties on exhaust emissions, focussing on the effects of fuel sulphur content on exhaust emissions. It also assesses the effects of biofuels levels and other parameters on exhaust emissions. The report also identifies the impacts of fuel properties on the functioning of engines and emissions after-treatment systems such as catalytic converters. This report was commissioned by UK government to independent consultants and should therefore present an impartial and balanced assessment.
Human Development Report. United Nations Development Programme (UNDP, 1998)	The Human Development Report is published on an annual basis by the Human Development Report Office of UNDP. It contains information on the human development index of all the countries of the world and how these evolve annually. This index uses data on economic growth, life expectancy, education and others to obtain scores and rank countries in terms of their human development. The HDR (1998) contained information on the steps taken by Sweden during the 1980s to introduce and promote unleaded petrol.
Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the reduction of sulphur emissions or their transboundary fluxes by at least 30 per cent (UNECE, 1985)	Helsinki protocol on SO_2 emissions, part of CLRTAP
Protocol on the Reduction of Sulphur Emissions (UNECE, 2015)	Brief summary of the CLRTAP protocols targeting SO_2 emissions
Facts on pollutants: Acid rain (UNEP, 2009)	Brief description of the concept of acid rain
Health effects of SO_2 (US EPA, 2016)	This report provides a brief summary of the health effects caused by SO_2
The effect of fuel and oil additives on automobile catalyst performance (Wilkins and Hannington, 1990)	This journal article assesses the impact of lead, manganese and phosphorus, which can be present as fuel additives or lubricating oils, on the performance of catalysts. It identifies that both lead and manganese are detrimental to catalyst activity and to the environment, and that catalysts containing platinum group metals are the preferred means of controlling CO, unburnt hydrocarbons and nitrogen oxides. This article is not the most recent in publication data, however it provides early evidence for the identified negative impacts of lead on catalyst performance.

Source	Summary
Industry publications and position papers	
ACEA Communication – vehicles and biofuels towards 2020. (ACEA, 2010).	ACEA expresses its opinion on the role of biofuels in the 2020 targets (20% renewable energy and 10% renewable transport). They agree that bioethanol and FAME will play a relevant role but do not agree with the idea of increasing their proportion in petrol and diesel blends. They believe there are other alternatives. The source was used to express the views of vehicle manufacturers on the role of biofuels for meeting the targets in the RED
Hydrotreated Vegetable Oil (HVO) as a Renewable Diesel Fuel: Trade-off between NO_x, Particulate Emission, and Fuel Consumption of a Heavy Duty Engine (Aatola, H., Larmi, M., Sarjovaara, T., Mikkonen, S., 2008)	This study presents HVO and compares it to FAME, showing that it does not lead to the same detrimental effects as when FAME is blended with diesel. Also, HVO are free of aromatics, oxygen and sulphur and have high cetane numbers
Recommendation concerning Guidelines for Marked Fuel Quality, in R.E3 and/or S.R.1. Informal document GRPE-68-16-Rev.1 (AECC, CLEPA, EUROMOT & OICA, 2014)	This joint document was prepared by the European Association of Automotive Suppliers, the Association for Emission Control by Catalyst, the International Organization of Motor Vehicle Manufacturers, and the European Association of Internal Combustion Engine Manufacturers. The document provides recommendations for the quality of fuels so they are in line with the latest vehicle standards.
Afton Chemical website	Company website providing information on the activities of Afton Chemical
WG1 meeting 14 February on Fuel Quality Directive (98/70) (CARS 21, 2012)	This presentation gives background of the FQD and EN standards and their relationship.
Fuel effects on emissions from modern petrol vehicles part 2 - aromatics, olefins and volatility effects (CONCAWE, 2004)	The influence of petrol quality on exhaust emissions was evaluated using vehicles with advanced engine technologies (as of 2004). Part 2 of the study described the influence of aromatics, olefins, volatility and final boiling point. The measured effects of fuel changes were small and sometimes conflicting. PM emissions were lower in the advanced Multi-point injection car in all cases. Fuel changes did not lead to significant changes in emissions in the point injection car, which the report considers to be the vehicle that represented the most the fleet in 2004. Direct injection cars emitted higher levels than the point injection car but less than diesel cars. It is a very useful report with experiments of the effects of changes in fuel specifications and their effects on engines. However, the data found in the report contradicts other data. It has to be taken into account that the study was financed by CONCAWE and is not academic research.
The evolution of oil refining in Europe. Volume 22, Number 1. (CONCAWE, 2013)	Evolution of the history of refineries in Europe since the 1960s, showing the changes in petroleum demand, petrol/diesel demand, quality requirements, capacity and complexity of refineries; as well as current challenges.
Oil Bulletin. Available here[35] (DG Energy, 2015)	To improve the transparency of oil prices and to strengthen the internal market, the European Commission's Oil Bulletin presents weekly consumer prices for petroleum products in EU Member States with and without taxes.
HVO/HFA (European Biofuels Technology Platform, 2014)	Overview of this product with description of its characteristics as well as an overview of its commercial production. It has been used to indicate the current

[35] https://ec.europa.eu/energy/en/statistics/weekly-oil-bulletin

Source	Summary
	HVO producers in Europe
EUROPIA 2012, Annual report	Annual overview of the association EUROPIA and its members in the perspective of the oil refinery developments.
Dataroom. (Fuels Europe, 2014)	Overview of fuel related EU statistics
Joint position ACEA/FuelsEurope on the intention of France to introduce B8 diesel (Fuels Europe and ACEA, 2014)	Reply of the ACEA and FuelsEurope on the introduction of B8 in France. Both organisations argue that it will not benefit market harmonisation.
Fuels Europe Statistical Report 2015 (FuelsEurope, 2015)	Overview of fuel related EU statistics summarised in a statistical report
Recent Developments in EU Refining and Product Supply. EU Refining Forum, 12 April 2013 (IEA, 2013)	Presentation at the EU Refining Forum in April 2013 presenting all the main trends related to refineries.
Recent developments in EU Refining and in the supply and trade of petroleum products. Presentation at the fifth meeting of the EU Refining Forum, Brussels, 15 June, 2015, International Energy Agency. (IEA, 2015)	Presentation at the EU Refining Forum in June 2015 presenting all the main trends related to refineries.
Afton Chemical court case documents (infoCuria, 2010)	Judgment of the Court (Third Chamber) of 18 December 2008. Afton Chemical Ltd v The Commissioners for Her Majesty's Revenue & Customs. Reference for a preliminary ruling: High Court of Justice (England & Wales), Chancery Division - United Kingdom. Directive 92/81/EEC - Excise duty on mineral oils - Article 2(2) and (3) and Article 8(1)(a) - Directive 2003/96/EC - Taxation of energy products and electricity - Article 2(2), (3) and (4)(b) - Scope - Fuel additives which are mineral oils or energy products but are not used as motor fuel - National taxation regime. Case C-517/07.
The impact of petrol fuel sulfur on catalytic emissions control systems (Manufacturers of Emission Controls Association, 2013)	This report assesses the impact of sulphur in petrol on the functioning of catalytic emission control systems. Overall, sulphur in petrol inhibits the performance of catalytic emission control systems, and reducing the level of sulphur in fuels will increase the performance of the catalytic control system. Other factors influencing its performance include the catalyst composition, design and location. The report also reiterates the statement that lead is a catalyst poison which permanently damages catalyst activity. The report is published by the Manufacturers of Emissions Controls Association, a US-based industry body for manufacturers of emission controls including catalytic emissions control systems. Therefore the report does not have the same impartial status as a strictly academic or government-commissioned report, however, the supporting research quoted is comprehensive and supported by other industry sources.
Annual report (UPEI, 2014)	This report shows the annual results of UPEI members (Union of European Petroleum Independents). The report focuses on biofuels and gives a description of the current market fragmentation caused by the different transposition approaches adopted by Member States with regard to the FQD

Source	Summary
Information from the Worldwide Fuel Charter and ICCT	
Methylcyclopentadienyl Manganese Tricarbonyl (MMT): A Science and Policy Review. (ICCT, 2009)	ICCT study providing a science and policy review of the use of MMT worldwide paying attention to: - status of MMT; - history in the US and Canada; - health and environmental impacts; - vehicle and emissions impacts; - and alternatives to MMT.
The impact of stringent fuel and vehicle standards on premature mortality and emissions. ICCT's global transportation health and climate roadmap series (ICCT, 2013)	The report studies a number of policy scenarios and assesses their impacts on mortality and emissions from transport. The conclusion is that in order to reduce emissions and their harmful effect, vehicles need to adopt low sulphur fuel and the latest vehicle standards. The report explains how vehicle standards need specific technologies and how an alignment between fuel and vehicle standards is beneficial for cars, since vehicle standards require specifications to be able to function properly.
Worldwide fuel Charter. Fifth Edition (ACEA, 2013).	ACEA and worldwide automaker partners publish this report periodically. The document was first established in 1998 to increase understanding of the fuel quality needs of motor vehicle and engine technologies and to promote fuel quality harmonisation worldwide in accordance with those needs. The fifth edition includes information on advanced engine systems with strict requirements for emission control and fuel efficiency. The report contains information on how fuel specifications need to be in order to be functional in modern engines and meet vehicle standards. This document identifies issues and provides recommend

Data analysis

In order to assess the more quantitative aspects of the Directive, and to permit an assessment of efficiency considering costs and benefits where possible, data analysis has been carried out. This section describes the steps that have been undertaken to find and analyse statistical data to complement and verify the outcomes of the questionnaire and literature analysis.

Identification of data needs

As described earlier, the evaluation questions have been drafted for the five evaluation themes (effectiveness, efficiency, coherence, relevance and EU added value) at the start of this evaluation. The Section **Intervention logic** and **Analytical framework** also described the elements of the analytical framework:

- evaluation questions and/or sub-questions;
- success/judgment criteria;
- qualitative and quantitative indicators;
- methods and tools.

The consolidated analytical table mapping each of the above elements per evaluation question is presented in Appendix F and contains an overview of the evaluation questions including these elements. Table 3 provides an example of these elements for one specific evaluation questions.

Table 3 Example of specification of an evaluation questions in terms of methods to be applied

Article 3	
EQ 1.6	Is the petrol fuel placed on the market in compliance with the specifications of Annex I of the Directive?
Judgement Criteria	Evidence showing what proportion of petrol sold meets the specifications of the Directive
Indicators	Petrol fuel specifications and related sales information
Method	Quantitative analysis of consultation responses from relevant stakeholders, including Competent Authorities, fuel manufacturers and suppliers. Quantitative analysis of data from Member State annual FQD reports
Sources	Consultation with relevant stakeholders, including Competent Authorities and stakeholders Member State annual reports and annual summary reports published by Commission
Comments	-

Based on Appendix F the needs for quantitative analysis have been identified. This has shown that especially the evaluation themes 'effectiveness' and 'efficiency' require a quantitative assessment of data, especially in relation to impacts on emissions, cost impacts and fuel markets. The evaluation themes 'coherence', 'relevance' and 'EU-added value' rely more on policy analysis and stakeholder opinions and can mostly not be assessed using quantitative indicators. The data analysis started with searching for the sources identified for each quantitative indicator and potential other sources. At the end the following key data sources have been used:

Table 4 Data sources used for quantitative analysis

Data source	Type of data
Data reported by MS under CLRTAP. http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-convention-on-long-range-transboundary-air-pollution-lrtap-convention-9	**Emission pollutant trends**
Fuel Quality Monitoring Reports and In relation to fuel sales, data for the period 1995-2000 data is taken from Eurostat, whereas data from 2001 onwards is taken from Figure 1 of the 12th Annual Report on Quality of Petrol and Diesel fuel used for road transport in the EU (European Commission, 2015b) (in million litres).	**Fuel sales data**
ICF, 2015 based on Eurostat and FQM reports	**Data on biofuel blends and mandates**
Eurostat Energy database	**Import and export trade data (intra and inter EU)**
Follow-up interviews with Member States	**Administrative burden in relation to the FQD**
Eurostat labour costs data: http://ec.europa.eu/eurostat/statistics-explained/index.php/Hourly_labour_costs	**Costs of labour across the EU**

The Fuel Quality Monitoring reports (in combination with the summary reports and the Commission reports) have been the main source for providing insight to fuel sales developments, the level of compliance and (to a lesser extent) the penalties imposed.

Data analysis in relation to emissions impacts

The data source for the emission impacts should cover the relevant air polluting emissions, the relevant years and should include the emissions from the transport sector. General sources on air quality (the concentration in the air) are not sufficient, because it is not clear to what extent changes in the concentration could be attributed to the transport sector. Data reported by MS under CLRTAP turned out to be the most suitable source to use here and therefore has been the main data source. This data has been submitted by MS and are the official inventories produced by Member States and submitted to the EEA in the context of the LRTAP convention. These are reported according to the Nomenclature For Reporting (NFR) 14 format[36]. This format classifies and splits emissions into more than 120 different activities.

Within this breakdown, the main activities that are relevant to the activities covered by the FQD are the following:

- Road transport: Automobile road abrasion
- Road transport: Automobile tyre and brake wear
- Road transport: Petrol evaporation
- Road transport: Heavy duty vehicles and buses
- Road transport: Light duty vehicles
- Road transport: Mopeds & motorcycles
- Road transport: Passenger cars
- International inland waterways
- National navigation (shipping)
- Railways

The following air pollutant emissions are identified as being relevant for the FQD:

- SO_X
- total PAH
- lead (Pb)
- NMVOC

NO_X and PM have also been analysed, since lower sulphur content of fuels leads to the following impacts:

- Lower SO_2 emissions
- Lower PM emissions
- Higher vehicle efficiency due to the facts that a lower sulphur content results in less need for regeneration of DPFs

[36] https://ec.europa.eu/energy/en/statistics/weekly-oil-bulletin
or classification. Available on: http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-convention-on-long-range-transboundary-air-pollution-lrtap-convention-9 [Accessed 13/01/2016]

- A lower sulphur content also contributes to NO_X reduction, because it enables the use of after-treatment technologies and consequently contributes to the realisation of Euro 5 and 6 emission limits.

For the assessment of how emissions have changed over the years see EQ 1.1.

Constraints and data limitations

The above list is quite limited because indicators, method and sources as defined for each evaluation question could not always be applied in practice: this overall resulted in less quantitative analysis than anticipated at the beginning of this project. There are a number of limitations in the data available at present, as follows.

Data analysis in relation to the single fuel market

The following indicators were deemed relevant in order to assess the level of market fragmentation:

- Fuel trade between Member States: hypothetically a higher level of market fragmentation as result of differences in national implementations would result in trade barriers between Member States and thus in lower trade levels.
- Overall import and export levels to and from the EU28 in terms of crude oil, gasoil and petrol, because this reflects refinery activities in terms of in- and output.

Data was extracted from the Eurostat Energy Database, which implies that there is no data gap here. There are however constraints in terms of interpretation of the data, because the changes in fuel trade and import and exports levels can also be caused, but are not limited to, the following factors:

- The economic crisis and consequential decrease in fuel demand (although lower fuel demand can also be caused by fuel efficiency measures and an increase in alternative fuel).
- The further dieselisation of the market.
- The continuing decrease in the competiveness of the EU refinery sector is probably also responsible for the decrease in trade in and outside the EU and intra-trade between Member States. This is also reflected in developments of overall refining capacity and utilisation rates.
- Differences in fiscal incentives between Member States might provide incentives impacting trade flows.

In relation to derogations of the Directive (Article 3, 4, 6 and 7):

Quantitative analysis was foreseen to be carried out for the various derogations in the Directive, like Article 6 and 7. However, these have not been applied in practice so no cost and emission impacts could be determined. For the Article 3 & 4 derogations for the Outermost Regions information available was also limited since the derogation has only been applied in one location (Mayotte).

No further steps have been taken, because further steps would only have been relevant in case of application of the derogations.

In relation to cost and benefits of the Directive (Article 8, 9, 9a)

The cost indicators defined for the various evaluation questions are mainly linked to cost for stakeholders groups (penalties, compliance costs etc.). The values of these costs were, however, hard to retrieve from general fuel cost data, such as Eurostat, because the level of disaggregation is not sufficiently detailed. Costs of compliance for fuel suppliers are not publicly available, because it can be seen as confidential information about the competitiveness of a company. The cost of compliance for

Member States mainly consists of man-hours required for monitoring processes etc. This is also not publicly available information.

Concerning penalties it can be concluded that lower authorities are mostly responsible for imposing penalties on non-compliant stakeholders. The number of penalties and values of each penalty can also not be accessed through publicly available information. For this reasons, the project team was only able to rely on estimations provided by stakeholders in the questionnaire response and follow up interviews.

Additional data gap filling

The table below summarises the key data gaps which were identified earlier in the project, and the steps which have been taken to address in the interim.

Table 3.5: Quantitative data gaps and steps taken to address them

Data gap area	Steps taken to address this gap
Costs of implementing the Directive at the Member State level	▪ Follow-up interviews with Member States included request to provide data on the costs to competent authorities of monitoring and reporting. ▪ 5 Member States provided some data, including estimates of the expenditure on fuel sampling, and estimates of the administrative man time spent in reporting under Article 8
Costs of implementing the Directive to industry, in particular fuel suppliers and manufacturers	▪ Stakeholders invited to supply data and links to reports in the questionnaire. These have been followed up where provided. ▪ In follow-up interviews with selected stakeholders these were again asked to provide information if possible. FuelsEurope consulted with its members before the interview and requested that any data on the additional costs of supplying multiple fuel blends be provided, however no information was received from members. ▪ Literature review of relevant reports, including EU Petroleum Industry Fitness Check (JRC, 2015) which contains quantitative estimates of the cost to refineries of adapting to comply with the FQD.
Quantitative data on impact of the Directive on engine development	▪ Stakeholders were invited to provide information in the questionnaire and to supply links to reports. These have been followed up where provided.
Quantitative data on the benefits of the Directive	▪ Stakeholders invited to comment on the benefits of the Directive in the questionnaire, however no quantitative data was provided. ▪ Literature review has been carried out to identify damage function costs, these have been applied to historic data on pollutant emissions in order to estimate avoided damage costs.

The outputs of the data analysis are incorporated into the overall evaluation and evaluation of Articles below (e.g. EQ 1.2).

4. Results and analysis

4.1 Overall evaluation

This section presents a summary evaluation of the FQD overall. For further analysis of each of the summarised issues refer to the later sections of this chapter as cross referenced with the relevant evaluation question (EQ) number.

Effectiveness

Effective elements of the FQD (elements positively evaluated)

Health and environmental protection

- The FQD has been effective in reducing emissions from transport. Historic data series available from the EEA show a reduction in emissions of SO_X, lead, NO_X, PM and PAH (EQ 1.2). These reductions can be linked to the FQD, either directly in the case of SO_X or indirectly for NO_X and PM. In the case of SO_X emissions the observed reductions correlate directly to the progressive lower sulphur limits permitted in fuels. For NO_X and PM emissions the historic observed reduction in emissions of NO_X and PM is not directly attributable to the FQD, however it could not have occurred in the absence of the FQD, since sulphur content in fuel inhibits the performance of catalytic converters which remove NO_X from tailpipe emissions, and also damage Particulate Diesel Filters which reduce PM. Therefore, both the FQD and vehicle emissions standard together have been responsible for this reduction. The introduction of Euro-6 and Euro-VI vehicles was only possible after the coming into force of petrol and diesel specifications of Directive 2009/30/EC.
- The improvements in health and environmental impacts arising from the FQD are due to the specifications for petrol and diesel fuel set out in Annex I and II. The high rate of compliance with the FQD specifications (in regards to minimum fuel quality standards) (EQ 1.6, 1.8) are supported by the monitoring and reporting requirements for Member States specified in Article 8 (EQ 1.14) and by the penalties regime stipulated in Article 9a (EQ 1.17).

Level of compliance

- As described above, compliance with the technical fuel specifications of the FQD is high, with the majority of Member State respondents noting that over 95% of fuels sold on the EU market are in compliance with the FQD (EQ 1.6, 1.8). This is supported by the non-compliance rates published in the annual FQD monitoring reports (EQ 1.6: around 2% for petrol; EQ 1.8: 3-5% for diesel in the 2009-2013 period, dropping to 1.3% in 2014, Ricardo-AEA 2014b, EEA 2015) and the limited number of penalties imposed (EQ 1.17). Non-compliance events can be classified as "exceptions" and/ or linked to introductions of new standards and/ or switches from grades (like winter to summer).
- In relation to monitoring and reporting (which contributes to the levels of compliance) there is potential for improvement among the Member States compared to the minimum required number of fuel samples taken, as many Member States are at the minimum level prescribed by the FQD. There have also been issues in the past with summer fuel grade samples being taken outside of the summer period. However monitoring and reporting costs are considered to be high by four of the 17 responding Member States (Croatia, Estonia, Luxemburg,

Sweden) (EQ 2.11). Penalties are considered to be necessary for meeting the objectives of the FQD by 14 of the 17 responding MS (EQ 4.15, 4.16).

Ensuring a single market

- Clear minimum fuel requirement specifications regarding the quality of fuels are an important driver towards the delivery of a single market (EQ 1.1). In this regard the Directive is achieving its objectives since the majority of the fuel placed on the EU market is compliant with the FQD specifications as evidenced in the summary FQD annual reports and Member States Fuel Quality Monitoring annual reports (comprehensively described under EQ 1.6 and 1.8). Member States view the FQD positively in this regard.
- However, as detailed below, compliance with the fuel specifications does not presently ensure a comprehensive single market.

Ineffective elements of the FQD (elements negatively evaluated)

Ensuring a single market

- Different biofuels blends are supplied unevenly across the EU, principally in relation to bioethanol blends (E0, E5, and E10) (see EQ 1.3). This range of bioethanol blends are all in line with the specifications of Annex I. The availability of this range of blends and the fragmentation of the market this entails is not a direct result of fuel specifications in the FQD, rather it arises from different policies put in place by Member States with regards to biofuels.
- Fossil fuel and biofuel producers and suppliers claimed the single market to be fragmented in regards to biofuel blends due to the supply of different blends across Member States, and also in relation to the use of CEN standards in certain Member States, the use of which introduces different fuel specifications.
- Within the Directive, the specifications for biofuel components in Annex I and II, specify an upper limit only, so that a variety of blends all meet the specifications of the Directive (e.g. E0, E5 and E10 are all compliant with the upper limit of 10% bioethanol permitted in Annex I).
- In addition, Article 4 of the FQD allows for the possibility of deviation from the percentage upper limit of FAME permitted in diesel, without a clear rationale. The fuel specifications for diesel in Annex II set an upper limit of 7% FAME permitted in diesel (B7)[37]. However, Article 4 states that higher than 7% FAME levels may be permitted. This discrepancy has led to differing transposition and implementation of the FQD by Member States, with some permitting >7% FAME levels (to date France, the Netherlands have proposed a similar implementation). This possibility to deviate from the FAME limit without conditionality poses potentially significant challenges in achieving a comprehensive single market.
- Drivers for increased use of higher biofuel blends arise from Article 7a of the FQD and from the Renewable Energy Directive[38] (RED), however the use of higher blends biofuels e.g. B+ is not the only route to meeting FQD and RED biofuel uptake targets (EQ 3.5). Other measures such as use of HVO, electrification of transport are available.
- Other sources of market fragmentation identified by stakeholders include non-alignment of fuel specifications for on-road and NRMM, derogations, freedom to

[37] Where 'B' denotes biodiesel (FAME) and the number denotes the maximum percentage in a diesel blend, or where '+' denotes 'greater than 7%'.
[38] OJ L140, 5.6.2009, p.16

apply FQD or CEN standards, no harmonised introduction path for E10 and differences between Member States in the implementation of RED and FQD Article 7a requirements (EQ 3.2, EQ 3.5).

Areas for further consideration

Single market

- The introduction of a minimum ethanol content requirement has the potential to reduce market fragmentation arising from the number of bioethanol blends as described above.
- Even though scope and objective are considered to be clear (EQ 1.1), numerous, but not univocal, suggestions have been made by stakeholders to improve FQD by widening both the scope (EQ 1.3) and objective, such as:
  - Adopting full EN 228 and EN 590 standards. However, there is no justification for this from an environmental and health benefits points of view, and no clear evidence that this would strengthen the single market.
  - Expanding the scope to cover all road transport fuels including alternative fuels, such as higher biofuel blends – suggested to improve single market and prevent a proliferation of fuel grades. However as discussed in EQ 1.3, the proliferation of fuel blends is not that significant to date, and it has not lead to significant reported problems. There is also no evidence to show that the biofuel targets of the RED and FQD Article 7a are hampered by the current upper limits for biofuel in the FQD (Annexes I and II) (EQ 1.3).

Efficiency

Overall the Directive is efficiently delivering health and environmental protection.

Efficient elements of the FQD (elements positively evaluated)

Environmental and health benefits delivered under Articles 3 and 4

- This is assessed on the basis of a comparison between the costs and benefits of this element of the Directive.
- The main costs for Member States in relation to implementing the FQD arise from the monitoring and reporting requirements, including requirements for fuel sampling. Costs vary significantly across Member States, with reported costs for overall fuel sampling and monitoring costs ranging from €173,000-€650,000 annually per Member State (EQ 2.11).
- The main costs arising from compliance with the FQD for fuel manufacturers are in relation to desulphurisation of fuel as required by the FQD and in meeting the vapour pressure limits (see EQ 2.3, EQ 2.4, and EQ 2.5). These costs were estimated to be in the region of €202 million per refinery[39], as a cumulative estimate for the time period 2001-2011. Of the €202 million cost, 51% corresponds to investment costs and 49% to operational costs[40]. Some additional costs to fossil fuel manufactures and suppliers arise from limits for ethanol blending (EQ 2.6) and the increased number of fuel grades to be supplied (EQ 2.3).
- There is uncertainty regarding the additional costs incurred by fuel suppliers in relation to the costs of supplying multiple fuel blends. Since E5 and E10 (the two

[39] For EU-28 refineries
[40] These are estimates from the EU Refineries Fitness Check (JRC, 2015) report.

predominant petrol blends) require the same base petrol blend, additional costs in relation to the provision of these two blends should not be significant (EQ 1.3).

- All of these costs are outweighed by the significant benefits delivered through the FQD (detailed in EQ 2.3, 2.4, 2.5). The FQD has led to a decrease in fuel related emissions from transport and the associated health benefits of avoided health impacts are quantified using damage cost functions (detailed in EQ 2.3, 2.4, 2.5).
- The benefits arising from desulphurisation have been estimated as being **€197** million[41] per average EU-28 refinery during the 2001-2011 period, for each refinery (EQ 2.4). Project calculations carried out using EEA data on historic emission trends estimated the benefits of avoided damage cost associated with reduced EU road transport and NRMM emissions, at **€ 695 million** for reduction in SO_X, and **€8,611** million for reduction in NO_X for the period 2009-2013 for the EU 28.
- The FQD does not operate in isolation and the above benefits arising from reduction in road transport and NRMM emissions are therefore not entirely attributable to the FQD. The observed historic reduction in SO_2 emissions is directly attributable to the FQD, whereas the reduction in emissions of NO_X and PM are indirect. Other factors include the influence of vehicle emissions standards and the economic recession in 2009, amongst others (EQ 1.2).The FQD has also delivered benefits in relation to engine and emissions abatement performance due to improved fuel specifications, which are compatible with advanced engine standards. For example, the application of particulate filters in modern diesel engines was only possible after the introduction of low sulphur content fuels (EQ 1.2, 1.4, EQ 2.4).
- The derogations associated with Articles 3 and 4 (derogations available in relation to vapour pressure for Member States with low summer ambient temperatures, in relation to vapour pressure and the use of bioethanol, derogations for the Outermost Regions), are considered to be cost efficient, taking into consideration the cost to the Member States of applying for these derogations, and the benefits obtained. Based on estimations provided by Member States in their applications for derogations, a minimum of €637 million (investment) and operational costs savings of at least €247 million per year are saved in the EU (EQ 2.8).

Inefficient elements of the FQD (elements evaluated negatively)

Failure to deliver a single market efficiently

- The FQD has not fully achieved the delivery of an entirely comprehensive single market. The impact of market fragmentation is difficult to evaluate but fuel suppliers recognise that this has a possible impact in terms of reduced cross border trade of biofuels.
- The position of stakeholders in the stakeholder engagement is diverse (which is to be expected given differing market drivers): some fossil fuel suppliers would prefer more harmonisation of the fuel market (fewer fuel grades), however fossil fuel and

[41] This value is a cumulative estimate for the period 2001-2011, not for a single year. These estimates are calculated using EEA damage cost values on the benefits of decreasing SO_2 intensities, and represent the difference between a baseline situation where the average sulphur content in gasoline and diesel would have remained at the level determined by the FQD in 2000 (150ppm for gasoline and 350ppm for diesel), against the actual reported sulphur levels in fuel (as illustrated in Figure 4.19 below).

biofuel suppliers highlight the additional cost in relation to supplying multiple blends.

- Some additional costs arise in relation to the administration and distribution costs of supplying multiple fuel blends (e.g. E0, E5, and E10). However it is not clear how significant these costs may be. In order to comply with vapour pressure requirements, it is necessary for fuel manufacturers to supply a different petrol base for the production of E0 than for E5, E10 (since bioethanol impacts on vapour pressure). However, E0 is not widely distributed across the EU so it is not clear how significant these costs are, and no supporting information in relation to costs arising from the supply of multiple fuel blends has been supplied by fuel manufacturers and suppliers.

Coherence

There are some inconsistencies between the FQD and the RED, and also internal inconsistencies within the FQD.

There are also a number of aspects of the FQD which are **coherent** with the remainder of the environmental policy acquis (e.g. approach to monitoring and reporting (EQ 3.13), penalties (EQ 3.15), approach to provision of derogations for Outermost Regions (EQ 3.10)).

Positively evaluated elements

- The use of derogations under **Articles 3** and **4** is coherent with the overall approach of the Directive and coherent with the approach taken by other environmental legislation to ensure that no Member State is unduly penalised due to exceptional circumstances beyond their control (e.g. Outermost Regions, countries with low summer ambient temperatures) (EQ 3.10).
- The FQD is coherent with Directive 94/63/EC on stage I controls for the VOC emissions arising from the storage and distribution of petrol. The objectives of the FQD and Directive 94/63/EC are complementary and both Directives aim to reduce harmful pollutants being released into the air.
- **Article 7** which provides for a safeguard in case of a disruption to the supply of crude oils is coherent with other environmental legislation which also contains safeguards to take into account circumstances outside the normal and outside the control of Member States (e.g. the Industrial Emissions Directive contains a similar safeguard) (EQ3.12).
- The monitoring and reporting requirements under **Article 8** are considered to be broadly coherent with those of other Directives and contribute to the overall aims of the Directive by encouraging compliance (EQ 3.13).
- **Article 9a** setting out the penalties regime is also coherent with the overall aims of the Directive and does not differ in key ways from the penalty regime of other environmental legislation (EQ3.15).

Negatively evaluated elements

Biofuels: lack of coherence with other legislation

- A lack of coherence between the objectives of the FQD (Articles 3 and 4) and the Renewable Energy Directive (RED) has been identified, including biofuel mandates and sustainability criteria and a possible overlap between the scopes of these two Directives (EQ 3.2, 3.11).

- The RED sets a target of 10% for the share of energy from renewable sources in transport by 2020 for each Member State. However, due to the upper limits for bioethanol and FAME set in the FQD (Articles 3 and 4, Annexes I and II) Member States cannot meet the RED target through the use of these biofuels alone and will need to implement additional measures (e.g. use of Hydrotreated Vegetable Oil (HVO) which is not included in the 7% limit for FAME, using advanced biofuels that can be double-counted, or the electrification of transport).
- There is however no evidence to suggest that the blend walls for bio components in fuel established by the FQD would hamper meeting the RED target. In particular, currently Member States are still far from reaching full implementation of the upper limits set in the FQD (ICF et al 2015, EQ 3.5).

Biofuels: lack of alignment within the Directive internally

- Whereas recent policy developments and the objectives of the FQD reflect a drive to encourage and introduce biofuels, this is not fully reflected in the Directive, since higher blends of biofuel are out of its scope (EQ 3.2). In addition, one of the main aims, the introduction of a single market in the EU, may be hindered by the use of different biofuel blends since Annexes I and II specify a maximum limit and not a fixed proportion of biofuel, thus allowing Member States the placing on the market of multiple varieties of blends (e.g. E0, E5, and E10).
- In addition, Article 4 is not fully in line with Annex II, as the Article states that Member States may allow the placing on the market of diesel with a FAME content above the 7% set in Annex II, so long as consumers are informed. To date only France has permitted the placing on the market of B8 since January 2015. Spain has indicated that they may take a similar approach to France in order to comply with obligations under the RED. In addition, in late 2015 the Netherlands reviewed its transposition of the FQD and transposed into national legislation the second paragraph of Article 4 (which permits the placing on the market of diesel with FAME content above 7%)[42].
- A third point is that Article 2 refers to CN codes for petrol and diesel, and the CN codes state that fuels must contain a minimum of 70% mineral oil in order to be classed as such. Therefore high biofuel blends such as E85 or B90 are not classed as fuels under the CN codes, and are therefore outside the scope of the Directive. There is a risk that the market could fragment further if the use of such fuels increases.
- The 7 % limit for FAME (B7) in Article 4 was the result of the need to compromise between allowing blending of biodiesel and ensuring the well-functioning of engines (and fuel systems). The parallel marketing of E5 and E10 as long as cars not fully capable of running on E10, is considered to be advantageous for ethanol producers, whereas the FQD lacks similar benefits for other biofuel producers, with no level playing field as a result. On the other hand the ethanol industry asks for more harmonisation of the EU ethanol blending market (the levels of ethanol blending are different in every Member State).
- **Article 5** should ensure the free circulation of fuels, but the coherence issues described above show that Article 5 has not been able to deliver a comprehensive single market for all fuels covered by the Directive: although Member States do not intentionally restrict the free circulation of compliant fuels, the differences in national implementation resulting in various biofuel grades create market barriers for compliant fuels (EQ 3.11).

[42] However the Netherlands have indicated that this does not mean any market actors have intentions of marketing blends with greater than 7% FAME.

Areas for further consideration

- Consider whether a minimum ethanol content requirement would reduce market fragmentation, since at present the upper limit set for bioethanol content in the Directive (Article 3, Annex I) permits the placing on the market of a range of bioethanol blends (E0, E5, E10) and contributes to a possible market fragmentation.

  This assessment will have to take into account sustainability aspects of biofuels and the availability of feedstocks for advanced biofuels as well the technological stage of development. These aspects are outside the scope of this review.
- Clarify the upper limit permitted for FAME in diesel in the Directive. At present Annex II specifications set an upper limit of 7% FAME in diesel, whilst Article 4 specifically sets out that levels above 7% are permitted. This internal inconsistency of the Directive further contributes to market fragmentation. Additionally, consider also a minimum level of FAME content to reduce market fragmentation. This will similarly have to take into account sustainability aspects of biofuels and the availability of feedstocks.
- Resolve the internal lack of coherence within the FQD in relation to scope and biofuels. At present the objectives of the FQD reflect a drive to encourage biofuels (Article 7a), which is not reflected internally, since the FQD excludes higher blends from its scope (due to Article 2 Definitions, defining petrol and diesel according to the CN codes 2710, which state a minimum mineral oil level of 70% is required to meet the definition). This means that the scope of the Directive excludes high-blend biofuels such as E85.
- Consider the potential for harmonisation of biofuels targets in the RED and the FQD.

Relevance

The Directive overall is still considered to be relevant and no articles are considered not to be relevant. The limitations placed upon petrol and diesel fuels by the FQD are still relevant to ensuring the health and environmental benefits of the FQD as well as promoting a single market for fuels within scope.

Positively evaluated elements

Relevance of derogations

- The FQD contains a substantial amount of derogations, ranging from derogations for the fuel quality for the outermost regions of the EU (EQ 4.6, EQ 4.8) to more lenient specifications in the event of disruptions of supply (EQ 4.12). This assessment evaluated whether these derogations are still relevant today.
- The derogation for Outermost Regions has been applied by Mayotte to date, and France states that the derogation is still relevant, and is allowing fuel supply to Mayotte to continue without incurring significant additional costs which would hamper the local economy (EQ 4.6, 4.8, 4.12).
- The derogation for vapour pressure is considered to still be relevant on the basis of the high number of applications to apply this derogation in recent years, and the supporting data included in the derogations which outlines the avoided costs to Member States (EQ 4.6).

- No Member State and none of the stakeholders propose to delete or repeal the derogations on grounds of administrative or legislative burden or single market considerations (EQ 4.4, 4.5, 4.7, 4.9, 4.10, and 1.7).

Relevance of Article 8a on metallic additives

- **Article 8a** is considered to still be relevant albeit Member States consider that MMT would not be used in the absence of the Article. However, MMT is used in other parts in the world and Afton, producer of MMT, still promotes the use of MMT (EQ 4.13).

Article 9a on penalties

- In relation to **Article 9a** on the setting of penalties, some Member States query whether it is necessary to have an Article at the EU level, considering that penalties could be dealt with at a national level. However its removal could contribute to competitive distortion across Member States, since there would be no driver to ensure the level of penalty setting is equivalent among them (EQ 4.16).

Areas for further consideration

There are no suggested areas for further considerations in relation to the relevance of the Directive or its Articles, additional to those already outlined above in relation to the Effectiveness and Efficiency.

EU-added value

- Member States consistently state that a single market could not be achieved in the absence of the Directive (EQ 5.2). Consequently, the directive maintains EU–added value.
- However industrial stakeholders (fossil fuel, biofuel and car industry) state that a single market established via the FQD does not bring competitive advantages for EU operators compared to extra-EU operators. They state that by introducing harmonised fuel specifications the FQD has reduced the barriers to entry for non-EU fuel suppliers, who can dedicate (part of) their plants to the refining of EU-specification compliant fuel, rather than having to comply with multiple specifications across different Member States. Meanwhile, EU refineries have converted their full production capacity to comply with the FQD, which then makes it more difficult for them to trade competitively with non-EU producers in regions with less stringent fuel specifications (EQ 5.4). This can be linked to the additional costs required to meet the FQD specifications, in particular the requirements of "deep desulphurization", aromatics (in petrol), PAH (in diesel) and increased number of fuel grades (EQ 2.3).

Positively evaluated elements

- **Articles 3 and 4** are considered by most stakeholders to add value at the EU level by ensuring environmental and health protections (EQ) and by ensuring correct functioning of vehicle engines and after treatment systems (EQ 5.6). Most Member States consider that EU action was necessary in order to ensure the removal of leaded petrol from the EU.
- **Article 7** on temporary relaxation of fuel specification in the case of disruption to fuel supply is considered to add value at the EU level, as a safeguard in case of future disruption to the fuel supply (EQ 5.10).

- **Article 8a** in relation to MMT adds value by acting as a safeguard to ensure a limitation upon the use of MMT, strengthening the position of national level bans within the EU in the face of ongoing international use of MMT. It is not clear whether the EU-added value of the Article would be enhanced if it imposed a complete ban rather than the present 2mg limit (EQ 5.13).

Negatively evaluated elements

- **Article 6** in relation to marketing of fuels with more stringent environmental specifications has not been used to date. Member States consider that this Article still has a purpose, however they also consider that it is cumbersome to implement and that other more easily accessible measures can be applied in the case that it is necessary to try to restrict emissions from a particular location (EQ 5.7).
- **Article 8 on monitoring and reporting** is assessed in a very mixed manner by stakeholders, with many considering that the value it delivers is not proportional to the administrative burden of reporting (EQ 5.11, EQ 5.12).
- **Article 9a** on penalties is considered to have limited added value by some Member States, which indicate that penalties could be arranged at the national level without this article. The value of the article however is that it defines the principles for how penalties should be set, providing a partial harmonisation and equivalence across countries, whilst allowing flexibility for Member States to set penalties according to national circumstances in the assessment of effectiveness, proportionality and dissuasiveness (EQ 5.15).

Areas for further consideration

There are no suggested areas for further considerations in relation to the EU-added value of the Directive additional to those already outlined above. The suggestions outlined above in relation to Coherence in particular would significantly improve the EU-added value of the Directive.

4.2 Evaluation of Effectiveness

Overall evaluation of effectiveness

The Directive has not fully achieved the delivery of a single market, however it has played an important role in contributing to reduced pollutant emissions from the transport sector, and therefore delivered associated health and environmental benefits. The evaluation of individual Articles below identifies areas with limited effectiveness and also highlights any remaining data gaps.

Further details of the analysis and evidence for this overall evaluation is presented in the subsequent evaluation questions (EQs).

- **Article 1**: in general the scope appropriately and properly reflects the objectives of the FQD. The current scope of the FQD does not hamper the introduction of biofuels and alternative fuels to the extent of current EU and Member States ambitions to 2020.
- The FQD appears to ensure the proper functioning of engines; there is no evidence to suggest that full application of EN228 and EN590 can be justified by the benefits of improved engine functioning (EQ 1.4).
- **Article 1**: the FQD has been effective in reducing emissions from transport. Based on the available emissions data, the FQD has significantly contributed to reducing emissions of SO_X, lead, NO_X, PM and PAH. In the case of SO_X emissions the observed reductions correlate directly to the progressively lower sulphur limits permitted in fuels by the FQD. The observed reductions of NO_X and PM emissions could not have occurred in the absence of the FQD, since effective emission after treatment systems can only operate under fuel quality standards introduced in Annex I and II. The introduction of Euro-6 and Euro-VI vehicles was only possible after the coming into force of petrol and diesel specifications of Directive 2009/30/EC. See EQ 1.2 for detailed discussion.
- **Article 2**: Member States and stakeholders are almost univocal in considering that fuel definitions in the FQD could be changed so as to no longer make reference to CN-codes. However, no clear evidence has been identified to indicate that the current use of CN codes as definitions would obstruct the EU single fuel market.
- **Article 3 (and Annex I)** is effective in that the majority of fuel placed on the market in the EU is in compliance with Annex I specifications. Official data reports that almost 100% of the fuel placed on the market complies with the specifications of Annex I. The level of non-compliance with the specifications is significantly low. However, there are some ineffective aspects of the article.
- The article is clear enough to support the overall objective of the single market, as the specifications set out in Annex I are minimum standards but do not ensure that the petrol placed on the market in all Member States will be homogeneous. The issue which has received most feedback and is perceived as problematic by fuel suppliers is the maximum bioethanol content in petrol (10% v/v) in Annex I, the reason being that this article has been transposed differently in different Member States, leading to a range of bioethanol content between 0% and 10%.
- The different transposition by Member States of Article 3 and Annex I, together with some of the responses from Member States regarding which fuels are in or out of scope, suggests that Member State authorities are somewhat unclear on the detailed meaning of Article 3 and Annex I (see E.Q. 1.6). This has led to non-compliance cases and to the reporting of some fuels which are out of the scope of the FQD in the official FQD annual reporting.

- **Article 4 (and Annex II)** According to available data and the Member States and stakeholders consulted, the majority of fuel placed on the market is in compliance with Annex II specifications.
- The maximum limit of 7% means that the European market may have diesel on the market with a FAME content between 0% and 7%. This does not seem to pose significant burden to fuel suppliers, as FAME is added to regular diesel at the end of the supply chain. Nevertheless, Article 4(1) creates an exception to Annex II, as it allows the placing on the market of diesel with a FAME content above 7% without specifying a maximum limit, which effectively means anything from 8% to 100% FAME (it is important to consider that above 30% the fuel would be out of the scope of the FQD).
- France and the Netherlands are already using this flexibility to allow the placing on the market of B8 diesel, although only in France is this fuel already being sold[43], as one of the options to comply with the requirements of other legislation (e.g. RED). Although there are other alternatives that Member States can implement (use of HVO, use of higher blend biofuels within captive fleets, electrification of vehicles), this provision has the potential to lead to a somewhat divergent market.
- Some information has been obtained on the effectiveness of the derogations for Articles 3 and 4. The derogation related to a higher vapour pressure of petrol (either related to a higher bioethanol content or to a low summer ambient temperature) appears to have been successfully implemented, and the derogation for the Outermost regions has been used in France (for Mayotte), with France stating that that the derogations are positive and provide a benefit. Also, no evidence has been found that would indicate that the derogations are obstructing the single market or have negative impacts on health and environment.
- **Article 5:** the differences in the implementation of biofuel mandates related to the RED and FQD appear to be the largest barrier preventing free circulation of fuel across the EU. Therefore Article 5 is considered not sufficiently effective to prevent the market fragmentation caused by the RED and FQD related biofuel mandates.
- **Article 6** has not been applied, therefore it is difficult to assess its effectiveness. Nonetheless, Member States consulted during follow-up interviews were broadly supportive of the article.
- **Article 7** has never been applied, however it is considered by Member States that it is still needed and that if an upstream disruption to supply occurred, Article 7 would provide an effective safeguard to ensure ongoing fuel supply to users.
- **Article 8** is effective in that all Member States have reported annually as required. Additionally, the driver to report contributes to delivering the overall aims of the Directive.
- **Article 8a** is effective in that reported MMT levels show MMT either not being in use, or always being below the permitted levels (in those cases where it appears in samples).
- **Article 9** cannot be conclusively evaluated in terms of effectiveness, because the report has not been published yet.

[43] The Netherlands has revised its transposition of the FQD to permit placing on the market of diesel with >7% FAME content but no such fuel has yet been placed on the market.

EQ 1.1 Are the objectives of the Directive sufficiently reflected in the scope of the FQD? (Article 1)

Member State responses to this question are mostly positive, with eight respondents believing the objectives were reflected in the scope 'to a large extent'[44], and nine 'to some extent'[45]. None of the respondents thought it was 'to no extent' indicated.

2 Member States have expressed views stating that impact on health is insufficiently covered by the FQD as it is: the Netherlands raises this point in general, but specifies later that its concern is about the possible air quality impact of the use of higher biofuel blends and alternative fuels, as engine operation and after treatment systems are designed to operate correctly with reference fuels, but not necessarily with the full range of biofuel blends. Sweden expresses concerns that the FQD insufficiently covers the impact of (possible) additives.

The response by 2 Member States stating 'to some extent' seems to contradict their opinion that the FQD is a key part of the single fuel market.

Most stakeholders indicate that the objectives are 'to a large extent' or 'to some extent' reflected in the scope. The only biofuel stakeholder that choose 'to no extent' (ePure) did not provide any further details. The majority of biofuel stakeholders[46] indicated the objectives were 'to some extent' reflected in the scope of the FQD and are of the opinion that the current FQD is hampering the introduction/use of biofuels and as a consequence is contradicting its objectives. No evidence is provided that this actually is the case. The majority of fossil fuel stakeholders also indicated that the objectives are 'to some extent' reflected in the scope of the Directive, and are of the opinion that the objective of establishing a single fuel market is insufficiently expressed in the scope of the FQD. Nevertheless, minimum requirement obligations are an important driver towards a single market achievement. Certain types of fuels (e.g. CNG) are not covered.

ACEA highlight that there is no justification for the application of ethanol and FAME based on environmental and health grounds. That view is debatable if considering the long term climate change impacts of greenhouse gas emissions.

Literature provides no additional evidence on the more general question of whether the objectives of the FQD are sufficiently reflected in its scope.

There are no signs that the objectives of the FQD are not sufficiently reflected in the scope. In particular there is no evidence for the statement of a number of stakeholders that the introduction of biofuels and alternative fuels to the extent of current EU and Member States (2020) ambitions is hampered by the scope of the FQD. This might become an issue if targets are increased for the post-2020 period.

EQ 1.2 Has the FQD been effective in reducing transport emissions?

Emissions data obtained from Member State submissions under the LRTAP Convention have been used to chart the historic variation in emissions of pollutants impacted by

[44] Austria, Croatia, Denmark, Finland, Luxemburg, the Netherlands, Romania, Slovenia
[45] Estonia, Germany, Malta, Latvia, the UK, the Czech Republic, France, Slovakia and Sweden
[46] All except two: ePure and one anonymous biofuel respondent,

the FQD[47]. These are then analysed in relation to the time of introduction of the relevant FQD specifications.

This evaluation considers the 2009 changes in the FQD as the baseline for evaluation, however to better understand this it is useful to take into account the history of previous FQD iterations and the progressive tightening of specifications in order to provide a better and full background to the impact of the FQD.

For this reason emissions are charted from 1995-2013 (the last year for which data is available). Key FQD legislation since includes:

- Directive 98/70/EC
- Directive 2003/17/EC
- Directive 2009/30/EC (evaluated in this study)

In each of the figures below, the volume of fuels sales of petrol and diesel, and overall fuel sales, is charted alongside the evolution of emissions pollutants. Since the volume of fuel sold and consumed is one of the key factors in overall emission levels, illustrating the volume of fuel sales alongside pollutant trends helps to remove one of the confounding factors in relation to pollutant emissions. In relation to fuel sales, data for the period 1995-2000 data is taken from Eurostat, whereas data from 2001 onwards is taken from Figure 1 of the 12th Annual Report on Quality of Petrol and Diesel fuel used for road transport in the EU (European Commission, 2015b).

Fuel sales data show that petrol sales have decreased, while diesel sales have increased in the same period. Overall fuel sales are more in line with the increase of diesel rather than the decrease in petrol. This can be explained by the higher market share of diesel. These trends clearly show the further dieselisation of the European fuel market. Fuel sales also reflect the impact of the economic recession in 2008 on fuel demand, with an overall decline in fuel sales, and a greater decline in petrol sales.

SO_X emissions

The table below summarises the relevant amendments to the Directive during its evolution, and the 2009 baseline for this project:

Directive 2009/30/EC	Earlier versions
- maximum 10 ppm sulphur content petrol and diesel - maximum aromatics content petrol: 35%	- maximum 50 ppm sulphur content petrol and diesel Directive 2003/17/EC established a limit value of 10 ppm sulphur and as per 1 January 2009 subject to a review.
Strengthening existing provisions: - maximum 10 ppm sulphur content gas oil - maximum polycyclic aromatic hydrocarbons content diesel: 8%	Levels according to Directive 2003/17/EC - Maximum 1000 ppm sulphur (as per 2008) - Maximum polycyclic aromatic hydrocarbons content diesel: 11%

Emissions of SO_X from the transport sector for the period 1995-2013 are illustrated in Figure 4.5.

[47] Detail of the methodology applied is described above in Data collection and analysis

Figure 4.5: SO_X emissions from transport sector compared to fuel sales in the period 1995-2013 (CLRTAP, EEA)

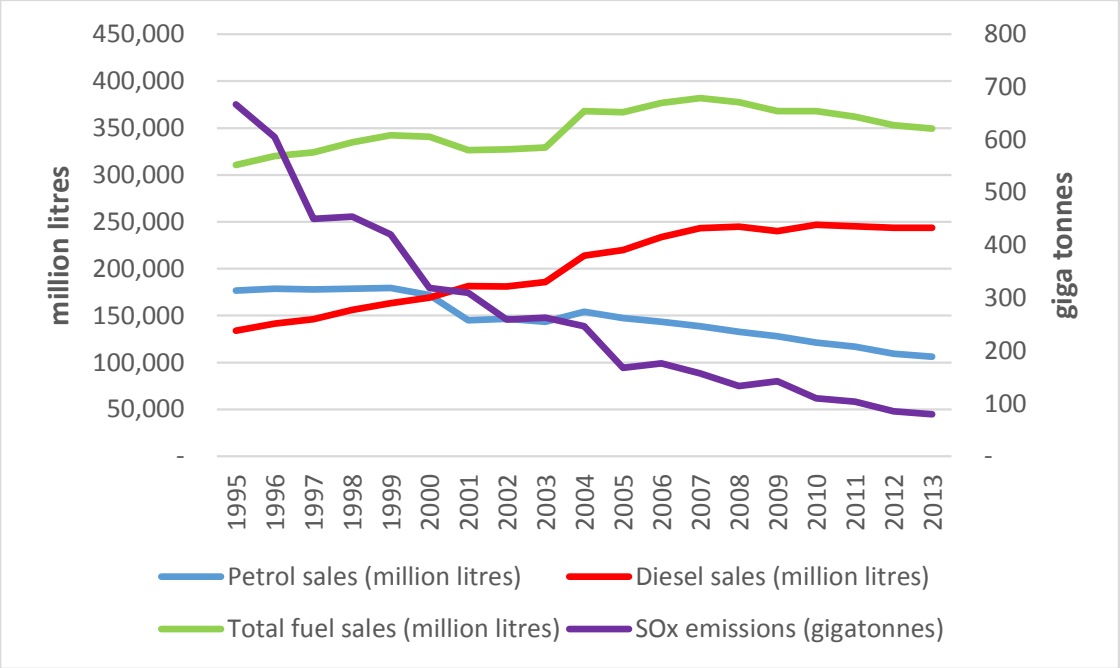


Figure 4.5 shows that SO_X emissions from transport were already decreasing prior to the introduction of the FQD in 1998. However the introduction of sulphur content limits for transport fuel by the FQD as summarised below has driven the ongoing reduction in emissions of SO_X:

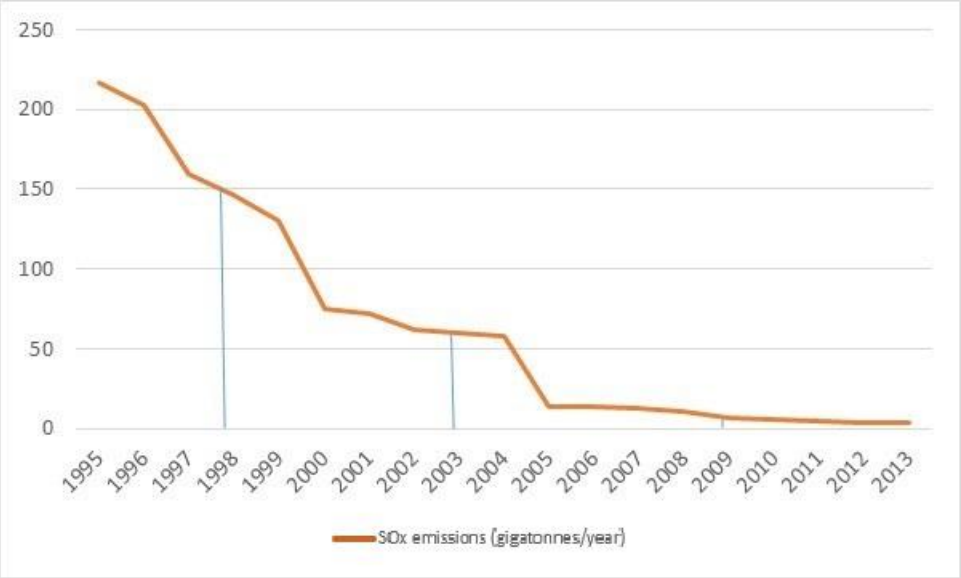
- 2000: 150 ppm sulphur limit in petrol, 350ppm limit in diesel,
- 2005: 50ppm limit for sulphur introduced,
- 2009: 10ppm limit for sulphur introduced.

SO_X emissions have experienced the strongest reductions in the road passenger and freight transport subsector (illustrated in Figure 4.6). SO_X emissions arising from passenger cars have decreased 98% over the 1995-2013 period. If the years where the various amendments of the FQD were introduced are taken into account, sulphur emissions decreased 32% in the period 1995-1998 (before the FQD), 59% in the period 1998-2003 (first version of the Directive); 89% in the period 2003-2009 (second amendment) and 45% in the latest amendment. It should be noted that these reductions are influenced by the number of years covered. This can be normalised by dividing these reductions by the number of years covered in each amendment. This results in the following annual reduction rates:

- 1995-1998: 11% reduction per year
- 1998-2003: 12% reduction per year
- 2003-2009: 15% reduction per year
- 2009-2013: 11% reduction per year

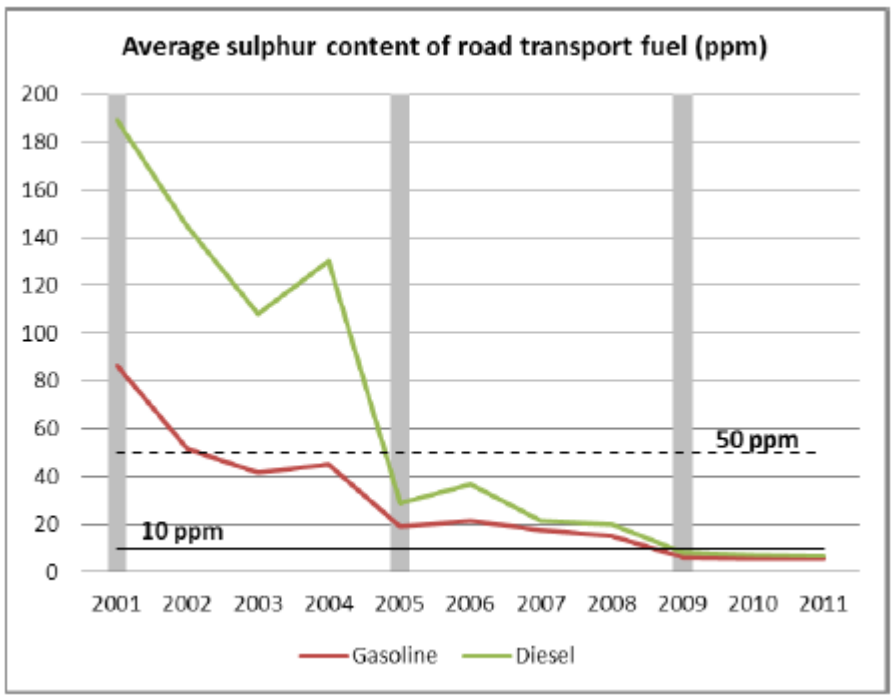
In view of these results, the most successful amendment thus far in terms of SO_X emissions reduction can be considered Directive 2003/17/EC.

Figure 4.6: SO_X emissions from passenger cars in the period 1995-2013 (CLRTAP, EEA)



Additionally it is useful to view the average sulphur of content in fuel (Figure 4.7 below) alongside the reported emissions data for SO_X, as the relationship between the two is clear. The inflection points observed in the graph below clearly correlate to the entry into force of new limits for sulphur in fuel (50ppm in 2005, 10 ppm in 2009, for petrol and diesel).

Figure 4.7: Average sulphur content of road transport fuel (ppm)

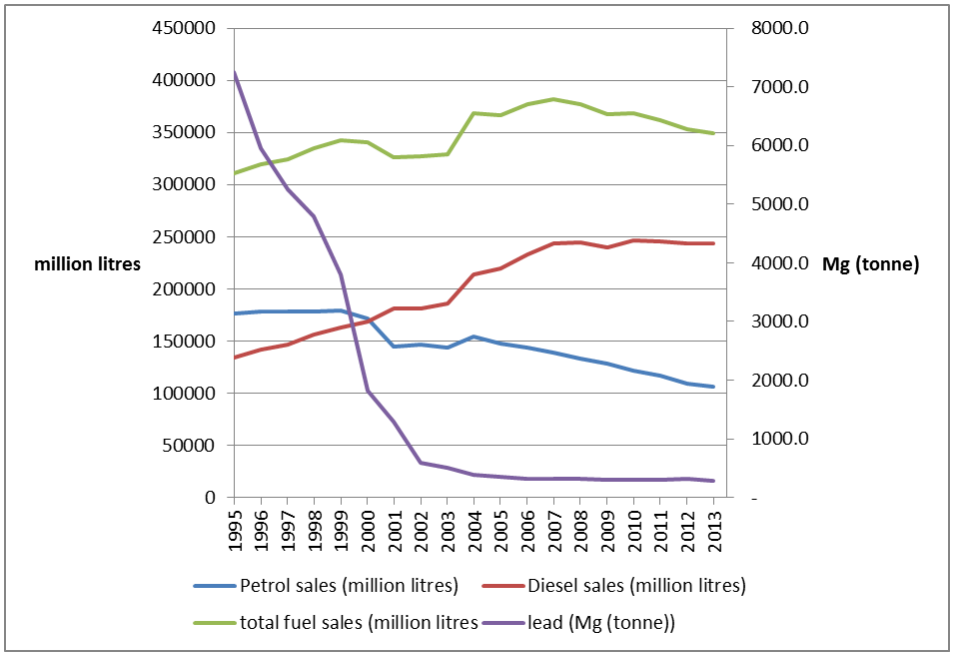


Source: EEA (2013) in JRC, 2015.

Lead (Pb) emissions

The strong reduction in lead emissions in the period up to 2002 shows the impact of the first iteration of the Directive in 1998, which banned the sales of leaded fuel from 2000. The Directive in its successive iterations has ensured that fuel remains lead free and emission levels low (this could not be guaranteed in its absence) (Figure 4.8).

Figure 4.8: Lead emissions from transport sector compared to fuel sales in the period 1995-2013 (source CLRTAP, EEA)

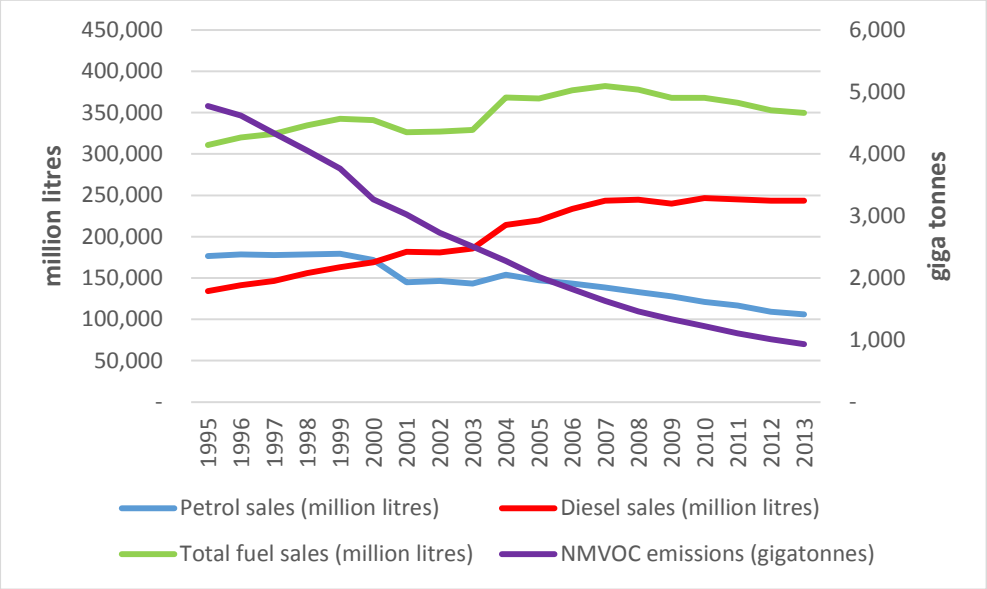


NMVOC emissions

Figure 4.9 below illustrates the decline in emissions of NMVOCs from the transport sector.

The levels of NMVOC emissions, as depicted in Figure 4.9, show a much more steady decrease in the level of emissions compared to e.g. emissions of lead. The decrease in VOC emissions is at least partly due to the FQD, although overall reduction is due to both the impact of the FQD and the influence of changes in vehicle standards. In regards to NMVOC the greatest reductions have been observed in the 'Road transport: passenger vehicles' category.

Figure 4.9: NMVOC emissions from transport sector compared to fuel sales in the period 1995-2013 (source CLRTAP, EEA)



NO_X emissions (indirect impacts of fuel specifications)

As highlighted initially in the Methodology section above (Data analysis), emissions of NO_X and PM are also impacted by the FQD through the limits imposed on sulphur and lead content in fuel.

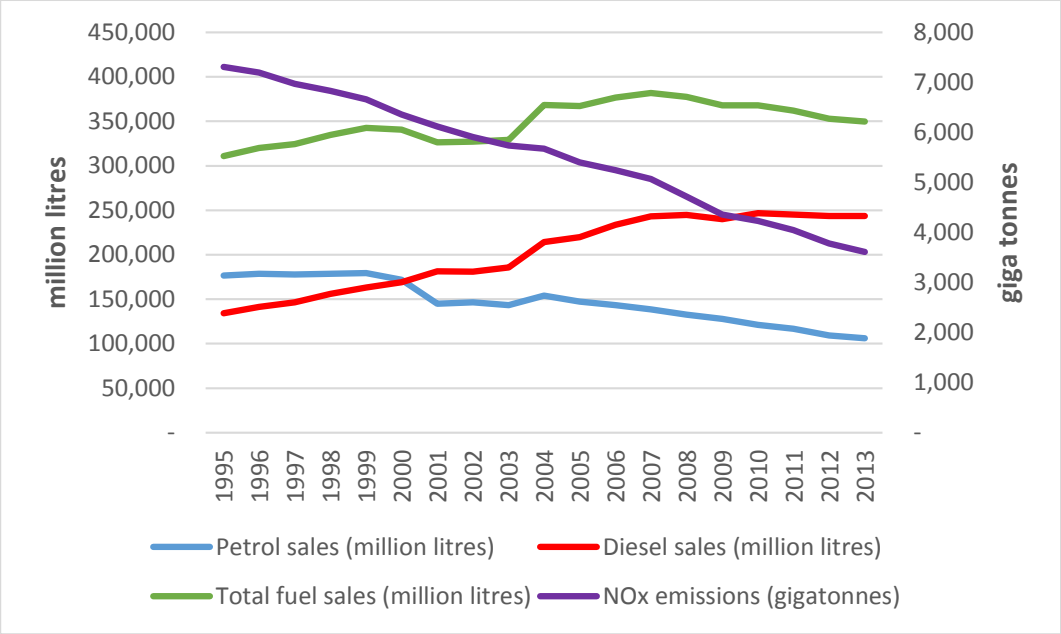
Catalytic converters were introduced to reduce emissions of NO_X from vehicles, however, their performance is affected by the presence of certain compounds in fuel, such as lead and sulphur.

Early on in the development of catalytic control technologies, lead was found to be poisonous to the catalyst material used, damaging it permanently (Wilkins and Hannington, 1990). The removal of lead from fuel has allowed catalytic converters to be used in vehicles, and therefore contributed to lowering emissions of NO_X.

A lower sulphur content contributes to NO_X reduction, because it enables the use of after-treatment technologies such as catalytic converters and consequently contributes to the realisation of Euro 5 and 6 emission limits. Sulphur content in fuel is detrimental to the performance of catalytic control technologies, although sulphur, unlike lead, does not permanently inhibit the operation of the catalyst. It does however reduce the performance of the catalyst (MECA 2013, TRL 2009). Therefore the gradual reduction in the sulphur content of fuels in the EU also contributes to a reduction in emissions of NO_X as these are controlled by the catalytic converter.

Therefore lower sulphur content in transport fuels enables the use of exhaust gas treatment technologies to limit NO_X emissions. As can be seen in Figure 4.10, NO_X decreased significantly in the period 1995-2013 (45% from 1995 to 2009 and a further 17% from 2009 to 2013).

Figure 4.10: NO_X emissions from transport sector compared to fuel sales in the period 1995-2013 (source CLRTAP, EEA)



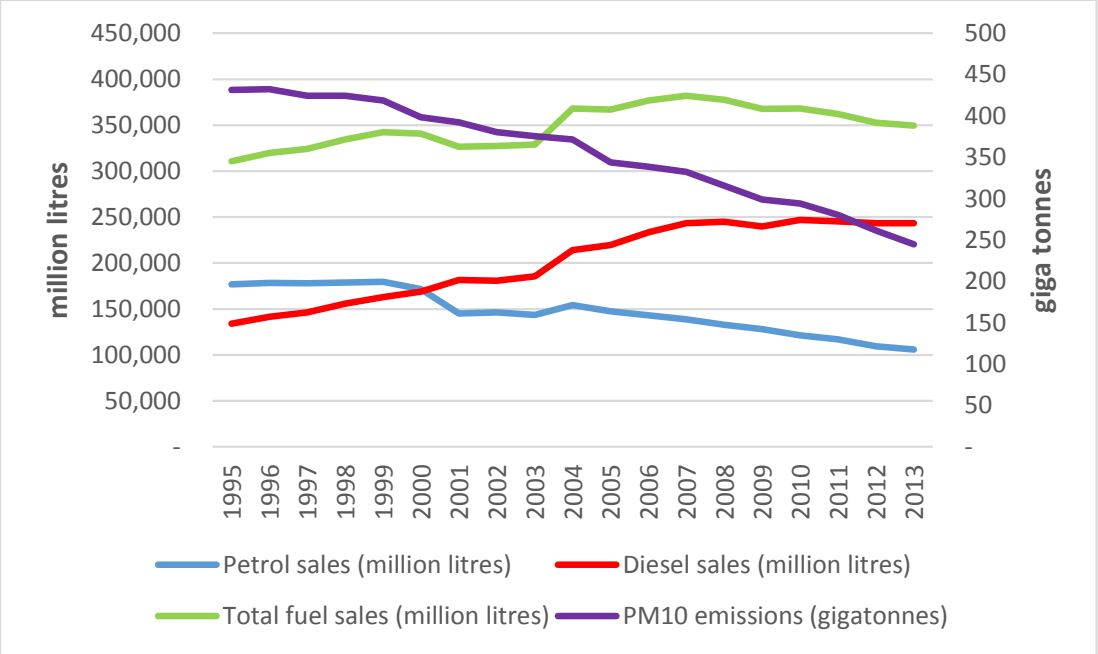
The FQD does not operate in isolation, and there are other drivers for the reduction in NO_X emissions from transport, notably the vehicle emission policies and standards which operate in the EU. The reduction in NO_X emissions cannot be single-handedly attributed to the impact of the FQD, however at the same time, it would not be possible to meet the present day vehicle emissions standards with fuel of the quality which was supplied historically prior to the introduction of the FQD. As shown above, sulphur in fuel inhibits the performance of catalytic converters and therefore the removal of NO_X from tailpipe emissions. Therefore the FQD and vehicle emissions standards have both been necessary in order to deliver such reduction in NO_X emissions.

Other vehicle related developments, like the developments in the vehicle fleet also impact the level of NO_X (and PM) emissions. The majority of NO_X emissions from transport are the result of passenger cars and heavy duty vehicles and buses. PM_{10} emissions are also mainly caused by road passenger and freight vehicles (light duty and heavy duty).

PM emissions (indirect impacts of fuel specifications)

Lower sulphur content in fuel impacts PM emissions by enabling higher vehicle efficiency, because lower sulphur content results in less need for regeneration of Diesel Particulate Filters (DPFs) and therefore greater efficiency of DPFs. There is also a direct correlation as PM emissions from high sulphur fuels are partly composed of sulphur compounds. The graph below illustrates the gradual decrease in PM emissions from transport. Although the adoption of diesel particular filters will be the primary driver for PM reduction, the desulphurisation of fuel in the EU has enabled the correct functioning and therefore widespread adoption of DPFs.

Figure 4.11: PM_{10} emissions from transport sector compared to fuel sales in the period 1995-2013 (source CLRTAP, EEA)



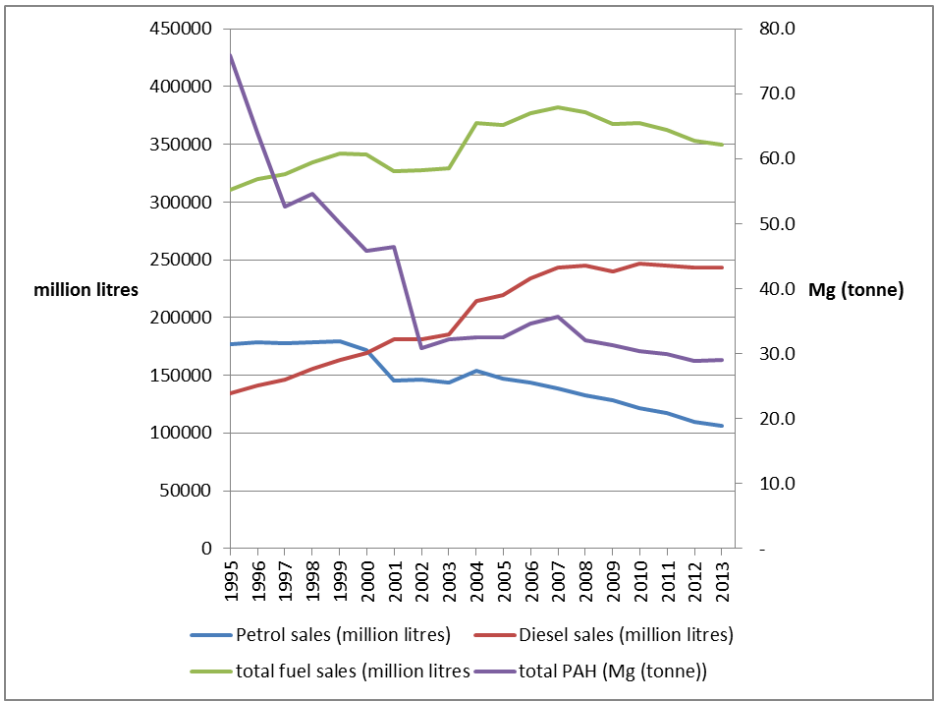
PAH emissions

The table below highlights the 2009 FQD baseline specifications in relation to PAH in comparison to earlier iterations of the FQD.

2009 FQD specifications	Earlier versions
- maximum aromatics content petrol: 35%	- maximum aromatics content petrol: 42%
Strengthening existing provisions: - maximum polycyclic aromatic hydrocarbons content diesel: 8%	Levels according to Directive 2003/17/EC - Maximum polycyclic aromatic hydrocarbons content diesel: 11%

Figure 4.12 illustrates total PAH emissions over time. A steep decrease is observed the period 1999-2002 (after the FQD was adopted in 1999). In the period 2002-2013 the levels are more stable, despite a peak around 2007 which may be linked to the growth in diesel sales. PAH emissions originate principally from passenger cars and this category also showed the strongest decrease.

Figure 4.12: Total PAH emissions from transport sector compared to fuel sales in the period 1995-2013 (source CLRTAP, EEA)



Very limited response was received from the stakeholder engagement questionnaire in regards to this evaluation question E.Q. 1.2.

Conclusion

The FQD has contributed significantly to the decrease of pollutant emissions from the transport sector in the EU since its introduction in 1998, and it is clear that this trend has continued during the period relevant to this evaluation (post 2009). The impact of the FQD is observed across a range of pollutants, and has had both direct and indirect impacts.

The FQD has been the main driver leading to desulphurisation of transport fuel in the EU and consequently to a decrease in **SO_X emissions** from the transport sector. Analysis of SO_X emissions trends in the EU since 1995 shows strong correlation between the stepped introduction of lower sulphur in fuel limits and the decrease of SO_X emissions.

The FQD was also instrumental in banning **lead** from transport fuel and therefore leading to a reduction in emissions of lead from the transport sector.

The FQD, by ensuring desulphurisation of transport fuel, has enabled the application of catalytic emission control technology and therefore enabled a reduction in the emissions of **NO_X** from the transport sector. In the case of NO_X emissions the FQD alone would have ensured the observed reduction in emissions, however these would not have been possible in its absence. The FQD together with EU vehicle emission standards (Euro standards) are responsible for the reduction in NO_X emissions.

The FQD has similar contributed to a decrease in **particulate emissions** from the transport sector, as the desulphurisation of fuel enables the better functioning of Diesel Particulate Filters, which are fitted to decrease particulate emissions.

In summary, the FQD has been instrumental in reducing emissions from transport in the EU. Significant emission reductions were observed prior to 2009 (the baseline for this evaluation), in regards to desulphurisation of fuel and the ban on lead. However, further reductions have been observed in the period following 2009 and up to 2014. Therefore, the Directive is considered to have been effective in reducing emissions from transport.

EQ 1.3 Does the FQD ensure a single market? Are there potential improvements if the scope was changed?

Both Member States and stakeholders were asked whether they considered that the Directive ensured a single market in relation to the scope as defined in Article 1.

Responses to the stakeholder questionnaire indicate a divided response regarding the success of the FQD in ensuring a single market. The majority of Member States responded in the affirmative (13 out of 17 respondents[48]), whereas the majority of fossil fuel and biofuel industry stakeholders consider the Directive has not ensured a single market (36 out of 40 respondents[49]).

The position of the Member States which consider that the FQD does not ensure a single market (Germany, Estonia) is linked to the fact that since the full requirements of European standards are not legally specified in the FQD, fuel quality can vary.

The majority (70%) of the Member State respondents (Germany, Malta, the United Kingdom, Austria, the Czech Republic, the Netherlands, France, Denmark, Sweden, Slovenia and Finland) state that a single market could not be ensured without the FQD.

The negative responses from the majority of fossil fuel and biofuel stakeholders, and one fuel additive manufacturer, were mainly in relation to the potential for derogations (for higher vapour pressure, and the higher FAME content in relation to Article 4). Also highlighted was the lack of harmonization in the roll-out of E10 across the EU (Article 3) and a lack of coherence between the FQD and the RED in relation to biofuels, leading to differences across member states and therefore not fully delivering a single market.

Fuel suppliers highlight the additional possible costs arising in relation to the need to supply a number of different fuel grades (E0, E5, and E10). The main additional costs arising for fuel suppliers are in relation to additional administration and distribution costs of having to supply a number of different fuel grades, especially when operating in multiple Member States, as suppliers chose to continue delivering the conventional fuel grades and in addition have to supply a range of different fuel grades. However, no supporting evidence was provided by fuel manufacturers and suppliers in relation to the additional costs incurred due to supplying multiple blends.

There is also an important distinction to be made between ensuring a minimum level of fuel quality across the EU by ensuring certain specifications are met, and delivering a single market in terms of fuels. The UK commented on this, stating that the FQD ensures a single market in terms of a technical specification for environmental and

[48] These were Malta, Romania, the UK, Austria, the Czech Republic, Croatia, Luxemburg, the Netherlands, France, Denmark, Sweden, Slovakia and Slovenia

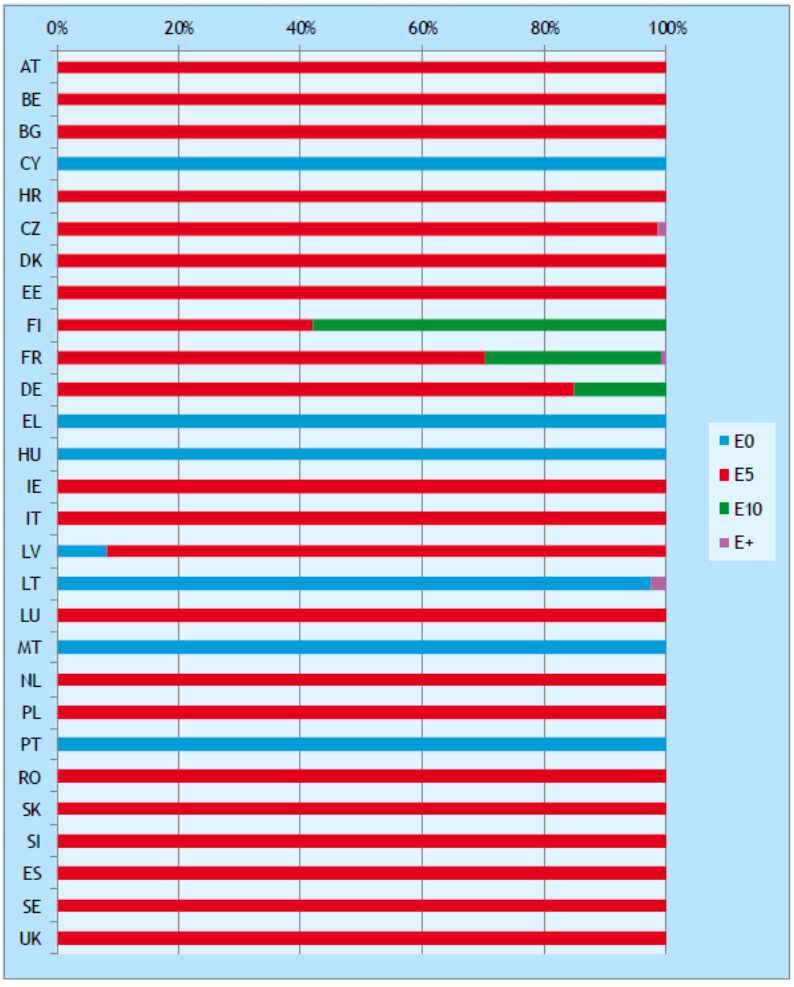
[49] There were also a number of stakeholders who did not reply to this question, these were Statoil Fuel & retail Lietuva, Inland Navigation Europe, Euromot, Greenergy Fuels, Scania engines, ASFE and NGOs Transport & Environment, Birdlife Europe, EEB, Oxfam.

health protection as indicate in the scope of the FQD but does not regulate the strict and complete quality that a specific fuel must comply with.

The graphs below illustrate the variety of petrol and diesel fuels for sale across the EU in 2013. It is clear from these that the FQD has not completely delivered a single market in terms of fuels and that in fact a variety of different bioethanol and biodiesel blends are available across the EU. The figures below show the problem is worse for petrol than for diesel.

Figure 4.13 below illustrates the range of bioethanol blends ranges for sales across the EU. The only blend exceeding the 10% bioethanol limit as set in Annex I is the E+ previously sold in Lithuania (in 2013), which was RON98E15, 15% bioethanol. The Commission has since intervened and this fuel is no longer available.

Figure 4.13: Fuel sales of ethanol blends per Member State (aggregated) in 2013, in volume % (source: Ricardo 2015 in ICF, 2015)



Source: Ricardo-AEA, 2015

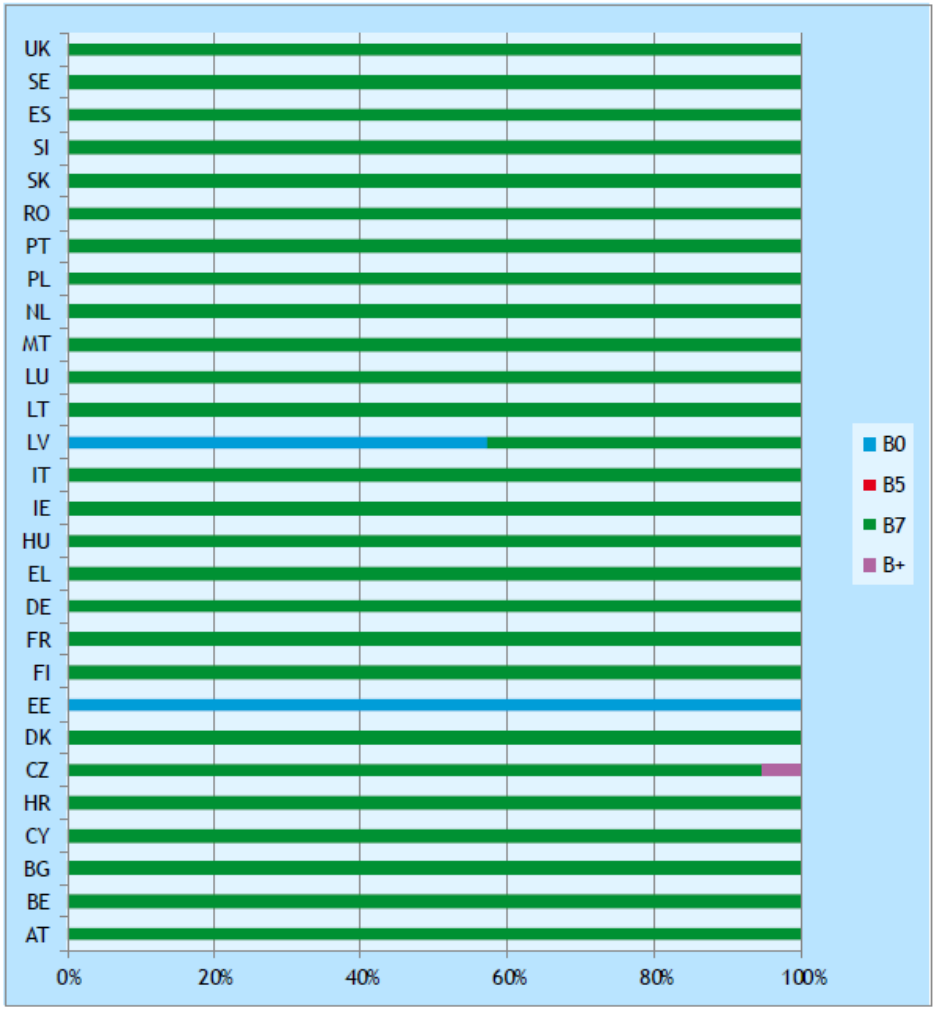
Note: E+ are petrol types with ethanol levels higher than E10

The figure below highlights the range of diesel blends available across EU Member States. The B+ sold in the Czech Republic is B31 (and B100). This is outside the scope of the FQD since the definitions in Article 2 use CN codes, which specify that fuel must contain at least 70% mineral oil in order to be classed as such. Therefore diesel with

>30% FAME content such as the B+ sold in the Czech Republic is outside the scope of the FQD.

Additionally, the figure below does not reflect the introduction of B8 in France as this was introduced January 2015[50].

Figure 4.14: Fuel sales of diesel blends per Member State in 2013, in volume % of total diesel sales (source: Ricardo 2015 in ICF, 2015)

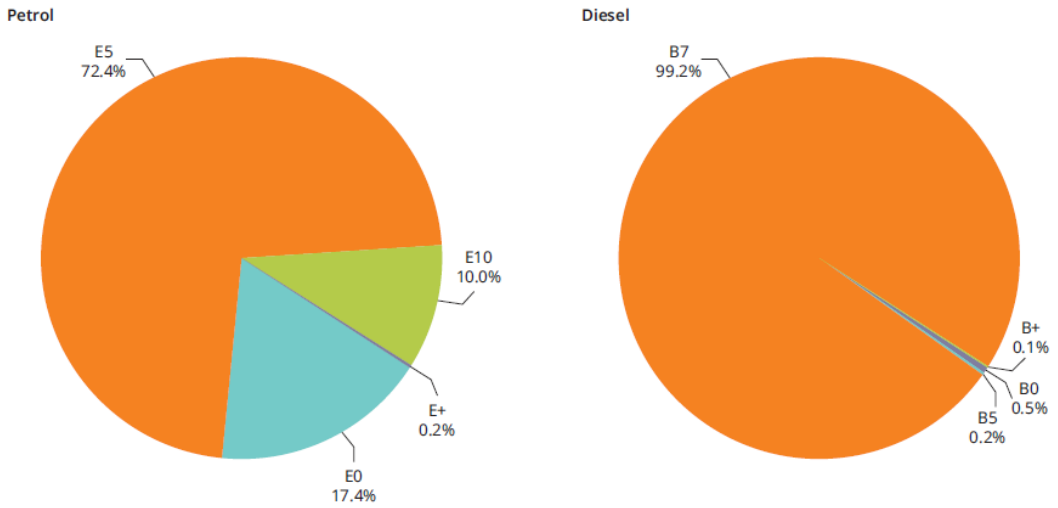


Source: Ricardo-AEA, 2015

In addition to the above, similar information is available for the 2014 reporting year from the EEA 2015 report, as seen in Figure below.

[50] The introduction of B8 in France is currently the subject of discussions with the Commission

Figure 4.15: Use of bio components in petrol and diesel in 2014, in volume % of total fuel sales (source: EEA, 2015)



Note: B+, Diesel fuel with > 7% (% v/v) biodiesel content; B0, diesel fuel with no biodiesel content; B5, diesel fuel with up to 5% (% v/v) biodiesel content; B7, diesel fuel with up to 7% (% v/v) biodiesel content; E+, petrol with > 10% ethanol content; E0, petrol with no ethanol content; E5, petrol fuel with up to 5% (%v/v) ethanol content; E10, petrol with up to 10% ethanol content.

The fragmentation of the market in terms of petrol and diesel blends is principally linked with petrol, because of the different grades, E0, E5 and E10. This arises because Annex I only specifies the permitted upper limits for bioethanol in petrol. Therefore E0, E5, E10 are all compliant with the Annex I upper limit of 10% ethanol. In regards to diesel, the fragmentation is minimal.

In addition to the fragmentation noted by the labelled blends, it must be noted that within a petrol blend, e.g. E5, 5% is the upper limit of bioethanol permitted. In practice, the blend can contain anything between 1% and 5%, meaning that E5 will not be identical across different Member States.

There are no reports of vehicles experiencing issues due to cross-border refuelling, therefore the fragmentation of the market is not an issue from a vehicle user point of view. It leads to some additional costs to fuel suppliers, although as indicated above, since E0 is not widely supplied and the base petrol for E5 and E10 is the same, the additional costs in relation to providing different base petrols for E0, E5 and E10 should be limited.

Conclusion

The FQD has delivered a minimum level of fuel quality across the EU, as evidenced by the high level of compliance of fuel samples tested and reported in the annual FQD summary reports. Compliance with specifications in relation to RON, MON, PAH, cetanes and other are consistently high across the EU.

However, the FQD has not delivered a fully harmonised single market due to different levels and blends of biofuel being permitted.

The level of harmonisation in the different Member States appears to be decreasing (based on data on biofuel blend variety as reported in the annual summary reports).

There are three specific issues within the FQD which are enabling this:

1. Ethanol blending

As a consequence of the provisions in the RED and in the FQD (Article 7a), the demand for fuel grades differs across Member States, because Member States have a choice in how they meet these targets. Although Member States can choose which measures they apply in order to meet the targets of the RED and FQD Article 7a, in practice meeting these targets will likely result in opting to make full use of the permitted ethanol and FAME blending limits. As result of the different biofuel blends marketed across Member States, refineries have to produce different grades of base-petrol and fuel suppliers have to deliver different base petrol grades for the EU-market in order to supply different blends of bioethanol (E0, E5, E10) while meeting vapour pressure requirements. Some additional costs for fuel manufacturers and suppliers arise in relation to this.

Figure 4.13 clearly shows that, within the specifications of the FQD, 3 different levels of ethanol blends are marketed in parallel in the EU: E0, E5 and E10. Ethanol blends are mostly produced via splash-blending. In the case of an ethanol blend and in order to meet the Vapour Pressure requirement of Annex 1 during summer periods, in general, refineries have to deliver a base-petrol with lower vapour pressure (unless the waiver of Annex III is granted).

2. Higher FAME contents

Article 4 (diesel) specifies that "notwithstanding the requirements of Annex II, Member States may permit the placing on the market of diesel with a FAME content greater than 7%". This is not consistent with Annex II, which specifies an upper limit of 7% FAME. This inconsistency in the FQD has percolated through to Member State implementation of the FQD, with some Member States not transposing the above-quoted paragraph of Article 4, therefore setting the upper limit of FAME at 7%. This opens the door to different interpretations of what is permitted across the different Member States, as some Member States have decided not to transpose this paragraph in their national legislation. This means for example FAME above 7% is permitted in certain Member States and forbidden in others.

3. CEN-standards

Member States are allowed to apply the CEN standards EN228 and EN590 in their national legislation. Several Member States made the application of the CEN standards mandatory. Fuel suppliers in other Member States can also opt for voluntary use of the CEN standards. In this respect the UK asks indirectly for a pragmatic widening of the scope for better alignment and cooperation between FQD and CEN standards, combining operational reasons (CEN) and environmental reasons (FQD) for setting requirements.

The possibility of harmonising the proportion of biofuel that is marketed, alongside legally binding requirements with regard to the use of European standards could be explored in order to ensure a single market in future years.

EQ 1.4 Does the FQD ensure the proper functioning of engines and emissions after treatment systems? (Article 1)

The opinion of both fossil fuel and biofuel stakeholders is that the FQD does ensure the proper functioning of engines and emission after treatment systems only 'to some extent'. The opinion of Member States is divided.

Some Member States ask for full application of the specifications of CEN standards EN228 and EN590 to ensure proper functioning in terms of emission requirements and to deliver what the customer demands. In addition vehicle manufacturers (ACEA) indicate that the application of "detergents and minimum oxidation stability (and many others) would help the FQD ensure proper functioning of present and future vehicle powertrains and emission control systems."

No respondent gives full evidence of:

- Malfunctioning of engines or emission control systems under the current FQD fuel specifications.
- Benefits of higher fuel quality or additional fuel requirements in terms of improved functioning of engine or emission control system or lower vehicle costs.

Feedback from Sweden and the UK (EQ 3.9) indicates that there may be issues caused by filter clogging in lower temperatures due to the FAME content in existing B7 blends. This is an area of ongoing research and the precise element responsible for the issue has not yet been identified (EQ 3.9).

Most biofuel sector stakeholders indicate that the proper functioning of engines and after treatment systems is impacted by the Euro-standards rather than the fuel quality standards. However, since it is the case that the FQD has delivered desulphurisation of fuels, and sulphur is known to inhibit the performance of catalytic emission control systems (MECA 2013, TRL 2009) the FQD is contributing to the correct functioning of after treatment systems.

In their opinion paper[51], the car industry (OICA), their suppliers (CLEPA, AECC) and the engine manufacturers (Euromot)[52] explicitly mention the FQD approach as a good practice of considering functioning of engine and after treatment systems and fuel quality in an appropriate and coherent manner. In literature no evidence is found of engine malfunctioning due to FQD fuel specifications. All automobile associations that are member of the FIA Foundation have special topics on their websites on malfunctioning due to misfuelling only.

Overall it is assessed that the FQD does ensure the proper functioning of engines. Based on the evidence delivered, application of the full specifications of EN228 and EN590 cannot be justified by the benefits of improved engine functioning. Benefits might be of a single fuel market nature, as some Member States prescribe and many fuel suppliers already deliver EN228 and EN590 compliant fuel.

EQ 1.5 Does the use of CN-codes contribute to establishing a single fuel market? Should additional definitions or codes be used? (Article 2)

Among the Members States the UK, the Netherlands and Sweden strongly request to add the CN-definitions to the FQD for clarity reasons and to prevent references to outdated CN-codes or fuels. Other Member States do not seem to have or don't seem to be aware of issues with the use of CN-codes.

[51] Recommendations concerning Guidelines for Marked Fuel Quality, in R.E3 and/or S.R.1. Informal document GRPE-68-16-Rev.1 (AECC, CLEPA, EUROMOT & OICA, 2014)

[52] "The clearly demonstrated link between emission standards and market fuel quality – which the European Union, Japan and the USA have all followed - should followed in those world areas that are now introducing for the first time, or adopting more stringent emission standards, for on-road motor vehicles and non-road mobile machinery."

On the other hand the current use of CN-codes is a concern for both fossil fuel and biofuel stakeholders, with only four fossil fuel stakeholders fully agreed that CN-codes contribute to a single fuel market (UPEI, Hungarian Petroleum Association, Lukoil, the Forecourt Equipment Federation). Most stakeholders that replied 'to no extent' and 'to some extent' (29 out of 34) expressed serious and similar concerns, and ask for explicit definitions of the fuels under the FQD rather than reliance on CN codes that may limit the scope of the FQD for addressing other and preferred cleaner fuels. Comments explicitly mentioned: CN-codes do not cover severe winter and arctic grades; CN-codes are not adequate to avoid different treatment of biofuels by Member States, CN-codes contribute to defining petrol and diesel in the FQD, and the same clarity on what constitutes ethanol fuel blends through a proper CN-code reference under the FQD would prevent the improper classification of ethanol blends across Member States.

Non-fuel stakeholders have no concerns on this issue.

Even though no evidence is found that the current use of CN-codes obstructs the EU single fuel market, the request from some Member States is strong and from both fossil fuel and biofuel stakeholders almost univocal to improve the FQD by including appropriate fuel definitions in the FQD rather than referencing to CN-codes. The downside of tailor-made fuel definitions included in the FQD might be a lack of coherence or even discrepancies with other pieces of (EU) legislation, like Customs rules, that rely on the CN-codes. Accounts of players on the fuel market are commonly based on these Customs rules.

EQ 1.6 Is the petrol fuel placed on the market in compliance with the specifications of Annex I of the Directive? (Article 3)

Equivalent issues in regard to Article 4 are addressed in EQ 1.8 below.

Petrol specifications and their evolution

Article 3 states that Member States have to ensure that the petrol placed in the market in their territory complies with the environmental specifications set out in Annex I of the Directive. This Annex contains minimum or maximum limits for 18 parameters (Table 4.1).

Table 4.1: Environmental specifications for vehicles equipped with positive-ignition engines (Annex I of the FQD)

Parameter	Unit	Minimum limit	Maximum limit
Research octane number (RON)		95*	
Motor octane number (MON)		85	
Vapour pressure, summer period	kPa		60
Distillation, % evaporated at 100°C	% v/v	46	
Distillation, % evaporated at 150°C	% v/v	75	
Olefins	% v/v		18

Parameter	Unit	Minimum limit	Maximum limit
Aromatics	% v/v		35
Benzene	% v/v		1
Oxygen content	% m/m		3.7
Methanol	% v/v		3
Ethanol (stabilising agents may be necessary)	% v/v		10
Iso-propyl alcohol	% v/v		12
Tert-butyl alcohol	% v/v		15
Iso-butyl alcohol	% v/v		15
Ethers containing 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

*Member States may decide to continue to permit the placing on the market of unleaded RON91 (MON81)

The same parameters were controlled by the first FQD (98/70/EC), but some of the limitations changed over the years (see Table 2.2). The main changes in the latest amendment of the FQD (2009/30/EC) compared to the previous amendment (2003/17/EC) are the following:

- Confirmation of the maximum level of sulphur in petrol (10 ppm), which was subject to review.
- Confirmation of the maximum aromatics content in petrol of 35% instead of 42%.
- Introduction of E10 compared to E5 in the previous amendment.

It should be noted that this Annex allows Member States to continue placing in the market petrol with a RON of 91.

Compliance reported in annual summary reports

The most reliable source to assess compliance with Annex I is the annual summary reports on the FQD published by Ricardo-AEA (2012, 2013, 2014a, 2014b) and the EEA (2015). These reports include information on Member State compliance with the Directive (i.e. whether the specifications in Annex I have been implemented correctly to ensure that all the petrol available has these specifications) and on operators'

compliance with the Directive (i.e. the level of exceedances in each Member State over the imposed limits).

According to these summary reports, all Member States have complied with the fuel specifications of Annex I since they were introduced. This does not seem to be entirely correct, as Lithuania reported the sale of 7 million litres of RON98 E15 petrol in 2014 (15% bioethanol), which does not comply with the requirements set out in Annex I. This is confirmed by the fact that the Commission has since intervened and Lithuania has withdrawn RON98 E15 from sale[53]. Also, the Netherlands allowed the placing on the market of HE15, which is not compliant with the FQD and was also withdrawn from the market after the intervention of the Commission. The official summary reports do not contain data on the sales of this product.

The 2014 annual report (EEA, 2105) states that 105,566 million litres of petrol were sold in the EU in 2014. As of 2014, the majority of petrol sold in the EU was RON 95 (86,279 million litres or 82% of the petrol sold). The rest was RON 95-98 (12%), RON 98 (6%) and RON 91 (0.3%). As of 2014, 72.4% of the petrol was E5. Therefore approximately 10.2% of petrol sold is petrol with a maximum bioethanol content of 10% and approximately 17.4% is petrol without bioethanol. As noted in EQ3.5, the sale of E10 is not evenly distributed among Member States, as it is only available in Bulgaria, France, Finland and Germany. Also, the percentages reported by Ricardo-AEA and the EEA do not take into account that within each fuel type, Member States can permit the sale of fuel with a varying percentage of bioethanol which will still comply with the requirements of Annex I so long as it does not exceed the upper level. For example, 40% of the petrol available in France has 10% of bioethanol, whereas the bioethanol content in Greece is 0%.

A footnote in Annex I allows for RON 91 to be marketed. This does not seem to be an issue as 99.7% of the petrol complies with the minimum RON requirements as set out in Annex I.

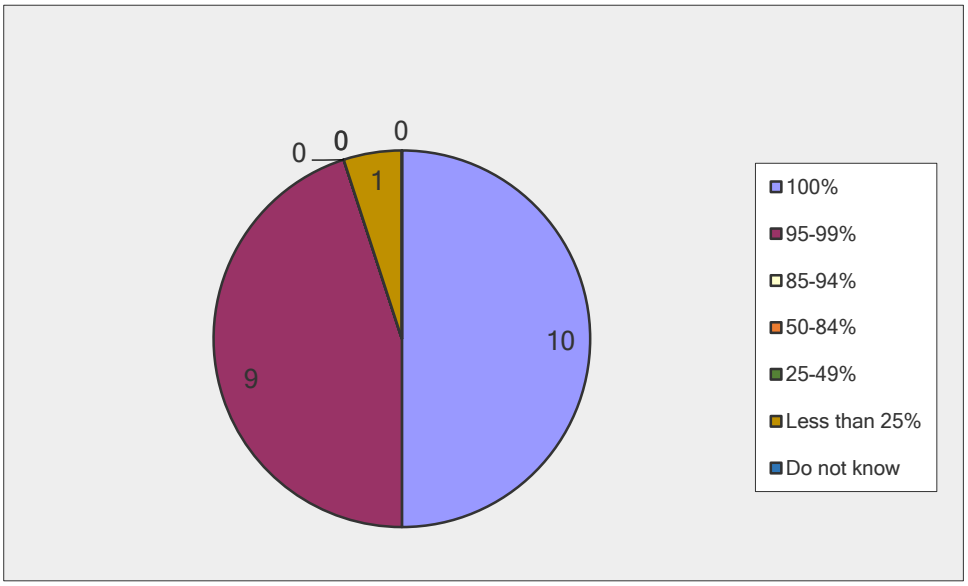
Compliance as reported in the stakeholder engagement

The Member States authorities and stakeholders consulted for this study reach the conclusion that the majority of the petrol put in the market complies with the requirements. However, the level of certainty is not the same among Member States authorities and among stakeholders.

As can be seen in the figure below, a majority of Member States (19 out of 20) state that more than 95% of the petrol sold complies with the requirements in Annex I.

[53] http://ec.europa.eu/atwork/applying-eu-law/infringements-proceedings/infringement_decisions/index.cfm?lang_code=EN&r_dossier=&decision_date_from=&decision_date_to=&EM=LT&DG=CLIM&title=fuel&submit=Search

Figure 4.16: What proportion of fuel placed on your national market is in compliance with specification of Annex I? Member State questionnaire response



10 Member States stated that 100% of the petrol is compliant with the specifications (Austria, Germany, Italy, Latvia, Luxembourg, Romania, Slovenia, Spain, Sweden and Finland). Among these, Luxembourg, Germany, Sweden and Spain provided comments. Luxembourg responded indicating they have fully implemented standard EN 228. Sweden complies with the specifications in Annex I as well, but noting that they have been granted a vapour pressure derogation (low summer ambient temperature). Germany indicates that the Regulation adopting the FQD has been implemented correctly and that authorities are obliged to monitor the implementation and impose penalties when this Regulation is breached. Spain notes that only road transport fuels are sampled, but also highlights that NRMM fuel has the same quality control procedures (through the CLH[54] infrastructure) and it represents a very small proportion of the fuel sold in the country. It should be noted that CLH is not sub-contracted to the Spanish Government, rather owned by various private companies and funds, including oil companies. There are rules that limit the power of each individual stakeholder (the maximum proportion of the company owned by a single shareholder is capped to 25% and oil companies with refining activities cannot own more than 45% of the company).

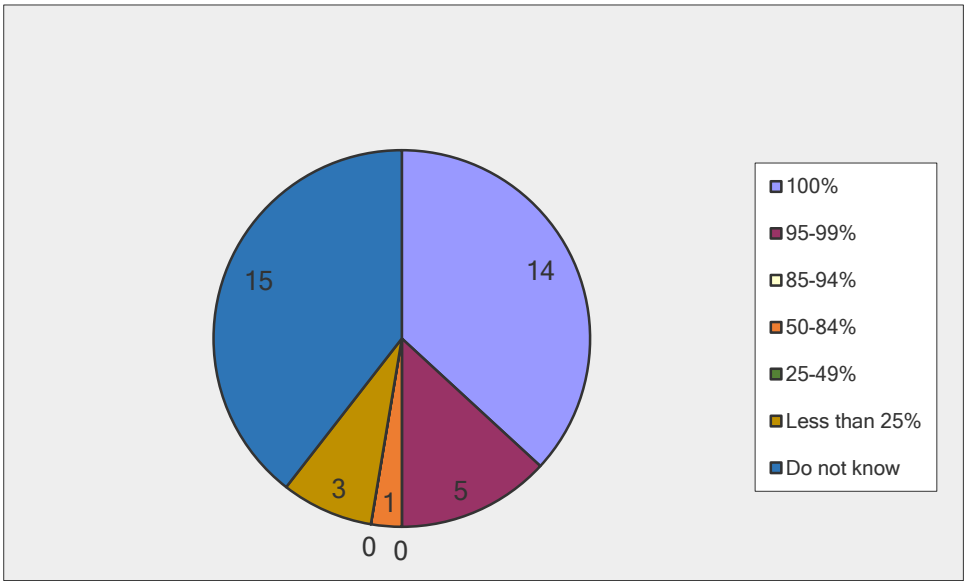
6 of the 9 Member States which indicate that 95-99% of the petrol is compliant with the requirements of Annex I (Estonia, France, Croatia, Malta, the Netherlands, Slovakia and the UK) comment on the figure provided. Only Denmark and Poland did not justify their answer. The Netherlands and the UK indicate that generally Annex I specifications are reported, but there has been a certain level of exceedances. Malta also indicates this, adding that the main cause is the petrol sold during the transition

[54] CLH is a private company responsible for all fuel transport and storage in Spain. This company handles all products in an undifferentiated way. The fuel from the various operators is the same and meets basic legal specifications. Product is only differentiated at the time when the operators' tank trucks load it at the destination storage facilities, when the specific additive of each operator is added automatically.
The company takes samples of the fuel and analyses them in each of the storage and transportation process phases, in order to guarantee that they comply with quality specifications. This ensures a uniform quality level compared to individual companies being in charge of this. Spain believes that this reduces the likelihood of deviating from the standards.

period between summer and winter. Croatia states that fuel imports are the main cause of non-compliance in their Member State. Estonia have specified that non-compliant samples are of the level of less than 2%, mostly related to RON, sulphur content and vapour pressure. France indicates that according to their records 99% of the petrol has blends with a bioethanol content between 5%-10%, whereas only 1% has 85% of bioethanol. This is a misinterpretation of the scope of the FQD by French authorities, as E85 is not regulated by the FQD[55].

Only the Czech Republic states that less than 25% of the petrol sold within its borders is compliant. According to the Czech authorities, less than 25% of the petrol sold has 10% bioethanol. This appears to be a misunderstanding of the question being asked, since according to reported fuel data, in 2014 98% of the petrol sold in the Czech Republic had 4% bioethanol and was classified as RON95 – E5 (EEA, 2015). Moreover, a further 2% is RON 98 – E5. Given that Article 3 allows for E5 petrol to be in the market for an undefined period, and that the 10% indicated in Annex I refers only to the maximum bioethanol content; virtually 100% of the petrol sold in the Czech Republic complies with the Directive. The Czech Republic reports 23,300 tonnes of RON 98 E85, which is outside the scope of the FQD (and therefore not classed as non-compliant petrol).

Figure 4.17: What proportion of fuel placed on your national market is in compliance with specification of Annex I? Stakeholder questionnaire response



Among stakeholders (see Figure 4.15), there is a relatively high proportion of them who do not know (15 out of 38). This seems to imply that industry stakeholders are not aware of the bigger picture of the Member States where they operate. It is possible that Member States have access to better information, since the Member State respondents to the project questionnaire have often been the same individual (or from the same department) as those responsible for the Member State reporting requirements.

[55] The scope of the FQD excludes fuel which contain less than 70% mineral oil, due to the definitions of diesel and petrol in Article 2 referring to CN codes which specify the lower limit of 70% mineral oil.

Among those who know, 29 of the industrial stakeholders consider that more than 95% of the fuel marketed in the Member States where they operate is compliant with Annex I of the Directive. The 14 industrial stakeholders that consider that 100% of the fuel placed in the market is compliant with the requirements in Annex I are one European industrial association (UPEI), five national petroleum associations (Germany, Bulgaria, Spain, Hungary and Portugal), and two biofuels associations/organisations (Sweden, Germany], and six industry operators (five of them covering both upstream and downstream operations [LUKOIL Neftohim Burgas, TOTAL Deutschland GmbH, OMV Deutschland GmbH, OMV Refining & Marketing GmbH, Refinery Heide] and one anonymous). It is worth noting that four of the industry operators cover more than one Member State, which would add value to their reply, although it has only been justified stating that compliance with the EN 228 standard is compulsory in the Member States where they operate. The other 2 operators have not justified their answer.

Industry associations give similar justifications, stating that the implementation is strong in the countries where they operate (Germany, Sweden) or giving an indication of the bioethanol content of the fuel used in the countries where they operate (Sweden, Portugal, Germany).

From the five respondents which state that 95-99% of the petrol sold in their area of operation is compliant, three are national petroleum industry associations (Austria, France, and the Netherlands); one is a national association for specialty chemicals manufacturers and one is an international oil company that covers refining and supply (TOTAL). These stakeholders stated that according to their information, the fuel was compliant with the EN 228 standard, with slight variations that justified a deviation from 100% compliance. According to the three respondents that have provided comments, this is due to a very small proportion of higher blends (E85) being sold. It should be noted that these higher blends are out of the scope of the FQD and do not have to meet these requirements, in any case. Again, there seems to be certain level of misinterpretation of the scope of the Directive by stakeholders.

Only one respondent states that the proportion of petrol that is compliant with Annex I is 50-84%, without a justification (FEF).

As for those responding that the compliant petrol is 25% or less, the three are national oil associations (Italy, Slovakia, and Denmark). The justification provided by the first two associations is that Italy and Slovakia do not sell E10 petrol (only E5). This does not seem correct, given that Annex I includes a maximum bioethanol limit, but does not have a minimum. Therefore, E5 is fully compliant. As for the Danish Oil Industry Association, they state that the reason for non-compliance with the Annex is the low summer ambient temperature derogation granted to Denmark by the Commission. This last statement does not seem correct, as the derogation allows them to have a higher vapour pressure, and their fuel would be, in principle, compliant with the Directive.

Reported non-compliances

Ricardo-AEA (2012, 2013a, 2013b, 2014a) and EEA (2015) also report on the level of non-compliance of operators reported by Member States.

Member States have reported non-compliance rates related to the limit values of Annex I of around 2% since 2009, with slight increases or slight decreases depending on the year, but that has increased in the last 4 years (1.3% in 2011, 1.9% in 2012 and 2.5% in 2013 and 2014). These sources indicate that the introduction of bioethanol blends imply challenges meeting the vapour pressure specifications in summer. This was tackled by the Commission with a derogation for Member States

that start introducing these blends. A higher vapour pressure was allowed in these Member States during a limited number of years (normally until 2020), with an increase over the 60 kPa limit that depends on the quantity of bioethanol introduced and had to be formally requested to and approved by the Commission (typically 68 kPa).

Furthermore, the Commission introduced a derogation for those countries with a low summer ambient temperature (Denmark, Estonia, Finland, Ireland, Latvia, Sweden, and the UK), which increased the limit on summer vapour pressure to 70 kPa in these Member States. According to the data submitted by Member States, there are a number of non-compliances over 70 KPa in 11 Member States, seven of which did not have this derogation in place. According to the latest summary report, a higher number of non-compliances were registered in the 2011-2014 period compared to previous years. However, it should be pointed out that biofuel blends did not have to be reported until 2011.

Conclusions

Taking into account the information gathered in the stakeholder consultation and the data available in the FQD annual monitoring reports, the following can be concluded:

- **Compliance:** The FQD summary reports consider that Member States are fully compliant so long as they have enacted the necessary national legislation transposing the FQD and they have introduced these fuels in the law. If the national legislation fully transposes the FQD, then operators are obliged to comply with the requirements in Annex I. In this sense, practically 100% of the fuel marketed in the EU is compliant with Annex I of the Directive. Member States have fully implemented the specifications in Annex I. The only case in which a Member State appears to sell non-compliant petrol is Lithuania, which sold 7 million litres RON98 E15 in 2014. Despite the fact that the specifications in Annex I are compulsory in all Member States, authorities must ensure that operators comply with these requirements, hence the sampling and inspection procedures set out in the Directive. The level of non-compliance with Annex I found in inspections is very low (below 2.5% for petrol), despite having increased slightly in recent years. Although the stakeholders consulted did not have the same interpretation of the term "compliance"[56] judging by the justification they have given to their answer, there is a general sense that the majority of the petrol sold in the EU complies with the requirements in Annex I. There are a high proportion of industrial stakeholders that stated that they did not know, which indicates that Member State authorities have better information on compliance levels.
- **Compliance vs. fuel homogeneity in Europe:** Compliance with Annex I does not ensure that all the petrol sold in the EU has the same characteristics, especially with regard to biofuel content. Annex I requires Member States to ensure that the petrol placed in the market has a maximum bioethanol content of 10%. However, there are multiple ways of complying with this (from E0 to E10). This obliges fuel suppliers to prepare various petrol bases in order to comply with the specifications in Annex I, given that the vapour pressure of the final blend will be influenced by the quantity of ethanol added. This is not very problematic as regards E5 and E10,

[56] AT, DE, ES, FI, IT, LU, LV, SI; UPEI, the national petroleum associations of Germany, Bulgaria, Spain and Hungary; the German biofuel association, Lukoil Neftohim Burgas, OMV, refinery Heide: They refer to compliance by Member State (i.e. implementation), which means that any petrol that does not comply with the specifications is considered illegal in these countries.
HR, MT, NL, UK: They refer to compliance by operators. The level of compliance is compared against the exceedances recorded

as the petrol bases that have to be used are very similar. It may lead to additional costs for those supplying E0, however this is not widespread throughout the EU.

- RON also differs among Member States, given that Annex I allows for a minimum RON of 95 (with a footnote indicating that RON91 may be allowed). However, over 70% of the fuel used is RON95. Therefore, the provisions in Annex I related to RON may potentially lead to minor market fragmentation, as analysed in E.Q. 1.3 and EQ 3.5.
- **Misinterpretation of the requirements of article 3 and Annex I:** Several stakeholders have misinterpreted certain aspects of the scope of the Directive, and therefore of their interpretation of compliance with Article 3. Therefore compliance is actually higher than the self-reported figure from the Member State questionnaire. The main misinterpretations arise from:
    - E85 petrol: Some Member States authorities and industrial stakeholders seem to believe that high petrol blends are in the scope of the FQD. This is not correct.
    - E5 vs. E10: Some Member States authorities and industrial stakeholders believe that petrol with less than 10% bioethanol is not compliant with the Directive. Since 10% is the upper limit for bioethanol content, their interpretation is not correct.
    - Low ambient summer temperature derogation: An industrial stakeholder considers that part of the petrol is not compliant due to the derogation. This is not correct.

EQ 1.7 Have the derogations in Article 3 been effective? (Article 3)

Derogations included in Article 3 are:

- Member States may make specific provisions for the Outermost Regions for the introduction of petrol with a maximum sulphur content of 10mg/kg.
- Member States with low ambient summer temperature may permit the placing on the market of petrol with a maximum vapour pressure of 70kpa during the summer. This has to be requested to the Commission, which shall assess whether the derogation could result in a lack of compliance with other European air quality and air pollution legislation in the Member State that requests the derogation or in other Member States.
- Those Member States that have not applied the low ambient summer temperature derogation may permit the placing on the market of petrol containing ethanol with a maximum vapour pressure of 60 kPa. This has to be requested to the Commission, which shall assess whether the derogation could result in a lack of compliance with other European air quality and air pollution legislation in the Member State that requests the derogation or in other Member States.
- Member States may continue permitting the marketing of small quantities of leaded petrol (maximum 0.03% of the total sales with a maximum of 0.15 g/l of lead) to be used by old vehicles and to be distributed through special interest groups.

The aim of the derogations is to ensure that where exceptional circumstances occur (such as e.g. low summer temperatures) which mean that compliance with the FQD is more difficult, Member States are not unduly burdened.

Low summer ambient temperature and bioethanol derogations

The low ambient summer temperatures derogation has been granted to all the countries to which it applies[57] (Denmark, Estonia, Finland, Ireland, Latvia, Sweden and the UK), whereas the petrol vapour pressure waiver related to the bioethanol content has been granted to Spain and Bulgaria. Member States had to provide a justification for this derogation and provide an assessment on current VOC, ozone and benzene levels; and how these would be affected by the derogation. According to the official submissions (annual reports) under the FQD, all the Member States that have been granted a low summer ambient temperature derogation are using it. As for the bioethanol waiver, Spain's official submission under the FQD reporting requirements states that this Member State has already implemented it. The national limit on vapour pressure is stated to be 66 kPa. As for Bulgaria, the derogation was granted during 2014. As a result, Ricardo-AEA and EEA summary reports do not contain information on the use of the waiver. However, Bulgaria has already allowed the placing on the market of E10 petrol (6% bioethanol) and had some exceedances over the vapour pressure limit in 2013 and 2014 (4 exceedances with a maximum vapour pressure of 67.1 kPa in 2013 and an undetermined number of exceedances with a maximum vapour pressure of 69.4 kPa), which makes it likely that this Member State will make use of the waiver from 2015 onwards. This shall be assessed in future summary reports.

The effect on the derogation on bioethanol content cannot be assessed using the Ricardo-AEA and EEA summary reports, as both derogations were granted after the latest year covered by available summary reports. Only two official summary reports were published by the Commission after the waiver was granted to Spain, however since the waiver was granted in November 2013 the possible effects cannot be quantified, as the latest Commission's summary reports cover 2013 and 2014 as a whole. Moreover, the individual Member States submission of one of the Member States that was granted this derogation (Bulgaria) cannot be used for assessing its effectiveness, as it was granted during 2014. As for Spain, only the latest annual submission was published after the derogation was granted. In this case, Spain had exceedances in the values of this parameter, but the number of them is unclear. The effectiveness of the derogation as a way to promote the introduction of bioethanol in the Member State market is likely to require longer to take effect, as Spain has not started introducing RON 95 E10 petrol yet. In fact, the maximum national limit is stated to be 66 kPa, which corresponds to a bioethanol content of 2% according to Annex III of the FQD.

The stakeholders consulted in this study do not seem to have relevant information on this issue. In fact, five fossil stakeholders[58] report having incurred higher costs due to adapting to petrol specifications related to the low summer ambient temperature derogation. It should be noted however that this derogation has not been granted in three of these Member States, indicating a misunderstanding in responses to the question. Most of the other respondents state that this is not applicable to the Member States where they operate in; or that they do not know (29 out of 40). According to the Commission's summary reports, some of the Member States which have applied the derogation exceeded the maximum allowed summer vapour pressure of 70 kPa (Estonia and Ireland). According to the latest national submission (2014), these Member States continue to have summer vapour pressures that are very close, or exceed the limit. Ireland has a mean summer vapour pressure of 69.29 kPa and 13

[57] All the countries classed as having low summer ambient temperatures

[58] The national petroleum industry associations from France, Portugal, Denmark and Slovakia and the integrated oil company TOTAL

of the 50 samples were above 70 kPa. According to Irish authorities, the companies involved were contacted and stated that all the fuel was within the specifications when it left the refineries and the terminals, and had no explanation for the exceedances measured at the service stations.

Derogation for sulphur content in the Outermost regions

The public information on these derogations is very limited, if any, which suggests that they have been rarely applied. Two of the three relevant States responded to the questionnaire (France and Spain). France indicated that the derogation was used in Mayotte, where the derogation is applicable until December 2016. This derogation was published in 2013[59] and allowed Mayotte the placing in the market of petrol with a maximum sulphur content of 50 mg/kg, a maximum aromatics content of 40% and a maximum olefins content of 22% (instead of 10 mg/kg, 35% and 18%, respectively). France also indicated that the benefits outweigh the costs of the derogation (see E.Q. 2.7).

On the other hand, Spain indicated that this derogation has not been necessary in the Canary Islands. There is a refinery in Tenerife that supplies fuel to other parts of Europe and is owned by the same company which owns other refineries in the south of the Iberian Peninsula, which supply to the islands when necessary. As a result, logistics for supply of FQD compliant fuel to the Canary Islands are well implemented and this derogation has not been required.

There is limited evidence from industry for the use of the derogation for Outermost Regions which allows the provision of petrol with a maximum sulphur content of 10mg/kg. Only one of the industry respondents, a fossil fuel manufacturer and supplier, reports awareness of the derogation being used (TOTAL SA). This same respondent considers that the benefits from applying this derogation outweigh the costs of implementing it.

Overall, it can be **concluded** that the derogations have been effective as they provide flexibility in fuel supply when it is challenging for Member States to comply with certain criteria when they add a small proportion of biofuel, when the summer temperature is low and for the Outermost regions, at least in the only case it has been used. Reasons for the minor conformance of Ireland and Estonia in relation to summer vapour pressure are unclear at present but may be linked to the transitional periods when suppliers are swapping winter fuel specifications for summer fuel specifications. It should be assessed whether these issues occur in future years. Also, special attention should be paid to future fuel quality monitoring reports provided by the Member States that have a vapour pressure waiver related to the use of bioethanol. Although there is limited data, Spain may not be increasing the amount of bioethanol as per the schedule of their request. If this trend is confirmed and is the case for other Member States, then the waiver will not have contributed to an increased bioethanol content in petrol.

EQ 1.8 Is the diesel fuel placed on the market in compliance with the specifications of Annex II of the Directive? (Article 4)

Diesel specifications and their evolution

Article 4 states that Member States have to ensure that the petrol placed in the market in their territory complies with the environmental specifications set out in Annex II of the Directive.

[59] *JORF n°0295 du 20 décembre 2013 page 20798, texte n° 39*, available at: https://www.legifrance.gouv.fr/eli/arrete/2013/11/21/DEVR1328804A/jo

This Annex contains minimum or maximum limits for 6 parameters (Table 4.2).

Table 4.2: Environmental specifications for vehicles equipped with compression ignition engines using diesel (Annex II of the FQD)

Parameter	Unit	Minimum limit	Maximum limit
Cetane number		51	
Density at 15°C	Kg/m		845
Distillation – 95%v/v recovered at	°C		360
Polycyclic aromatic hydrocarbons (PAH)	% m/m		8
Sulphur content	mg/kg		10
FAME content	% v/v		7

The same parameters were controlled by the first FQD (98/70/EC) with the exception of FAME content. Some of the limitations changed over the years (see Table 2.2 above). The main changes in the latest amendment of the FQD (2009/30/EC) compared to the previous amendment (2003/17/EC) are the following:

- Confirmation of the maximum level of sulphur in petrol (10 ppm), which was subject to review in the previous version of the Directive.
- Introduction of a 7% limit for FAME.
- Maximum PAH content of 8% instead of 11%.

However, article 4 allows Member States to permit the placing on the market of diesel with a FAME content above 7%.

Also, Article 4 obliged Member States to ensure that gas oil to be used in NRMM with a sulphur content not exceeding 1,000 mg/kg from 01-01-2008 to 31-12-2010 and not exceeding 10 mg/kg from 01-01-2011 onwards. However, Member States may permit the placing on the market of gasoil for NRMM with a sulphur content of 20 mg/kg at the point of final distribution to end users. Finally, Member States could extend the availability of gasoil with 1000 mg/kg sulphur for rail vehicles and agricultural and forestry tractors until 31-12-2011.

Article 4 allows Member States to have specific provisions related to the sulphur content of diesel for the Outermost regions and those Member States with severe winter weather to have a maximum distillation point of 65% at 250°C.

Compliance reported in annual summary reports

As with E.Q.1.6, the most reliable source to assess compliance with Annex II is the official annual summary reports on the FQD published by Ricardo-AEA (2012, 2013a, 2013b, 2014a) and the EEA (2015).

According to these sources, all Member States have complied with the new fuel specifications in all years. This means that Member States have implemented the

Directive, although there is a proportion of non-compliances by operators (as discussed below). Evidence from the stakeholder questionnaire also indicates that a high proportion of diesel placed on the market is compliant with the specifications of the Directive.

Compliance reported in the stakeholder engagement exercise

19 out of 20 Member State authorities indicate that more than 95% of the diesel placed in the market is compliant with Annex II. Six of the Member States which state that 100% of the diesel sold is compliant (Germany, Latvia, Romania, Austria, Luxembourg and Sweden) have provided additional commentary. This only indicates that their fuel is compliant with the EN 590 standard according to their data. The other Member States with 100% compliance are Spain, Italy and Finland.

Among the 8 Member States which replied that the proportion of diesel complying with Annex II is between 95% and 99% (Estonia, Malta, Poland, the UK, the Czech Republic, Croatia, France, Denmark, Slovakia and Slovenia), 6 have provided further commentary. Malta and the UK indicate that they are "generally" compliant, with a few exceptions which lead to enforcement procedures (no further details). Croatia state that the few exceedances correspond to imported fuel, and that this cannot be avoided as authorities do not have the capacity of verifying all shipments. Estonia indicates that around 1.8% of the samples are non-compliant, mostly related to the cetane number and distillation. Finally, Slovenia indicate that 0.2% of the diesel sold within their borders is 'sold as pure biodiesel'. It has been assumed that this refers to higher diesel blends that are out of the scope of the FQD. Only one Member State (the Netherlands) states that they do not know the answer to this question, without further explanation.

The majority of stakeholders (30 out of 39) state that the proportion of diesel that complies with Annex II of the FQD is higher than 95%. Those that state that 100% of fuel was compliant are 15 fossil fuel manufacturers and suppliers[60], one biofuel industry association (VDB), two biofuel and fossil fuel suppliers (Nesté and the Swedish Petroleum & Biofuels Institute).

Five[61] fossil fuel stakeholders add that Member States have to comply with EN 590 or that the diesel is fully compliant, without providing any justification. The stakeholders which state that 100% was compliant are fossil fuel manufacturers and suppliers.

Nesté state that non-road diesel is often FAME-free because this prevents issues related to the long periods that this equipment is likely to not be used. The Swedish Petroleum and Biofuel Institute indicate that there has been low-sulphur diesel in Sweden since the 1990s and that no transitional periods have been required.

The 11 respondents who stated that the proportion of diesel that complies with Annex II is between 95-99% are seven biofuel[62] manufacturers or suppliers and four[63] fossil

[60] LUKOIL Neftohim Burgas, Bulgarian Petroleum and gas association, TOTAL Deutschland GmbH, UPEI, Unione Petrolifera, Asociación Española de Operadores de Productos Petrolíferos (AOP), Polish Organisation of Oil Industry and Trade, OMV Deutschland GmbH, OMV Refining & Marketing GmbH, VNPI, Hungarian Petroleum Association, Refinery Heide, APETRO- Associação Portuguesa de Empresas Petrolíferas, Mineralölwirtschaftsverband e.V., and Danish Oil Industry Association

[61] TOTAL Deutschland GmbH, OMV Deutschland GmbH, OMV Refining & Marketing GmbH, Refinery Heide and APETRO and Unione Petrolifera

[62] Agroinvest, Bio-oils energy, Centre Ouest Cereales, Združenie pre výrobu a využitie biopalív, Verbio, EEB and one anonymous response.

[63] TOTAL SA, INEOS, APIA and Slovak Association of Petroleum Industry and Trade

fuel manufacturers and suppliers. Only three of these stakeholders have provided further commentary. According to them, the reasons for the small proportion of fuel that is not compliant are: the proportion of B8 diesel that has been available in France from the beginning of 2015 (TOTAL SA); slight variations in some samples (APIA), and the existence of certain exemptions in Slovakia such as army vehicles, state reserves, arctic diesel and marine fuel for inland vessels (Slovak Association of Petroleum Industry and Trade). It should be noted that although B8 diesel is not compliant with Annex II, it is compliant with article 4, as it allows the placing on the market of diesel with a higher FAME content. This issue will be further discussed in coherence (E.Q. 3.8.). The comment by the Slovak Association of Petroleum Industry and Trade may be their misinterpretation of the Directive in this regard. The exemptions they mention could be related to the provisions mentioned in article 4(2) and 4(4) of the FQD. As no further details on these exemptions have been provided, this cannot be confirmed. Only the Forecourt Equipment Federation stated that 50-84% of the diesel placed in the market is compliant with Annex II, although it has not included further comments.

As can be observed above, most of the stakeholders that stated that less than 100% was compliant refer to non-compliances by operators and not to any Member State allowing the placing on the market of diesel that does not comply with Annex II or the rest of provisions in article 4 of the FQD.

Reported non-compliances

The summary reports by Ricardo-AEA and EEA contain information of the level of exceedances over the national legal limits. The average level of non-compliances for diesel is higher than for petrol specifications (Annex I), as it ranged from 3.5% to almost 5% in the 2009-2012 period. This dropped to 1.1% in 2013 and 1.3% in 2014. As of 2014, various parameters emerged as being particularly problematic:

- FAME content: 11 Member States reported non-compliances related to the FAME content in diesel (Belgium, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Poland, Slovakia and the UK).
- S content: 9 Member States reported non-compliance related to sulphur content in diesel (Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, France, Ireland, Italy, and Poland).
- Density at 15°C (Croatia, Czech Republic, the UK).

As described in E.Q. 1.3, it should be noted that compliance with Annex II does not ensure a single market, and this is mainly related to the FAME content of diesel. First of all, Annex II of the FQD establishes maximum (density, temperature of 95% recovery, PAH, sulphur, FAME), or minimum (cetane number) limits, so that Member State may comply with the Annex without selling diesel with the same specifications. In the case of FAME, the maximum content of 7% allows Member States to permit the placing on the market of diesel with a FAME content between 0 and 7%. For the Member States that specified the proportion of FAME blended with diesel during 2014, there were multiple fuel types (EEA, 2015):

- B0 was sold in Austria, Latvia and Lithuania.
- B7 was sold in all Member States. However the content varied from 1.68% (Slovenia) to 7% (Cyprus, Denmark, Finland, France, Luxembourg, Malta, Poland and Slovakia).

Moreover, the provisions of Article 4 allow the placing of the market of diesel with a quantity of FAME above 7% as set out in Annex II of the Directive. The use of CN codes in Article 2 defining a minimum of 70% mineral oil, together with Article 4,

would theoretically allow Member States to permit diesel with any quantity of FAME from 8% to 30%, as long as consumers are informed. France is already permitting the sale of diesel with 8% FAME, and other Member States such as Spain have expressed their interest in following this approach in order to comply with the RED requirements (see E.Q. 3.8).

Conclusions

In view of the data in the literature and stakeholder consultation presented above, the following can be concluded:

- **Compliance:** The FQD summary reports consider that Member States are fully compliant as long as they have enacted the necessary national legislation transposing the FQD and they have introduced these fuels in the law. If the national legislation fully transposes the FQD, then operators are obliged to comply with the requirements in Annex II. In this sense, 100% of the fuel marketed in the EU is compliant with Annex II of the Directive. Member States have fully implemented the specifications in Annex II. The only case in which a Member State sells diesel with a higher FAME level than that indicated in Annex II is France, which allows the placing on the market of B8 diesel. However, this is fully compliant with the FQD, as article 4 allows the placing of the market of diesel with a higher FAME content. Despite the fact that the specifications in Annex II and the other provisions of article 4 are compulsory in all Member States, authorities must ensure that operators comply with these requirements, hence the sampling and inspection procedures set out in the Directive. The level of non-compliance with Article 4 found in inspections is very low (1.3% during 2014; always below 5% in the period 2009-2014). Among stakeholders, there is a general sense that the majority of the diesel sold in the EU complies with the requirements in Annex II.
- **Compliance vs. fuel homogeneity in Europe:** Compliance with Annex II and Article 4 does not ensure that all the diesel sold in the EU has exactly the same specification with regards to biofuel content. Annex II requires Member States to ensure that the diesel placed in the market has a maximum FAME content of 7%, which includes blends ranging from B0 to B7. This is unlikely to lead to practical issues of fuel supply, given that the specifications of Annex II allow FAME to be blended directly into regular diesel without the need for several fuel bases.

  In addition, the scope of the Directive excludes fuel with greater than 30% biofuel content. Article 4 allows the placing in the market of diesel with a FAME content greater than 7%, creating an exception to the Annex II specification, which may potentially lead to more heterogeneity in the diesel sold in the EU. To date, France has already allowed the placing on the market of B8 diesel[64]. This is relevant because a FAME content above 7% may lead to engine compatibility issues (see EQ3.9).

EQ 1.9 Were there any cases of MS States prohibiting, restricting or preventing marketing of fuels complying with the Directive? (Article 5)

During this evaluation no examples have been found of MS States prohibiting, restricting or preventing the marketing of FQD compliant fuels.

Article 5 has not been effective in preventing the market fragmentation, in fact it has contribute to the problem because it allows the movement of fuels across Member States that are not fully harmonized as direct effect of Articles 3 and 4, and as a result

[64] This is currently subject to discussion with the Commission

of the national implementation of the fuel specifications of the FQD, Article 7a of the FQD and the 10% renewable energy in transport target of the Renewable Energy Directive.

Biofuel mandates

Many Member States have introduced renewable energy obligations (or biofuel mandates, or blending quotas) for the transport sector: these mandates oblige fuel suppliers to bring a certain share of their fuel sales as biofuels on the market in order to meet both the 10% transport target of the Renewable Energy Directive and the GHG reduction target as laid down in Article 7a of the FQD. The blending mandates are mainly focused on an increase of biofuel shares in overall energy consumption in the transport sector, like the 10% of the RED is defined in terms of a share of total energy consumption. At the same time, these mandates automatically contribute to the realisation of Article 7a of the FQD (depending on the type of biofuels used and their specific GHG savings). If the blending mandates are not sufficient to meet the 6% target set in Article 7a of the FQD, Member States will have to take additional measures (like upstream emission reductions). The variation between national biofuel mandates is relevant to Article 5 of the FQD, because Article 5 is not able to prevent the market fragmentation as result of this variation in biofuel mandates. Although Member States do not intentionally restrict the free circulation of compliant fuels, the differences in national implementation resulting in various biofuel grades creates market barriers for compliant fuels.

Member States may have formulated an overall target and/or specific targets for diesel and petrol. In Table 3 the blending quota per Member State for the year 2014 are depicted. These quota show that some Member States, like France and Poland, are very close or exceeding the blending limits of Article 3 (Annex I) and 4. Note that overall blending quota above the 7% can be met using E10, drop-in biodiesels or higher blends in niche vehicles (the higher blends falling outside the scope of the FQD).

Table 3 Overview blending quota per Member State in 2014, in energy content

Member State	Overall Target	Target for petrol	Target for diesel		Overall target	Target for petrol	Target for diesel
France	7.57%	7.00%	7.70%	Bulgaria (v)	4.94%	3.34%	5.53%
Poland	7.10%			Hungary	4.90%	4.90%	4.90%
Slovenia	7.00%			Romania (v)	4.79%	3.00%	5.53%
Sweden (v)	6.41%	3.20%	8.78%	Luxembourg	4.75%		
Germany	6.25%	2.80%	4.40%	Czech Republic (v)	4.57%	2.73%	5.53%
Finland	6.00%			Slovakia (v)	4.50%	2.73%	6.27%
Lithuania (v)	5.80%	3.34%	6.45%	Italy	4.50%		
Austria	5.75%	3.40%	6.30%	Malta	4.50%		
Denmark	5.57%			Spain	4.10%	3.90%	4.10%
Portugal	5.50%			United Kingdom (v)	3.90%		
Netherlands	5.50%	3.50%	3.50%	Greece (v)	2.64%		
Belgium (v)	5.09%	2.66%	5.53%	Croatia (v)	2.06%		
Ireland (v)	4.94%			Mean target	5.15%	3.58%	5.81%

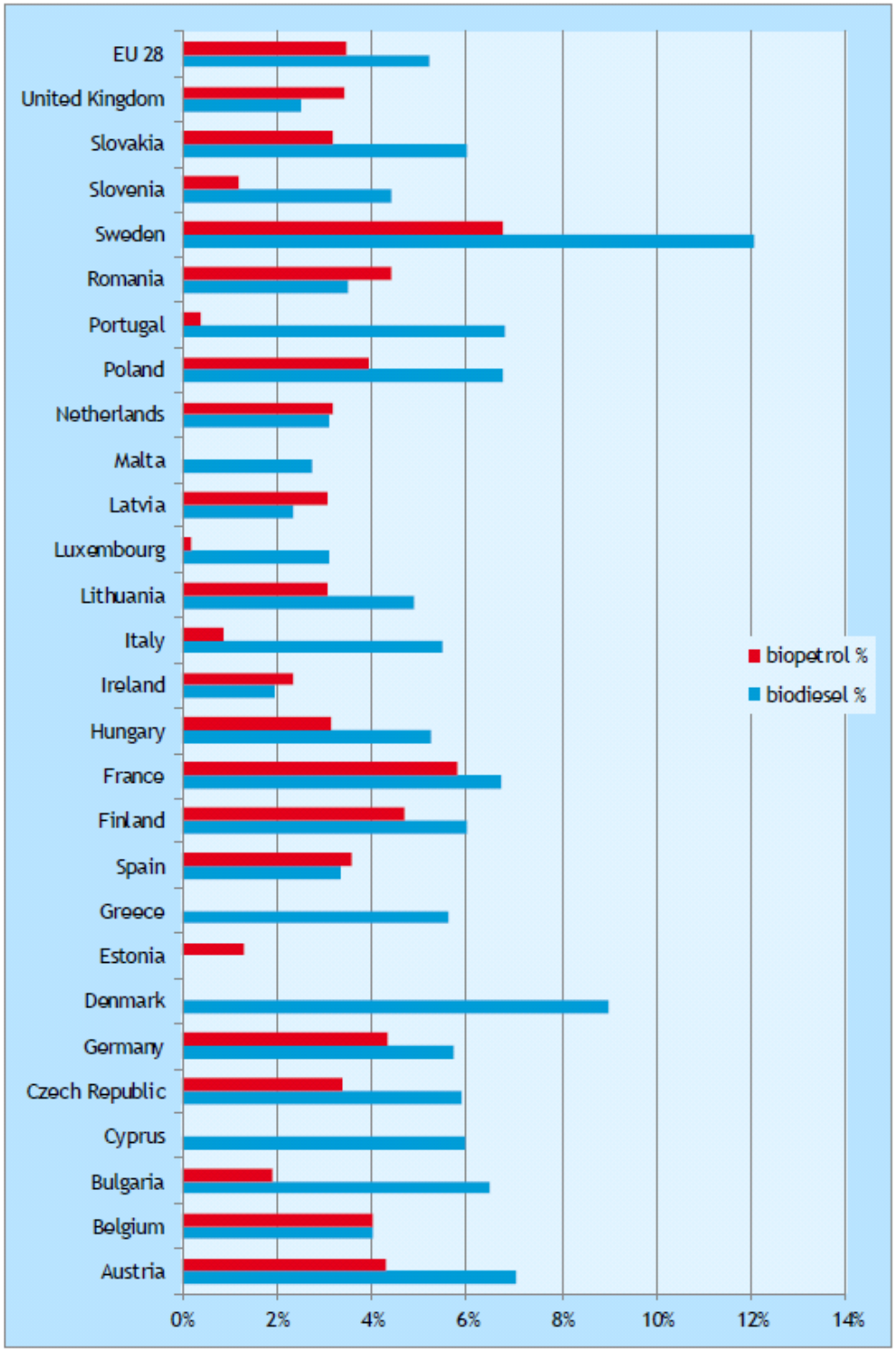
Source: Biofuel Barometer, 2014

(v) = obligations originally set in % v/v

There are, however, also some other Member States with far lower quotas, like Greece and Croatia. The actual shares of bio petrol and diesel (for the year 2013) are depicted in Figure 18.

The differences in levels between quotas mean that the B7 and E5 (or E10) will contain different levels of biofuels in different Member States. It is difficult to provide insight in the exact content of the various biofuel grades on the market per Member State, because the level of detail of the FQM reports (as specified by Article 8 of the FQD) is not detailed enough to identify the actual percentage of bio content in fuel in individual Member States. There is however real variation and range in the proportion of bio content, e.g. the proportion of FAME in B7 varied from 1.68% to 7% in 2014 (EEA, 2015. See EQ 3.5). Fuel suppliers and refineries operating in multiple Member States may therefore have to meet different levels of bio blends, which could require more effort and result in higher cost due to the need to produce and administer multiple different fuels.

Figure 18 Shares of biodiesel and biopetrol in total diesel and petrol sales, respectively, in 2013 (source: Eurostat via ICF, 2015)



Not only does the level of the mandates seem to impact free circulation negatively: but also the type of biofuels allowed under national legislation differs. In relation to Article 5, Nesté, as a biofuel (HVO) producer, mentions that there are national mandates which only allow for FAME as the renewable component. This is despite

Article 5, Annex II and recital 33 of the FQD fully allowing the use of HVO and BTL (biomass to liquid) as well (alone or in combination with FAME).

In the open answers on the questions related to free circulation and the realisation of a single market various stakeholders state that Article 5 has not led to a single market. FuelsEurope and its individual members all refer to the national biofuel schemes and mandates being responsible for the fragmentation of the motor fuel market within the EU. Based on this fragmentation these fuel industry actors draw the conclusion that free circulation is not guaranteed within the limits of the FQD. UPEI (fossil fuel manufacturers and suppliers) also mentions that biofuel schemes resulting in different biofuel grades lead to higher cost for fuel suppliers which hinder free trade.

ACEA (the automobile manufacturers association), as representative of the car industry, also refer to the various biofuel grades and provided the use and availability of these grades as example. Member States like France and Germany have special policy measures in place to stimulate the use of E10. In this way fuel suppliers started to supply E10 resulting in significant shares of E10. But there are also Member States where E10 has not been introduced yet. Although it is not forbidden to sell E10 in these Member States, market actors have not taken actions yet to supply E10 in these countries and therefore it is hard for E10 available in France, Germany and Finland to cross borders.

In relation to coherence FuelsEurope has raised the following issues in relation to incoherence during the additional interview:

- a volume objective under the RED, while FQD has set intensity targets.
- incoherencies in methodologies, like the double counting under the RED, while the FQD does not allow double counting.
- the cap on food based biofuels as introduced by the ILUC Directive, which use is not compulsory under the FQD.

Although these issues are strongly linked to coherence, these issues are also responsible for the differences in biofuel shares as depicted in Table 3 and Figure 18 and therefore are mentioned here as well. See also EQ 3.11 on coherence.

Definition of FAME/petrol in Article 3 and 4

The targets as defined by the RED and Article 7a providing an incentive for increasing biofuel consumption also have resulted in some Member States going beyond the blending limits as laid down by Article 3 and 4. The following cases are known:

- the introduction of HE15 (hydrous ethanol) in the Netherlands;
- the introduction of B8 in France;
- the introduction of E15 in Lithuania.

This is partly the result of confusion among Member States on how to interpret Articles 3 and 4 in combination with these Member States looking for opportunities to increase the share of renewable energy in the transport sector. Various industry stakeholders have argued that these fuels are not FQD-compliant and hinder harmonisation of the fuel market, like the joint position paper of ACEA/FuelsEurope on the intention of France to introduce B8 diesel[65]. The European Commission has taken corrective

[65] https://www.fuelseurope.eu/uploads/Modules/Resources/140929-joint-acea-fuelseurope-position-on-the-intention-of-france-to-introduce-b8-diesel---september-2014.pdf

actions. These issues can also be identified as factors having a negative impact on the free circulation of fuels. However, following intervention from the Commission, HE15 in the Netherlands and E15 in Lithuania have both been withdrawn.

During the follow-up interviews, FuelsEurope mentioned B8 in France and the non-clarity of FAME levels in diesel as contributing to market fragmentation. In 2014 France increased its target of 7% in biofuels in road fuels to 7.7% with the idea that 0.7% would be met by advanced biofuels (0.35% without double counting). Since this is above the blending limit the introduction of B8 seemed necessary. Although precise data is not available on the proportion of B8 supplied to date (due to the short time period since its introduction in 2015), in the follow-up interview with France it was stated that initial data indicates that to date 10% of diesel supplied is B8, and the remainder B7.

The NGO Transport & Environment also identified the lack of clarity about derogations to the FAME limits in Article 4.1 paragraph 2 as a loophole in the system, but T&E also noted that there will be bigger disparities between Member States without the FQD in place.

Based on these responses reflecting on the higher blends that came on the market it can be concluded that the current definitions of Article 3 and 4 have led to the introduction of some non-compliant fuels. On the other hand, one could argue that the FQD has been successful in ensuring a single market, because the infringement procedures have stopped the marketing of these fuels (in case of Lithuania and the Netherlands).

NRMM

In the additional interview Euromot (engine manufacturer) referred to the differences in national legislation between Member States with respect to the specification that NRMM (or just agricultural construction machinery) must use the same grade of diesel as on-road diesel. Because not all Member States use this specification, this contributes to the market fragmentation of the market and therefore also impacts the free circulation of fuels.

Technical requirements

Finally, there are also some technical requirements which oblige Member States to set different fuel specifications in order to take into account local conditions. The Swedish Petroleum & Biofuels Institute (fossil and biofuel manufacturer) refers to the differences in requirements within EN580 for technical reasons (for example the cold properties). These different technical requirements are included in the various national Annexes and mean that, even if the fuels are in compliance with the FQD, fuels are not equal across the EU.

The United Kingdom states that additional national requirements are especially the case for FAME. Although these requirements are required from an operational perspective, this does not contribute to the creation of a single market. During the additional interview the United Kingdom also mentioned that the current level of harmonisation is being mainly delivered through adherence to CEN standards rather than because of the FQD. In order to further improve the level of harmonisation CEN and CE should work better together.

Market fragmentation and Article 5

Overall the above four examples show that Member States do not intentionally hinder the free circulation of compliant fuels, but that the differences in national implementation of the RED and FQD contribute to fragmentation of the fuel market and therefore result in barriers for the free circulation of compliant fuels.

Although these issues are identified, both Member States and other stakeholders indicate that the requirement for free circulation of compliant fuels has contributed to the development of a single market. This implies that both Member States and other stakeholders think that market fragmentation would be even worse without Article 5 in place (see also EQ 4.9).

Of the Member States Austria, Finland, France, Latvia, Malta, the Netherlands, Sweden, Slovenia and Romania responded 'to a large extent' to this question. The United Kingdom, Croatia, the Czech Republic, Denmark, Germany and Slovakia are less convinced of the contribution of Article 5 to the single market: these Member States responded 'to some extent'. Luxemburg and Estonia stated 'do not know'.

Member State respondents seem to be more convinced of the contribution of Article 5 to the free circulation of compliant fuels than industry respondents. However, some Member States also agree with the industry respondents that national requirements can be a barrier for free circulation, like the United Kingdom (see text on technical requirements above).

Croatia also mentions that there are also other European regulations that regulate and ensure free circulation. Article 5 should therefore be seen as an additional provision, which might help to only further ensure compliance by all market actors. According to Poland, Poland ensures free circulation of fuels by a mutual recognition clause. Spain stated that Article 5 ensures that Member States do no create unnecessary barrier to trade.

The stakeholders which have responded 'to a large extent' include fossil fuel manufacturers and associations[66], biofuels sector stakeholders[67] and the NGO Transport & Environment.

The stakeholders which have responded 'to some extent' are fossil fuel companies[68], biofuels companies[69], the Swedish Petroleum & Biofuels Institute, the equipment manufacturer Forecourt Equipment Federation, Afton Chemical limited (fuel additive manufacturers).

The stakeholders which have responded 'to no extent' are INEOS (fossil fuel manufacturer and suppliers), EBB European Biodiesel Board (biofuel industry), and Nesté (Fossil and biofuel manufacturers). The industry stakeholders which have responded they don't know are biofuel industry stakeholders[70] and ACEA.

Whilst industry respondents find the FQD and RED not coherent, Member State respondents do not identify any problems in relation to the coherence of the free circulation provision with other EU legislation. It is important to note that the opinion of industry respondents is likely to be based on their experience with the national transposing legislation rather than the EU Directives, because at the end they have to

[66] Unione Petrolifera, Asociación Española de Operadores de Productos Petrolíferos (AOP), Polish Organisation of Oil Industry and Trade, VNPI, UFIP, Hungarian Petroleum Association, Danish Oil Industry Association and FuelsEurope

[67] Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec, Ethanol Europe), the fuel additive manufacturers EFOA (European Fuel Oxygenates Association

[68] LUKOIL Neftohim Burgas, TOTAL Deutschland GmbH, UPEI, TOTAL S.A., OMV Deutschland GmbH, OMV Refining & Marketing GmbH, the Bulgarian, German, Slovak, Austrian and Portuguese petroleum industry associations, and Refinery Heide

[69] The Slovak biofuels association, Bio-Oils Energy S.A., Centre Ouest Cereals and Bio-Oils Energy S.A

[70] Agroinvest SA, ePURE, Verbio Vereinigte Bioenergie AG, APPA Biocarburantes.

meet national requirements. On the other hand, Member State respondents are likely to refer to the Directives at the EU level. Because the Member States are responsible for the transposition of both Directives and the differences as result of the national choices made, Member States have certainly contributed to the difference between the negative attitude of industry respondents and positive attitude of Member State administrators.

Conclusion

The main conclusion here is that Article 5 has not been fully effective in ensuring free circulation and thus prevents the market fragmentation resulting from the national implementation of the fuel specifications of the FQD, Article 7a of the FQD and the 10% renewable energy in transport target of the Renewable Energy Directive. This analysis has, however, not identified any potential changes which could be made to Article 5 to reduce market fragmentation other than adjusting the provisions in the FQD and RED which seem to be responsible for the market fragmentation. It should be noted that most of the implementation actions having a negative impact on the single fuel market are in compliance with the FQD and RED: so Member States operate in the freedom given by these Directives. Adjustments to ensure a single market will imply limitations to the freedom that Member States currently have in their national implementations.

EQ 1.10 What environmental gains have been achieved by this Article (which allows MS to require some fuels to meet more stringent environmental specifications) (Article 6)

Based on the evidence obtained through the stakeholder engagement, none of the Member States which responded to the questionnaire have applied Article 6. This has been confirmed by the European Commission.

In the follow-up interviews, a number of Member States (France, Spain, Sweden, the UK) indicated that they agreed with the logic underlying the introduction of the article, however a number of issues were anticipated to its application.

The UK states that trying to introduce fuels with different requirements would be a challenge, since the majority of vehicle manufacturers use EN590, and it would be difficult to get vehicle manufacturers to sign up to the use of a different fuel.

France indicated that the logistics of applying the article – e.g. requiring fuel suppliers to produce specific fuels for specific times or locations, would be a barrier to the application of the article, and that in practice, if there are pollution issues in a large urban area such as Paris, the application of this article would be too difficult and the preferred approach to reducing emissions in an urban area would likely involve banning the circulation of selection sub-sections of vehicles based on their number plates.

Overall, no environmental gains have been achieved by this Article, because the Article has not been applied. Considering the potential application the provisions of Article 6 seem to be not efficient: although the CEN standards provide room to set stricter environmental requirements without violating the CEN standards Article 6 is to be considered to a less efficient provision to apply in practice compared to other policy instruments. Vehicle-related policy options are preferred over fuel-related policies in case of local environmental problems.

EQ 1.11 Has the application of Article 7 ensured a supply of fuel following exceptional events which would otherwise have led to the loss of supply? (Article 7)

The aim of Article 7 is to ensure that in the case where a sudden change in the supply of crude oils or petroleum products renders it difficult for the refineries in a Member State to fulfil the specifications requirements of Articles 3 and 4, the Commission may authorise higher limit values for one or more fuel components in that Member State for up to six months.

Article 7 has not been applied by any Member State to date. This was confirmed by Member State responses to the stakeholder questionnaire, however the UK considered applying Article 7 in response to a threatened UK fuel tanker strike in 2012, and discussed details of a potential application with the Commission. Ultimately the threatened fuel tanker strike was cancelled and it was therefore not necessary to request permission to apply this article.

Since the Article has not been applied and no additional commentary was provided by Member States in their questionnaire responses, Member State perception of the Article was investigated further in the follow-up interviews carried out with selected Member States in December 2015. Spain, France, the Netherlands and Poland all consider that Article 7 provides a necessary safeguard. Sweden considered that within Sweden, Article 7 is not necessary since Swedish environmental fuel standards are generally higher than the requirements of the FQD, and therefore Sweden already has an internal 'fall back' position available which would still meet the FQD requirements.

Stakeholder questionnaire responses indicated a low level of awareness and knowledge of the Article across a range of sub-sectors (biofuel industry, fuel additive manufacturers and engine manufacturers stated they 'Did not know' in response to questions relating to Article 7, and NGOs did not respond). Stakeholders from the fossil fuel sector had a better knowledge and awareness of the Article, and responded to indicate that the article has not been applied to date. The UK stated that in the absence of the article, if the threatened fuel tanker strike had gone ahead, security and continuity of supply would have been threatened. Therefore the effectiveness of Article 7 is evaluated positively.

Following the UK's experience of considering an application to apply Article 7 and discussions with the Commission, feedback on potential improvements to the article are as follow:

- Greater clarity in the scope and definitions of the article. For example, in the UK's case it was not clear whether a future situation (i.e. the potential tanker strike) would be covered by the article's definitions of disruption to supply. The present wording of the Article does not specifically include pre-emptive applications for the Article, rather it is worded such that an application will be made once the disruption has occurred. Modifying the scope to allow pre-emptive applications would resolve this.
- It would also be beneficial to expand the scope covered by the article so that it covers supply at all points of the refining and distribution chain (downstream as well as upstream supply). The UK considers that in the current fuel market, the downstream supply sector can be more disruptive than the upstream supply sector. The current wording of the article describes the circumstances in which it would apply as "If, as a result of exceptional events, a sudden change in the supply of crude oils or petroleum products renders it difficult for the refineries in a Member State to respect the fuel specification requirements of Articles 3 and 4", which does not include disruption in the downstream fuel supply.

Overall, even though it has never been used, it is considered that Article 7 provides an effective safeguard in case an emergency situation should arise. It is considered effective in ensuring fuel supply to a Member State is not disrupted in the event of an upstream disruption to fuel supply.

EQ 1.12 Have Member States resumed compliance with lower limits after the 6 month derogation periods? (Article 7)

Since Article 7 has never been applied there is no data on the resumption of compliance with lower limits following a 6 month derogation period. However, in the case of the UK which considered submitting an application to apply Article 7, the UK considered that compliance with the lower limits of the FQD would have been re-established after the 6 month derogation period or potentially earlier given the circumstances which caused the UK to consider application of Article 7 (a limited duration tanker strike).

EQ 1.13 What are the impact on health and the environment of this Article? (Article 7)

Since Article 7 has never been applied, there is no data available on changes in emissions due to higher limits being temporarily imposed.

However, the impact on health and the environment of the application of Article 7 would depend on which of the fuel specifications set by the FQD were being temporarily amended or exceeded. For example, in the case of the potential application of the UK, the specification issue at stake was vapour pressure. In the theoretical case of an application being made under Article 7 to the Commission, the health and environmental impacts would vary depending on which of the specifications were to be temporarily relaxed (i.e. a relaxation of the vapour pressure limit would have a very different impact to the relaxation of the sulphur content limit).

EQ 1.14 Has the reporting of MS been useful to reduce health and environmental impacts from fuels used in transport? (Article 8)

Article 8 in Directive 98/70/EC required Member States to monitor and report compliance with the requirements of Articles 3 and 4. Directive 03/17/EC[71] amended 98/70/EC and required Member States to develop Fuel Quality Monitoring Systems (FQMS) in accordance with European Standard EN 14274:2003 and to implement these monitoring systems by 1 January 2004. Reporting template for MS to use were developed centrally and have been updated annually.

The 2013 EU Fuel Quality Monitoring Summary Report (Ricardo-AEA, 2014a) summarises Member State reporting for the 2013 year and presents an overview of Member State reporting historically.

In 2013, Member State compliance with monitoring and reporting requirements was positive: all 28 MS submitted their reports to the Commission (only 3 after the deadline of 30th June[72]). Of the 10,095 samples tested for petrol in 2013, 2.5% were found to be non-compliant (1.8% if weighted by fuel sales). Of the 14,764 samples tested for the 6 mandatory parameters for diesel in 2013, 1.1% of all samples were out of specification with Directive limits (0.9% if weighted by fuel sales).

The most common parameters found to be outside specification limits for petrol were summer vapour pressure, and RON and MON. For diesel the most common parameters

[71] OJ L76, 22.03.2003, p.10 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0017&from=EN

[72] From 2015 the reporting deadline has changed to 31st August

found to be outside specification limits were sulphur content, FAME content above the 7% level (excluding B+ diesel) and distillation and density exceedances.

The level of on-time reporting has improved consistently over the years (since 2001), and the level of limit value non-compliances for petrol and diesel has decreased significantly in 2012 and 2013 after a spike in 2011 non-compliances. (Ricardo-AEA, 2014a).

Emissions of pollutants from road transport (SO_X, NO_X, PM, lead and PAH) have decreased since the introduction of the FQD, and since the 2009 revision of the FQD which is the baseline for this evaluation. Graphs illustrating the decrease in transport emissions are detailed above in EQ 1.2 Has the FQD been effective in reducing transport emissions?. As discussed in detail in EQ 1.2 above, the FQD is not the only factor influencing transport emissions, rather it is one of a number of factors. Nonetheless, the reduction in emissions of lead and sulphur in particular correlate very well with the various iterations of the FQD in 1998, 2003, and 2009. Therefore as set out in EQ 1.2, on the basis of the available evidence it is evaluated that the FQD has contributed to the reduction in emissions from road transport.

It is acknowledged that measuring and monitoring is an indispensable step in reducing emissions (and in managing other variables, as the business management states "you can't manage what you don't measure"). It is also the case that in the absence of reporting requirements for Member States, the Commission would not have the necessary data to allow monitoring and enforcement of compliance with the FQD. Therefore in the absence of Article 8 Monitoring and reporting requirements, compliance with specifications of the FQD would be reduced. Even if Member States were to introduce their own national level monitoring requirements, these would not be equal and comparable across Member States, leading to higher costs and lower success rates for the Commission in monitoring and enforcing the Directive.

Given that the Directive has led to a reduction in pollutant emissions and associated reduction in health and environmental impacts, and that Article 8 is a crucial tool in ensuring compliance with the FQD and therefore the associated reduction in pollutant emissions, then Article 8 is clearly contributing to reducing the health and environmental impacts of transport fuels.

Therefore, on the basis of the available evidence from literature Article 8 is assessed as being effective.

EQ 1.15 Would the use of MMT be any different without this Article, and which would be the impacts of this? (Article 8a)

Policy background

Article 8a limits the use of metallic additive MMT (Methylcyclopentadienyl manganese tricarbonyl) and requires labelling in case MMT or any other metallic additive is applied. Directive 98/70/EC contained a limit value for MMT of 6mg manganese per litre, which has become 2mg manganese per litre from 1 January 2014 onwards. Article 8a of Directive 98/70/EC also required the Commission to report on a test methodology to assess the risks for health and the environment from the use of metallic additives in fuels to the European Parliament and the Council. This report has been published in June 2013 and also refers to the developed test methodology[73]. This report acknowledges that metallic fuel additives (MFA) are substances which are intentionally added to fuel to improve its performance and that MFAs might enter the

[73]http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0456&from=EN

environment, because the metallic portion of MFA is not degraded during the production or usage phase. Therefore MFA can become a source of exposure for humans with possible impacts on health and the environment. These potential impacts therefore justify the regulation through the adoption of limits based on the precautionary principle. The limits can be revised based on assessment following the test methodology.

Note that Article 8a not only prohibits certain levels of MMT, but in fact all metallic additives (in terms of scope). However, limits have only been defined for the levels of MMT (and lead), because the Commission is not aware of other MFA in fuels sold through the public fuels distribution network.

Use of MMT at the time of drafting the 2009 version of the FQ

At the time of drafting the 2009 version of the Fuel Quality Directive, MMT was rarely in Europe. However, a policy review of the ICCT mentions that based on Afton Chemical sources MMT was used in 45 countries in the period 2004-2006, and Afton on their website state that 150 refineries and blenders in 53 countries are happy to use MMT[74]. For this reason the introduction of bans should be seen more as a measure to apply the precautionary principle rather than a measure to strongly lower MMT consumption in the EU.

The Afton court case

The introduction of MMT limits in Directive 2009/30/EC led to a court case. Afton Chemicals, producer of MMT, stated that the limits imposed by the Directive were so stringent that they equated to a de facto ban. Afton also argued that evidence had been assessed incorrectly and limits set arbitrarily. The court ruled that the European Council and Parliament were correct in setting the limits, because they had taken into account sufficient scientific documents and studies in their legislative procedures, and by this had properly exercised their discretion under EU law. The limits were also assessed to be justified according to the precautionary principle and to be non-discriminatory, because the limits applied to the entire European Union and to all stakeholders involved in the use of MMT, not only Afton[75] [76].

Afton Chemicals Limited, being one of the questionnaire respondents is aware of the use of MMT and disagrees with the Member States, which do not see MMT as a preferred option and are in favour of a ban or restriction of the product. According to Afton MMT 'is a cost effective and scientifically proven safe option to raise octane. Therefore there is no justification to ban or severely restrict the use of this product'.

National transposition and prior ban

Prior to the introduction of limits to the use of MMT in the FQD several voluntary and mandatory initiatives had already been taken by Member States within the EU and outside the EU to ban MMT. A policy review study of the ICCT shows that prior to the FQD policy laws have been introduced in Germany and Czech Republic. While Czech Republic had banned MMT, Germany introduced a law requiring producers of additives to demonstrate that no additional health risks were associated with the use of MMT. Since Afton Chemical was not able to demonstrate this, this law was similar to a ban

[74] http://www.aftonchemical.com/Solutions/FuelAdd/Octane_Improver/Pages/Octane%20Improver.aspx

[75] http://curia.europa.eu/juris/liste.jsf?td=ALL&language=en&jur=C,T,F&parties=Afton

[76] http://www.icis.com/resources/news/2010/07/09/9375448/eu-court-confirms-limits-on-fuel-additive-mmt/

of MMT. In other European Member States, the industry has avoided the use of MMT voluntarily[77].

Most Member States have transposed the MMT limit in national legislation after 2009. Sweden has implemented the MMT limits in 2011 for petrol and in 2015 for diesel. The UK transposed Article 9a in an amendment to national legislation, which was approved in 2010-2011. Spain also transposed Article 8a in national legislation in 2010, Italy in 2011. France believed that legislation limiting MMT was already in place before transposition of the EU FQD, but could not recall the exact date (this was not mentioned in the ICCT study). Poland only transposed Article 8a recently: the legislation limiting MMT was introduced in the regulation of the Minister of Economy of 09 October 2015 on quality requirements for liquid fuels and notified to the Commission. Although some questionnaires outcomes gave the impression that most Member States have banned MMT before the implementation of the FQD, these interview outcomes prove that the introduction of a ban on MMT in several Member States also relied on transposition on the FQD after 2009.

Austrian fossil fuel manufacturers and suppliers mention that the introduction of MMT based on the FQD has been in contradiction with the national bans on MMT (APIA and OMV Refining & Marketing GmbH). Also fuel manufacturers and suppliers OMV Deutschland GmbH, Refinery Heide, TOTAL Deutschland GmbH and the German petroleum association indicate that the introduction of MMT limit is problematic due to existing bans. Although the German law was mentioned in the ICCT study, the Austrian ban was not.

Current use

Questionnaire responses show that not all stakeholders are aware of the use of metallic additives (6/14 Member State stakeholders, and 11/35 stakeholders).

Of the Member State stakeholders the Czech Republic, Croatia, Denmark, Estonia, Finland, France, Luxemburg, Malta, Slovakia, Slovenia and Sweden indicate they are aware of the use of MMT. According to the Czech Republic they are informed about it by their control system through the Czech Trade Inspection and they have the obligation under national legislation to inform customers about any other metallic additives, which are applied in fuels at the petrol stations in the country. Sweden states it is aware of the limit in Article 8a, but also mentioned that Sweden is not aware of any use of MMT in Sweden. Slovakia also mentions that MMT are not used in their fuels. Slovenia replied positively, but on the other hand also indicates the lack of monitoring of MMT in 2014. Austria, Romania and the UK are not aware of the use of MMT and Latvia and the Netherlands 'do not know'.

In the additional interview Sweden stated that the fuel industry and vehicle industry in Sweden are not actually interested in the use of MMT, because there are better alternatives available to raise the octane number in fuels and because MMT could also damage emission cleaning mechanism. This was also confirmed by the German response to the questionnaire: Germany stated that according to statements from German Automobile and Refinery Industry the use of MMT is unnecessary for the German fuel market and would be harmful for vehicle technology.

Fuel additive manufacturer EFOA and biofuel industry stakeholder Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec emphasise the reading of the FQD and CEN including the statement that many vehicle manufacturers advise against the use of fuel containing metallic additives and that the use of such fuel may invalidate vehicle warranties.

[77] http://www.theicct.org/sites/default/files/publications/MMT_dec08.pdf

Biofuel producer Nesté identifies some risks for EU vehicles refuelling in neighbouring non-EU Member States and the potential for harm to be caused to vehicle technology.

According to ACEA 'there have been several instances of MMT in EU petrol in 2011 (when the manganese limit was at 6mg/l). Today, the use of MMT is not apparent in the EU at the limit of 2mg/l.

Other fuel industry related stakeholders confirm that MMT is not used in the Member States they operate in or by their organisation.

Among the Member State stakeholders, 7 (Austria, the Czech Republic, France, Germany, Luxemburg, Slovakia and United Kingdom) state that the use of MMT would not differ in the absence of Article 8a, and 9 (Croatia, Denmark, Estonia, Finland, Malta, the Netherlands, Romania, Slovenia and Sweden) responded they did not know. None responded in the affirmative. In addition, there is a poor level of awareness regarding labelling of MMT in fuel stations. Many respondents indicate that MMT is no longer used in their Member States and therefore labelling is no longer required.

According to ACEA the FQMS is not frequent enough or detailed enough to appropriately detect any possible fuels sold containing MMT. The FQMS is regulated by Article 8 of the FQD.

According to the NGO Transport & Environment MMT should be banned completely and they ask for a revision, because limiting and labelling is not found to be sufficient.

It is worth remarking that none of the stakeholders have pointed at the definitions used in Article 8a: the article in fact covers all metallic additives (in terms of scope), but then only specifically prohibits MMT, which is an inconsistency/incoherence within the FQD. This is probably, because MMT and lead are the only MFAs to be used in fuels trough the public fuels distribution network. Besides this, Article 8a also prohibits the use of MMT in 'fuels', while in practice MMT is only used as additive to petrol. Because Article 8a states 'fuels' and not 'petrol' Member States are obliged to test diesel for the presence of MMT as well.

Conclusion

To conclude, there is a difference of opinion between Member States and certain stakeholders (in particular Afton, manufacturer of MMT), as to whether the use of MMT would differ in the absence of Article 8a. The majority of the stakeholders states that MMT isn't used in their Member States, but given the fact that Afton is still in favour of MMT and MMT is still used in other parts of the world there is a chance that this might change in the absence of this article. Based on the precautionary principle it is therefore recommended to maintain Article 8a. There is also no agreement on the level of the limit: the European Commission relies on the developed test methodology to determine the acceptable limit and some other stakeholders do not see a problem in the 2 mg, because it already implies a ban. There are however also stakeholders which disagree and argue that a complete ban should be introduced.

EQ 1.16 Has the reporting and proposal as required by this Article resulted in a better understanding of the impacts of the Directive and how it could be further developed? (Article 9)

Article 9 obliges the European Commission to come with a report every three years in order to provide insight in the impacts of the FQD. First of all, it must be noticed that the report, as referred to in Article 9 and which was originally due to be issued in 2012, has been delayed: no report has been published at the moment of writing this evaluation. This implies Article 9 could not have led to a better understanding of the impacts yet.

The delay has probably also resulted partly in stakeholders not being familiar enough with the content of Article 9 as could be concluded from the stakeholder responses: respondents often refer to the annual fuel quality monitoring reports, while Article 9 does not regulate the monitoring reporting obligations. Evidence from the stakeholder engagement questionnaire does not strongly support the statement that '*reporting as required by this Article resulted in a better understanding of the impact of the Directive'.* Among Member State respondents, opinion was evenly divided between those who believe the reporting requirements have resulted in a better understanding (the Czech Republic, Croatia, Denmark, France, Malta, the Netherlands, Slovakia), and those who have stated they do not know (Austria, Denmark, Estonia, Germany, Latvia, Luxemburg, Romania, Slovenia, Sweden, United Kingdom), with only Finland responding in the negative.

Among stakeholders over half replied in the negative, and under a quarter thought the reporting requirements resulted in a better understanding. Stakeholders that replied in the positive are from a variety of industry sub-sectors, including fossil fuel industry associations[78] and the NGO Transport & Environment.

Stakeholders which replied negatively include fossil fuel manufacturers and suppliers and associations[79], biofuels manufacturers and associations[80], an equipment manufacturer (Forecourt Equipment Federation), the Swedish Petroleum and Biofuels Institute (fossil and biofuel manufacturer), and one NGO (Oxfam International).

Stakeholders which replied they 'do not know' include conventional fuel manufacturers[81], biofuel manufacturers[82], the automobile manufacturers association (ACEA), Afton Chemical limited (fuel additives manufacturer) and an anonymous respondent.

Only the respondents who replied in the negative provided additional comments. The biofuel industry related stakeholders state that reporting should better deal with the fact that Article 7a is not implemented in reality. However, Article 7a is not part of the scope of this study. Fuel industry related stakeholders mainly respond with 'We are of the opinion that the detergents should be removed from the reporting requirement.' The multiple identical responses indicate an industry wide consultation undertaken prior to responding individually to the questionnaire. In addition fossil fuel manufacturer and supplier TOTAL SA state that the reporting requirements go beyond the scope of the Directive, because information not related to fuels specifications are required (engine evolution, amount of additive, detergent, petrol components). Afton Chemical limited (fuel additives manufacturer) stated that "detergents" should be called deposit control additives. Both the reference to detergents and the reference to reporting requirements other than fuel specifications are seem to referring to the

[78] Bulgarian Petroleum and gas association, UPEI, Polish Organisation of Oil Industry and Trade, Nesté) biofuels organisations (Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec, EFOA.

[79] TOTAL Deutschland GmbH, TOTAL SA,OMV Deutschland GmbH, Austria Petroleum Industry Association (APIA), OMV Refining & Marketing GmbH, UFIP, Refinery Heide, the Danish, German, Italian, Spanish and Portuguese petroleum industry associations, INEOS and FuelsEurope

[80] AGROINVEST SA, Bio-Oils Energy SA, Centre Ouest Cereales, EBB (European Biodiesel Board), the Slovak biofuels association, Verbio Vereinigte Bioenergie AG

[81] LUKOIL Neftohim Burgas, VNPI, Hungarian Petroleum Association, the Slovak Association of Petroleum Industry and Trade

[82] APPA Biocarburantes, Association of the German Biofuel Industry (VDB), Ethanol Europe, ePure

reporting obligations under Article 8 and prove that not all stakeholders are familiar with the content of Article 9. A further view on the principle of having a provision in place which obliges the European Commission to review the Directive can be found under EQ 4.14 and EQ 5.13.

Overall, at this moment in time, Article 9 has not resulted in a better understanding of the impacts of the Directive yet.

EQ 1.17 Have penalties for not meeting the Directive been imposed by Member States? (Article 9a)

In order to get insight in the penalties imposed by Member States the Fuel Quality Monitoring summary Reports 2011-2013 (AEA reports) have been studied. In these summary reports Member States describe sampling procedures and actions taken in case of non-compliance. Due to a lack of information it is not possible to provide insight in the number of penalties being imposed by each Member State, although the following conclusions can be drawn from the analysis of the FQM reports:

Some penalties have been imposed in the few cases of non-compliance, but softer measures also have been applied to reach compliance. These softer measures include increased frequency of sampling, repetition of sampling and issuing warning letters or letters requesting explanations.

For example Belgium states in its FQM report of 2011:

'Whenever a sample is non-compliant the owner of the public or private refuelling station or depot (depots are legally considered as public places as they sell the fuel) is warned about the quality of his fuel. After being informed they are required to take action to avoid possible danger and to ensure the quality of the fuel for the customer. If necessary change the fuel in the tank, etc. Another sample is taken at the same public station within one month in order to make sure the quality of the sold product is compliant. In case infringements the responsible of the public station receives a warrant, to be paid within 30 days. These measurements are taken by the Belgian government to improve the quality of the fuels and the system proves to be valuable.'

Bulgaria has been the only Member State which has included the level of the penalties in their reporting: Bulgaria mentions a penalty fine of 10,000 lv (circa €5,100 for all non-compliances per each sample which exceeded tolerance limits (2013). The questionnaire outcomes provide insight in the penalties as begin imposed in Poland: there the penalty could range from 50,000 PBL (circa €11.564) to 500,000 PLN (circa €115.638) or imprisonment up to 3 years, but penalties might also be lower (10,000 PLN is circa €2312) or higher (up to 1,000,000, circa €231.276) The Energy Regulatory Office, is also informed, which imposes a penalty for breach of the license conditions on the marketing of fuels.

A reason why the information in the FQM reports is quite general is the fact that lower authorities, like inspectorate bodies, are responsible for sampling and follow-up actions, while the ministries have been mainly responsible for reporting.

The questionnaire outcomes show similar results: a proportion of the Member States responding to the questionnaire indicate that penalties had been imposed under Article 9 (6 out of 17 responses). These Member States are Austria, Croatia, Estonia, Germany, Slovak Republic and Slovenia. According to Austria only a very few financial penalties are imposed each year (about 1 to 4 penalties) as result of the exceedance of a limit. Croatia stated that penalties have been imposed under the Air Protection Act (OG, 130/11, 47/14). These penalties were related to quality of fuels which are placed on the market, product labelling and reporting obligations, all relating to the distributors and producers. In 2014 penalties were imposed for non-compliance of

limits for motor octane number, research octane number, vapour pressure, olefins and aromatics in petrol fuels and FAME content in diesel fuels in the Slovakia. Slovenia indicated to have imposed any penalties, but could not give any details of these penalties. Where other Member States provided details Slovenia answered 'do not know'. It can, therefore, be questioned to what extent Slovenia does not know the detail of the penalties or did not impose any penalties at all.

Latvia states it has not imposed any penalties within the last two years and the Czech Republic states it has no experience in imposing penalties at all. The Swedish Transport Agency & Swedish Energy Agency do not know of any penalty case. Finland states that no actual penalties have been imposed so far although certain provisions of the Environmental Protection Law and in extreme cases Criminal Law can be applied. Remarks are made and explanations are requested if individual exceedances of the limit value (and margin of tolerance) are observed. When diesel fuel is contaminated by light fuel oil the diesel fuel is removed from the storage tank and delivered back to the refinery.

The outcomes of the additional questionnaire for Member States shows in Spain enforcement is carried out at a regional level of the autonomous communities. According to Italy the competent authorities for inspections may apply penalties for violation. In Poland penalties have been imposed: if the sample does not meet the quality requirements an investigation is started and a penalty is imposed by court.

Among stakeholders, only Nesté, a biofuel producer (1 out of 30 responses) had a penalty imposed upon them. Note that not all respondents could have a penalty imposed on them, because not all industry respondents are active on the fuel market (for example NGO Transport & Environment and ACEA).

Member States authorities and industrial stakeholders were asked whether other factors influenced the ability to comply with the requirements and avoid penalties.

Opinion is divided among Member States regarding whether stakeholders could avoid these penalties, or whether there were other factors which meant they could not comply (4 (Austria, the Czech Republic, Malta and the Netherlands) think stakeholders could comply, 7 (Croatia, Denmark, Estonia, France, Germany, Romania and United Kingdom) think they couldn't, and 5 (Finland, Luxemburg, Slovakia, Slovenia and Sweden) do not know). From the additional remarks it can be understood that the Member States related this question to avoiding penalties in case of non-compliance (and not to avoiding penalties by being fully compliant). According to Malta penalties can be avoided if reasonable justification is provided. The Czech Republic provided a similar answer: according to this Member State sanctions can be avoided by explain how required tasks were secured. Estonia, which thinks stakeholders could not comply referred to the possibility that fuel is not stable and might cause problems if the fuel is not sold very quickly.

A small number of industry respondents believe that there are factors influencing the ability to comply with requirements (4/32 responses; LUKOIL Neftohim Burgas, Bulgarian Petroleum and gas association, UPEI and an anonymous respondent), however there was not a high level of knowledge or awareness on this topic (28/32 replied they 'Did not know').

However, those that do know respond that other factors influence on the ability to comply. One stakeholder highlights that an effective enforcement system should be put in place along with penalties, as an inefficient inspection body may lead to non-compliances that are not reported (so other factors would influence on avoiding penalties in this case). Two respondents (LUKOIL Neftohim Burgas and Bulgarian Petroleum and gas association) mention the vapour pressure derogation: having this

derogation in place would lead to fewer penalties being imposed by Member States, as they would then be permitted to have a higher vapour pressure for a certain period of time.

Based on this analysis the **conclusion** can be drawn that penalties alone are a strong provision to reach compliance, but that the impact of penalties will be higher in combination with a strong national enforcement systems (efficient inspection bodies). Besides this, there might always be regional circumstances which might result in non-compliances, but because this has only been mentioned by two respondents this does not seem to be a major issue. Overall, there is no justification to change this provision.

4.3 Efficiency

Overall evaluation of efficiency

EQ 2.1 Has the Directive delivered its objectives in an efficient manner?

Due to the limitations of the available data it is not possible to provide a cost-based assessment of the Directive overall. It is clear while implementation and compliance with the Directive has imposed costs on some (on fuel suppliers and industry, and on Member State competent authorities), there have also been benefits from health and environmental protection.

Further details of the analysis and evidence for this overall evaluation is presented in the subsequent evaluation questions (EQs).

- **Article 1**: the single market could not be ensured in the absence of the FQD.
- **Article 2:** the discrepancy in perception between Member States and industry stakeholders whether or not the definitions have contributed to the clear implementation of the FQD is notable. In the perception of Member States the definitions work well, whereas the position of the industry suggests operators in the market may have encountered some problems.
- **Articles 3** and **4** have delivered benefits to health and the environment through reduction in air pollutant emissions, and benefits related to engine performance due to improved fuel specifications, which are compatible with advanced engine standards. A full cost-benefit analysis has not been possible due to the lack of specific cost data for all aspects of these Articles, however estimates of costs and benefits available from previous studies are discussed in this report (EQ 2.3, 2.4, 2.5). In the consultation, stakeholders acknowledge that although there are costs associated with the implementation of these Articles, benefits are delivered. Therefore overall these Articles are considered to be efficiently delivering benefits. However, the impact of market fragmentation is difficult to evaluate but fuel suppliers recognise that this has an impact in terms of reduced cross border trade of biofuels.
- The derogations associated with **Articles 3 and 4** (derogations available in relation to vapour pressure for Member States with low summer ambient temperatures, derogations for the Outermost Regions), are cost efficient, taking into consideration the cost to the Member States of applying for these derogations, and the benefits obtained. Clearly, the vapour pressure derogations seem to provide significant benefits in terms of cost savings, in view of the Member States estimations provided as part of their derogation requests. Based on these estimations, a minimum of €637 million (investment) and operational costs savings of at least €247 million per year are saved in the EU.
- **Article 6** has not been applied to date, however setting more stringent fuel specifications for certain areas and timeframes does not seem the most efficient way to reduce air polluting emissions in certain areas. Urban access restrictions seem to be more efficient and preferred over the application of Article 6.
- **Article 7** has not been applied to date, however it is considered to be efficient by Member States, including the UK who considered applying Article 7 in the past. It is considered that in principle the benefits of the article would outweigh the costs of its application, which would include costs of disruption to fuel supply chain and knock-on effects to users.
- **Article 8** is considered to be effective, although some Member States considering that the costs of monitoring and reporting are high. It is considered effective because the costs to Member States of reporting and monitoring is significantly

outweighed by the quantified estimated health and environmental benefits delivered by the Directive.

- **Article 9** cannot be assessed since the European Commission has not yet published the report and proposal.
- **Article 9A** is difficult to evaluate. Given that compliance appears to be being obtained with a limited number of softer measures and penalties, this article seems to be already efficient. It is not clear what the potential to reduce these further is, if any.

Individual Article evaluation

EQ 2.2 Have the definitions contributed to the clear implementation of the FQD? Are the definitions clear and understandable? (Article 2)

Questionnaire responses from Member States give clear support for the above statements. The UK and the Netherlands repeat the request to include the specifications from the CN-codes in the FQD-definitions. Sweden emphasizes the discrepancy in the definitions of 'bio-components' in FQD and RED and asks for clarity on the definition of 'supplier'.

The position of Member States indicates that implementation of the FQD (amendments by Directive 2009/28/EC) has settled: initial problems and lack of clarity have been solved either by EC guidance papers or by national implementation.

The stakeholders from the fossil fuel and biofuel industry are less positive about this: more than half of respondents think that definitions are **not** fully clear and understandable (19 out of 35 responded No, definitions were not clear and understandable, 16 responded Yes). Most 'No'-respondents repeat their position on CN-standards - see EQ1.5 (related to biofuel definitions, outdated codes, etc.). The fossil fuel companies, as well as several Member States request clarification that only fuels with more than 70% m/m crude oil based products are covered by the FQD.

Although mentioned by only one respondent each, explicit attention was asked for the - unclear or missing – definitions of 'Inland waterway vessels', 'Diesel fuel for inland waterway vessels', 'Low ambient summer temperature' and 'Placing on the market'[83].

The discrepancy between Member States and industry stakeholders is striking. In the perception of Member States the definitions of the FQD are doing the job and no serious problems remain, whereas the position of the industry suggests operators in the market may have encountered serious problems. This could incur market fragmentation and differences between countries.

[83] "For 'placing on the market' would be needed to ensure that quality requirements are applicable for the whole supply chain. Placing on the market, according to the Blue Guide on the implementation of EU product rules, occurs when the product is made available for the first time on the Union market. It should be made clear that requirements set by FQD must be met downstream the supply chain, and at the final sale to the consumer in particular. Using the term 'making available' defined by the Blue Guide would be one option worth considering."

EQ 2.3 What are the costs arising from the restrictions on petrol and diesel fuel that can be placed on the market? (Articles 3 and 4)

The main costs associated with the specifications of articles 3 and 4 are related to:

- Obligation to ensure fuels are sulphur free;
- Reduction in aromatics from 42% to 35%;
- Introduction of 8% PAH limit;
- Potential increase of bioethanol and FAME content[84].

Also, Member States incur administrative costs in order to transpose the FQD into national legislation and to put in place and regulate enforcement procedures.

Most of the above costs are mainly born by refineries, which have to ensure that the fuel on the market is compliant with the specifications. In this regard, the EU refining industry has studied the cumulative costs arising from European legislation. Fuels Europe[85] (2015) estimated the cost of sulphur content reduction in fuel would have a cost of between $1.5 and $2.2 per barrel of refined product by 2020. However, this research focused mainly on the legislative changes related to Directive 1999/32/EC, which focuses on marine fuel. A report by EUROPIA (EUROPIA, 2012) indicates that the FQD and the IED pose significant threats to the EU refining's competitiveness. However, the report focuses principally on Article 7a, which is out of the scope of this study.

Despite these data from refineries, several aspects need to be taken into account:

- Changes to the specifications did not occur at the same time. Most of the costs arising from the FQD have already been accounted for in previous updates of the Directive. As a result, refineries have gradually adapted to the FQD over 18 years.
- These costs may be transferred to consumers, so that refineries would not ultimately be as affected.
- Articles 3 and 4 contain several derogations that may reduce the economic burden to refineries.
- It is clear that there are costs associated with the specifications in article 3 and 4, but there are also benefits (see E.Q. 2.5). For the FQD to be efficient, these benefits have to outweigh the costs (see E.Q. 2.9).

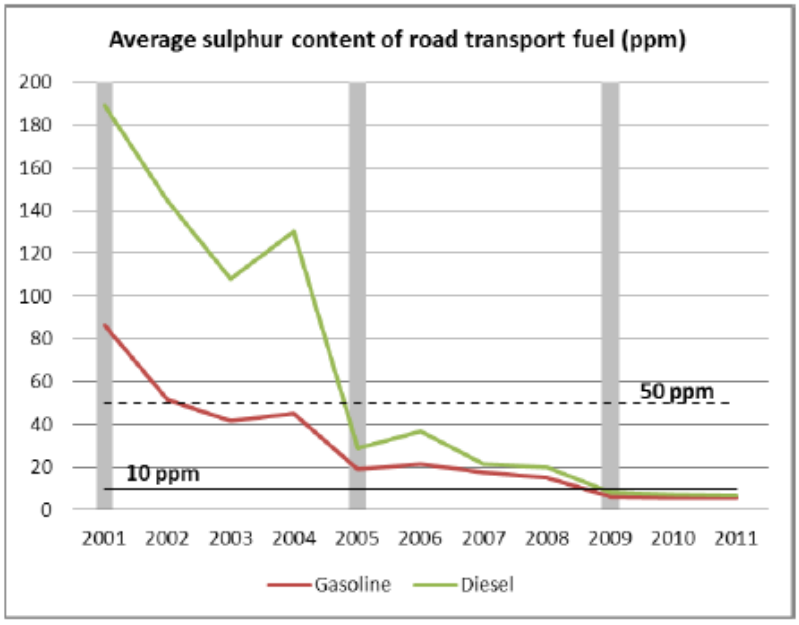
Obligation to ensure fuels are sulphur free

The JRC (2015) published a report on the EU Refining sector and the impact of legislation in the sector (hereafter referred to as the refineries fitness check). According to this report, the limit on sulphur content is the requirement which has the greatest economic impact on refineries. Further reinforcing the above, the graph below illustrates the average sulphur content of road transport fuel in the EU-27 (EEA data), with decreases observed after 2003, 2005 and 2009.

[84] Although the increase of biofuel content is incentivised by the RED, the increase of the limit on bioethanol content and the provision of Article 4 that allows a FAME content above 7% (both provisions are not present in the previous amendment) are indirect incentives for the increase of biofuel content in petrol and diesel

[85] https://www.fuelseurope.eu/uploads/Modules/Dataroom/fuelseurope_graph_2015-27.pdf

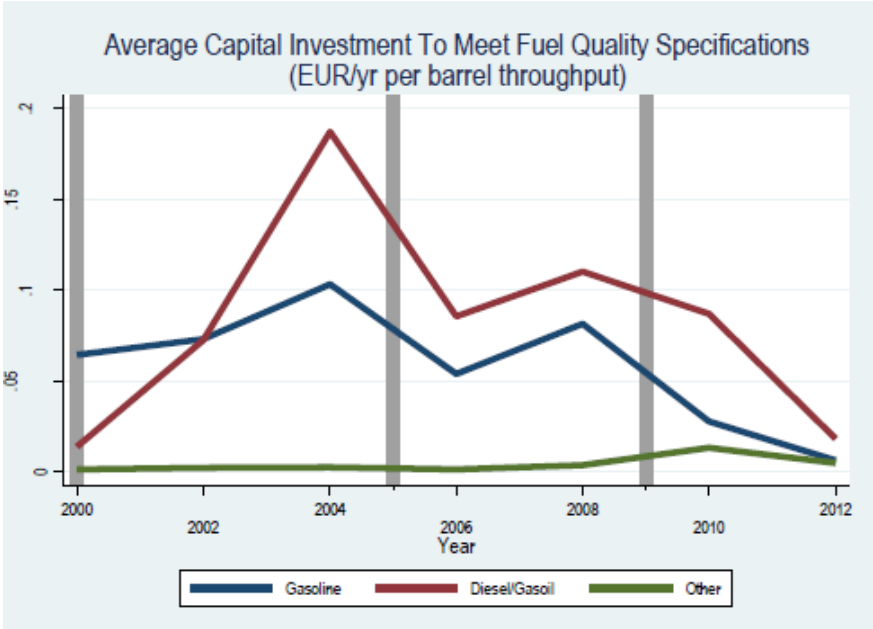
Figure 4.19: Average sulphur content or road transport fuel (ppm) in the EU-27



Source: EEA data in JRC, 2015.

Using data on capital investment in 'New process unit/modifications for clean fuels' (data from Solomon Associates, 2014), the JRC report illustrates average capital investment to meet the fuel quality requirements, per barrel of fuel throughput (see Figure 4.20 below).

Figure 4.20: Average capital investment to meet fuel quality specifications (EUR/year per barrel throughput of product) in the EU 28



Source: Solomon Associates (2014), in JRC 2015.

The figure above reflects the capital investment by refineries to ensure compliance, and the peaks in e.g. 2004, 2009, reflect an increase in capital investment prior to the entry into force of new sulphur limit requirements (50ppm max of sulphur in petrol or diesel 2005, dropping to 10 ppm maximum in 2009). It is reasonable to assume that capital investment increases prior to the entry into force of new requirements.

Evidence from the stakeholder consultation indicates that this obligation leads to an increase in fuel production costs, with 22 out of 37 stakeholders stating this. The 22 consisted of 20 fossil fuel manufacturers, together with one biofuel manufacturer and the Swedish Petroleum and Biofuels Institute. The supporting commentary provided by a number of the fossil fuel manufacturers in a common and concerted manner (suggesting an industry-wide response has been coordinated by Fuels Europe or UFIP), states that "Deep desulfurization of fuels needed to adapt both the process and the fuel blending has led to significant costs for the refining sector. Desulphurization requires more energy and leads to an increase in the GHG emissions of the refining sector". The Swedish Petroleum and Biofuels Institute states that Sweden had sulphur free fuels before these were required by the FQD, and that deep desulfurization of fuels needed to adapt both the process and the fuel blending has led to significant costs for the refining sector. Further, desulphurization requires more energy and leads to an increase in the GHG emissions of the refining sector.

Biofuel content

ACEA (ACEA 2010) published a communication stating that vehicle manufacturers committed to modify engines for new vehicles by 2010, so that all new vehicles could use E10 and B7 fuel. However, the European fleet does not have a very high replacement rate and it is recognised in the report that a number of years will be necessary to see an effect. The costs to vehicle manufacturers have not been quantified.

A report for the Commission on impacts of higher levels of bio components in transport fuels (ICF et al., 2015) indicate that the EU refining industry would also be impacted by the increase of the proportion of biofuel used in the fuel industry. However, the impacts on the gross margin of refineries would be relatively small compared to the base case (see explanation in E.Q. 3.5). In relation to this, France indicated that it has an incentive tax with a value that is similar to the additional cost of producing petrol and diesel blends. As a result, refineries in France would face similar costs regardless of their choice.

Reduction in aromatics from 42% to 35%

The latest amendment of the Directive confirmed a limit for **aromatics** of 35%, whereas previously it was 42%. Industry stakeholders were asked whether this changed fuel production costs. Around half of those responding state that it did change fuel production costs (23 out of 50), 15 state they do not know and 12 have not replied.

Those who state that fuel production costs **are** affected are primarily fossil fuel manufacturers (all the fossil fuel manufacturers, except INEOS, replied in the affirmative), as well as the Swedish Petroleum and Biofuels institute, EFOA (additives manufacturer) and one anonymous respondent.

Reasons given for the change in fuel production costs include that the 'production costs of petrol increased since more aromatics had to be extracted and exported or hydrogenated'. It should be noted that this exact response has been received from 11 of the fossil fuel manufacturers (including the national oil associations for Italy, Spain, Poland, Austria, Portugal, Hungary and Denmark, as well as Fuels Europe and UFIP, OMV Deutschland GmbH and OMV Refining &Marketing GmbH, and the Swedish

Petroleum & Biofuels Institute), indicating that an industry-wide response was likely coordinated by Fuels Europe, of which all the national oil industry associations are members. VNPI (the Dutch oil association) state that the change in aromatics level reduces flexibility to blend on specification petrol at minimum cost (so has led to higher costs).

EFOA suggest that the higher the quality of fuels, the lower the cost for vehicle production and maintenance, and that although any improvement in fuel quality would imply some cost for producing the fuel itself, consideration should be given to societal benefits (e.g. health and environment protection).

TOTAL S.A. state that the limitation on aromatics has required adaptation in both the process and the fuel blending, which has led to a significant cost increase for the refining sector and to higher CO_2 emissions at the refinery level.

An anonymous respondent from the fossil fuel industry similarly comments that lower aromatics levels has led to higher production costs, specifying that this is because more expensive components such as alkylates are needed in blending fuels, and that these additional costs are ultimately passed on to consumers.

Those stating they do not know include six biofuel industry organisations, two fossil fuel manufacturers (INEOS and one anonymous response), one fossil and biofuel manufacturer (Nesté), an engine manufacturer (ACEA), the Forecourt Equipment Federation, and an additives manufacturer (Afton).

Introduction of 8% PAH limit

The majority of fossil fuel manufacturers (19 of the responses) together with the Swedish Petroleum and Biofuels Institute, state that the changes in PAH level have led to increased production and distribution costs. The reasoning provided for this is that higher production costs are observed mainly due to the need for more hydrogen and higher energy consumption and more severe process conditions to produce diesel with 8% PAH max. A high level of consistency is observed among responses from fossil fuel manufacturers, again indicating that an industry wide response was coordinated (likely by Fuels Europe), which the majority of members have submitted in the verbatim form agreed, while a smaller number have made small edits or additions. Those responding in this manner include Total Deutschland, TOTAL SA, OMV refining & Marketing GmbH, IFP and Fuels Europe, together with the national industry associations for Bulgari, Italy, Spain, Austria, the Netherlands, Hungary, Portugal and Denmark. Separately, UPEI state that costs change but not significantly, and the Swedish Petroleum and Biofuels Institute indicates that while the change in PAH levels leads to higher costs generally across Europe, in Sweden this is not the case since their existing specifications for Class I diesel are tougher.

19 stakeholders stated they do not know – this includes most biofuel manufacturers (11 of them), two fossil fuel manufacturers (INEOS and the Polish national oil association) together with ACEA, the Forecourt Equipment Federation, EFOA, Afton Chemical and two anonymous responses (one from the biofuel sector, one from the fossil fuel sector).

10 have not responded, these include the four NGOs, two engine manufacturers, one fossil fuel manufacturer, one biofuel manufacturer and one classified as 'other'.

Introduction of restrictions under the latest amendments of the FQD- do they lower production, administration or distribution costs for suppliers?

The majority of respondents, primarily fossil fuel manufacturers, indicate that the opposite is the case, and that costs are expected to rise, primarily due to the diversification of fuel grades. 18 stakeholders stated that costs were raised by the

latest amendments, mainly fossil fuel manufacturers (the Swedish Petroleum & Biofuels institute, LUKOIL Neftohim Burgas, the Austrian, Bulgarian, German, Italian, Spanish, Polish, Dutch and Portuguese national oil industry associations, TOTAL Deutschland GmbH, OMV Deutschland GmbH and OMV Refining & Marketing GmbH, UFIP, Fuels Europe, and Refinery Heide) together with the Forecourt Equipment Federation and one anonymous response. They state that the flexibility provided in Article 4 is hindering the introduction of a single market for motor fuels, and that a multiplication of the motor fuel grades leads to higher production costs, logistic and supply costs as well as an increase in the administrative burden. Identical responses have been submitted by a number of the fossil fuel manufacturers, indicating industry-wide coordination of their response to the questionnaire.

UPEI and TOTAL S.A. state that costs are expected to be reduced, however UPEI's supporting commentary states the ways in which costs have increased, suggesting they may have misunderstood the headline question, and actually believe that costs will rise. TOTAL S.A. is the only other stakeholder to reply that costs would be lower, and they provided no supporting commentary for this response.

18 state they do not know in response to this question. These include biofuel industry stakeholders, together with two fossil fuel manufacturers (INEOS and the Hungarian petroleum association), two fuel additives manufacturers (EFOA and Afton Chemical), ACEA, Nesté and one anonymous response.

A further 11 have not replied to the question – these include the 4 NGOs, fossil fuel manufacturers (Slovak association of Petroleum Industry and Trade, Statoil Fuel & Retail Lietuva), Greenergy Fuels, Inland Navigation Europe, Scania, EUROMOT, and ASFE.

As mentioned above, the refineries fitness check (JRC, 2015) states that the limits on sulphur content is the requirement which has the greatest economic impact on refineries. However, other specifications that did not imply significant economic impacts during the 2000-2012 according to JRC (2015) were vapour pressure requirements introduced before 2000, reduction of PAH content, reduction of lead-based additives before 2000, avoidance of the use of MMT. Moreover, most of these requirements pre-date the latest amendment of the Directive in 2009. It was concluded that the sector incurs the following costs:

- Meeting FQD requirements for all clean fuels: €8.5 million per refinery per year (for the period 2000-2012).
- Meeting the petrol specifications: €3.4 million per refinery per year (for the period 2000-2012).
- Meeting the diesel specifications: €4.9 million per refinery per year (for the period 2000-2012).
- Total increase in annual operating costs attributed to additional fuel quality efforts in the period 2000-2012: €8.9 million per refinery per year.

The JRC Refineries Fitness Check report, when discussing impacts of fuel quality legislation (as above and below), considers the impacts on refineries of the Fuel Quality Directive together with those of the Sulphur in Liquid Fuels Directive (SLFD)[86].

Member States authorities

Member States have to ensure compliance with the specifications set out in Annex I and II of the FQD, as well as with the provisions set out in articles 3 and 4. Member

[86] OJ 121 11.95.1999 p.13

States provided information on their costs in relation to monitoring and reporting under the FQD (during follow-up interviews). This data includes costs of fuel sampling, and internal cost within the Competent Authority, that is time spent on the reporting and monitoring.

Data on the costs of monitoring and reporting was provided by Finland, France, Poland, the UK, Spain and Sweden during follow-up interviews in December 2015. A summary of the range of costs reported is presented in the table below Table 4.8.

The man-time costs reported by Member States on the administrative time required by the Competent Authority to comply with the FQD, have been monetised by applying Eurostat hourly labour costs[87], providing an estimate of the financial costs of reporting. This information is summarised in the table below.

Table 4.4: MS administrative costs of reporting under the FQD.

Cost category	Reported range of costs	Further information
Administrative time required by MS Competent Authority to report under the FQD	Range between 5 man days per year and 20 man days per year	These two values are for MS where the competent authority outsources the sampling, therefore it is the time required to manage and compile reporting. The range depends on the FQMS system used, in some MS (e.g. the UK) industry has a large role in compiling the monitoring data, such that the burden on the competent authority is smaller.
Monetised cost of the administrative time expended by the MS Competent Authority in reporting	€836 – €5,190	Calculated by applying Eurostat hourly labour cost data (Member State specific) to the above data on time expended. Assumes a 37.5 hour working week.
Fuel sampling costs	€800-€1,250 per fuel sample	France provided additional cost break down, reporting costs of €200 for taking each sample from a fuel station, together with costs of €600 (for petrol) and €700 (for diesel) laboratory analysis costs. Spain indicated a similar cost breakdown.
Overall fuel sampling and monitoring costs	€173,000-€650,000	These are annual costs estimated by Member States, and include all fuel testing costs, including costs involved in outsourcing or contracting fuel monitoring to 3rd party companies.

[87] http://ec.europa.eu/eurostat/statistics-explained/index.php/Hourly_labour_costs

Summary evaluation

The available information indicates that the costs arising from Articles 3 and 4 are related to the new specifications compared to the previous amendment. These include on the one hand the need to reduce the content of certain substances in fuels (e.g. sulphur, lead, PAHs), and on the other hand costs arising from the increased use of biofuels under the FQD. Also, Member States authorities incur costs in order to ensure that these specifications are met.

Literature indicates that costs for the refinery sector have increased, principally due to the investment required to ensure desulphurisation of fuels. With regards to the increased costs due to higher levels of biofuels, these are considered to be relatively small, and the impact of other issues (including market conditions, the reduction of petrol sales or incentives that Member States could put in place) will be higher than or as high as the cost of increasing the proportion of biofuel that is blended with petrol and diesel.

The analysis of the benefits has been included in E.Q. 2.5. The analysis on whether these benefits outweigh the costs is included in E.Q. 2.6.

EQ 2.4 What are the benefits arising from the restrictions on petrol and diesel fuel that can be placed on the market? (Articles 3 and 4)

Defining the benefits

One of the main accomplishments of European legislation has been the reduction of sulphur dioxide emission levels in the EU. This pollutant has long been of special concern due to its health effects and its role (alongside particulate matter) in forming winter-time smog (Defra, 2013). SO_2 causes nerve stimulation in the lining of the nose and throat. This, in turn, causes irritation, coughing and other symptoms that may cause the airways to narrow. This is particularly relevant for people suffering from asthma.

According to the US EPA (2016), current scientific evidence shows a correlation between short-term exposure to SO_2 and a series of respiratory problems, which has been linked to hospital admissions due to respiratory illnesses, particularly in at-risk populations (children, the elderly and asthmatics).

The first legislation on SO_2 emissions dates back to the 1970s, mainly related to acid rain phenomena recorded in the US and Europe. Acid rain has caused substantial environmental damages to materials and ecosystems over history, and started to be considered a main issue in the 1970s, as there was a gradual global increase of industrial activities (UNECE, 1985; UNEP, 2009). One of the main issues related to acid rain is that SO_2 and NO_X emissions can cause acid rain up to 1,000 km away. SO_2 emissions have been controlled since then, and especially after the adoption of the 1985 Helsinki Protocol of sulphur emissions (under CLRTAP). CLRTAP has also addressed sulphur emissions under the 1994 Protocol on Further Reduction of Sulphur Emissions and 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (UNECE, 2015). Sulphur emissions have also been addressed by other legislation focusing on the sulphur content of liquid fuels (In Europe, firstly with Directive 93/12/EC, later repealed by the first FQD).

SO_2 emissions in the EU have decreased 94% since 1970 and 75% since 1990. This long-term reduction has been due to switching to alternative fuels from solid fuels, improved abatement technology and more stringent legislation on the sulphur content of some fuels. Since 2009 sulphur emissions have flattened out, and in some years increased slightly, mostly due to a short-term increase in coal use by the power sector (Defra, 2013; EEA, 2012b).

The largest source of SO_2 emissions is public electricity and heat production (Defra, 2013). Between 1970 and the early 1990s, road transport emissions grew with the increase in road vehicles. However, more recently, emissions have declined with the reduction in the sulphur content of Diesel Engine Road Vehicle (DERV). Similarly the reduction in sulphur content of gas oil is reflected in the emissions from off-road vehicles and domestic and commercial heating where gas oil is used extensively.

According to the JRC Refineries Fitness Check (JRC, 2015), the estimates of the monetary benefits associated with decreasing the SO_2 emissions amounts to **€196.8** million per average EU-28 refinery during the 2001-2011 period. This value is a cumulative estimate for the period 2001-2011, not for a single year. These estimates are calculated using EEA damage cost values on the benefits of decreasing SO_2 intensities, and represent the difference between a baseline situation where the average sulphur content in petrol and diesel would have remained at the level determined by the FQD in 2000 (150ppm for petrol and 350ppm for diesel), against the actual reported sulphur levels in fuel (as illustrated in Figure 4.19 above). To calculate total SO_2 emission decrease, JRC used the petrol and diesel production volume data provided by Solomon Associates (2014).

It is also worth noting that these estimates are based on the lower end damage cost function from avoided SO_2 emissions used by the authors (obtained from EEA, 2013). An assessment based on the higher limit estimate would result in the total benefits being three times higher.

According to the Worldwide Fuel Charter (2013), the content of aromatics has an effect on toxics content and benzene emissions, linked to the formation of deposits in the engine. Engine performance benefits from these low standards given that vehicles are moving to EURO 6 and EURO VI standards. A common position paper from AECC, CLEPA, EUROMOT and OICA[88] (AECC et al, 2014) also stresses the importance of maintaining these specifications once vehicle manufacturers are adapting to EURO 5, V, 6 and VI standards, since engine performance may be affected. According to a report by ICCT (ICCT 2013), each vehicle standard needs a specific technology, for which certain specifications are recommended for the correct functioning of engines. As a result and given that new vehicles are compliant with the latest standards, vehicle performance benefits from the alignment of vehicle and fuel standards.

Quantifying the health benefits of reduced pollutant emissions

In order to quantify the benefits to health arising from the FQD, pollutant data from CLRTAP has been obtained to quantify the reduction in pollutant emissions between 2009 (the baseline for this evaluation), and 2013 (the latest year for which CLRTAP is available). In order to quantify the benefits of reductions in pollutant emissions, **damage cost function** values have been used.

Damage cost values for pollutants from transport were obtained from the Updated Handbook on External Costs of Transport (Ricardo-AEA, 2014b). The tables below show the reduction in damage costs associated with SO_X and NO_X due to the FQD. This report uses damage costs from the NEEDS project (Preiss et al, 2008), updated to the year 2010 using EU average GDP figures.

[88] AECC, CLEPA, EUROMOT and OICA (2014) Recommendation concerning Guidelines for Market Fuel Quality in R.E.3 and/or S.R.1. 68th Working Party on Pollution and Energy (GRPE) - UNECE.

Damage Cost Functions

Damage cost functions are monetisation of the impacts of a pollutant. Damage cost functions for the health impacts of transport include valuations of health effects such as new cases of chronic bronchitis, respiratory and cardiac hospital admissions, restricted activity days, and days of lower respiratory symptoms assessed.

The Clean Air For Europe (CAFÉ, 2005) calculated damage functions per tonnes of emission were produced for a number of pollutants (NH_3, NO_X, $PM_{2.5}$, SO_X, VOCs). A range of values were calculated, taking into account variation in the methodologies used to value mortality, reflecting the use of median and mean estimates for the value of a life year (VOLY) and statistical life (VSL). The range also includes sensitivity to the range of effects included, and to the use of a zero cut-out point for assessment of ozone impacts (the core analysed is based on use of a cut-point of 35 ppb for ozone impacts). This was the best available research for a number of years, however it is now somewhat outdated.

Since the publication of the final CAFÉ outputs, further work on damage cost estimation has been carried out by EMRC and IIASA as part of the analysis underpinning the Thematic Strategy on Air Pollution. In particular, the 2014 report 'Cost-benefit analysis of final policy scenarios for the EU Clean Air Package' included update damage cost estimates, taking into account new data published by the World Health Organisation (WHO) Health Risk of Air Pollution in Europe (HRAPIE project) on impact of pollutants including PM and NO_2. However, this report only included damage cost estimates for ozone and PM, on the premise that there is some evidence to suggest that double-counting can occur under the CAFÉ methodology if applying damage cost functions to both PM and NO_2. In addition, EMRC identified that further research is required in order to update the damage cost value for NO_2 to include latest WHO research.

More recently, the NEEDS project produced damage cost functions covering all major pollutants and all Member States. These values were used the by the latest Handbook on External Costs of Transport (Ricardo-AEA, 2014b). Therefore these values have been used in our analysis.

Using the damage cost functions and the information on historic pollutant emissions, the reduction in damage costs for health impacts associated with emissions reductions for SO_X and NO_X were estimated and are summarised in Table 4.5 and Table 4.6 below. These damage cost values are based on the actual reduction in emissions between 2009 and 2013, for the transport sector in the EU.

Table 4.5: Reduction in damage costs associated with emissions of SO_X in the EU

2009 quantified damage cost of emissions (million €)	2013 quantified damage cost of emissions (million €)	Damage costs avoided in 2013 vs. 2009 baseline (million €)
€ 1,573	€ 878	€ 695

Table 4.6: Reduction in damage costs associated with emissions of NO_X in the EU

2009 quantified damage cost of emissions (million €)	2013 quantified damage cost of emissions (million €)	Damage costs avoided in 2013 vs. 2009 baseline (million €)
€ 50,074	€ 41,463	€ 8,611

Source for tables 4.1, 4.2: own calculations, based on CLRTAP emissions database and Ricardo-AEA 2014b report for damage cost functions. Inflated to 2015 values in line with EU inflation.

It must be emphasised that the above are estimates only, based on damage cost function values. For context, the CAFE (2005) damage cost functions provided a range of 4 sets of damage cost function values for each pollutant, depending on the input factors and assumptions (in relation to Value of a Life Year and Value of Statistical Life – see text box above).

Although not all the avoided damage costs associated with the decline in emissions between 2009 and 2013 can be attributed to the FQD directly, since other factors are at play in the emissions trends (vehicle standards, global recession, increasingly efficient vehicles), it can be seen that significant benefits have accrued from the reduction in emissions between 2009 and 2013, a proportion of which is attributable to the FQD.

Conclusion

The FQD has contributed to a reduction in pollutant emissions, and associated benefits to health and the environment. Benefits to health include decrease in mortality and decrease in ill-health due to respiratory and cardiac illnesses associated with air pollution, in addition to a decrease in working days lost to such illnesses.

Monetisation of benefits are always necessarily an estimate, therefore it is not proposed to give a single value quantifying benefits of the Directive. However, this is not to imply that these are not real and tangible benefits.

EQ 2.5 Are the costs arising from the restrictions of petrol and diesel fuel that can be placed on the market justified in light of the benefits? (Articles 3 and 4)

The Refineries Fitness Check (JRC, 2015) estimated that the total benefits arising from the SO_2 emissions avoided were around €196.8 million per average EU-28 refinery, cumulatively for the period 2001-2011, taking into account the fuel produced by refineries in this time period also, and using the lower end of the damage cost function obtained from the EEA (2013)[89]. If the higher end is used, the total benefits amount to €600 million. On the other hand, the same report calculates that the total costs to refineries in the same period were around €202 million (51% of which corresponds to investment costs and 49% to operational costs). The range in the damage cost functions is very significant, and uncertain. As a result, it is not possible to give an accurate indication on whether refineries may have incurred costs that outweighed the benefits obtained by society. It should be noted that this calculation covers a longer period than that since the latest amendment of the FQD in 2009. According to JRC (2015), the proportion of investment costs associated to the FQD have been decreasing in recent years, especially after 2009. Conversely, operational costs have been increasing in recent years and have been higher after 2009 than in previous years.

Also, ICF et al. (2015) give an indication of possible impacts of increasing the proportion of biofuel in petrol and diesel. According to this source, higher biofuel blends would not have a negative impact on engines. There are various pathways in future engine technology, namely:

- Petrol engines:
    - Increased turbocharger boost and engine downsizing
    - Increased compression ratios
- Diesel engines:
    - Increased turbocharger boost and engine downsizing

In view of these trends, future petrol engine technology would benefit of the use of high octane fuels and higher bioethanol content, given that this increases energy efficiency and reduces emissions. As for future diesel technology, current fuel properties would be suitable. As a result, future developments do not seem to be

[89] For further detail on underlying assumptions see EQ 2.4 above

impacted from higher biofuel blends, and these may improve the performance of future petrol engines.

With regards to the use of higher biofuel blends and the cost impacts of this, future engine developments will be able to use higher biofuel blends and will not be impacted if these are introduced in the market, which indicates that the benefits arising from the use of higher blends will not be outweighed by a hypothetical malfunctioning in petrol and diesel engines. As current R&D and future engine technology will be fully compatible with higher biofuel blends, further improvements would not be required if Annexes I and II are modified to increase biofuel content.

Based on the evidence from the stakeholder engagement exercise, Member States have limited knowledge as to whether the costs to car manufacturers and fuel manufacturers outweigh the benefits of the Directive. A small number consider that the costs do outweigh the benefits (3 out of 17), however half of Member State respondents chose the 'Do not know' response.

Among the three Member States (France, the Czech Republic and the Netherlands) which believe that costs outweigh benefits, the Czech Republic comments on the fact that older vehicles are still prevailing in the car fleet as the new ones are more expensive. The other two have not provided any additional commentary.

Three Member States (Austria, Germany and Sweden) are entirely positive about the cost/benefit impact of the Directive. Sweden states that in the absence of the FQD fuel suppliers would likely have to comply with REACH, at higher costs. Moreover, Germany argues that car manufacturers benefit the most from a more stringent regulation, since higher quality fuels enable them to meet the relevant ELV and greenhouse gas limits more easily, therefore decreasing the costs of reducing emissions from vehicles.

The remainder of MS (9 out of 17) stated they do not know. Of these, the UK stated they had not recently conducted any cost-benefit analysis. The UK also commented that there is unlikely to be suitable cost-benefit for moving away from the current summer vapour pressure derogation in place in the UK, stating that they would like to see the current derogation extended when it comes to an end.

Member States have also commented on the costs of implementation (see E.Q. 2.4).

Stakeholders are overall positive about the cost benefit relationship, with the majority believing that the costs to car manufacturers and fuel producers do not outweigh the benefits of the Directive (environmental, health, single market) (22 out of 39 respondents).

Those who are positive about the cost-benefit relationship include: 12 fossil fuel manufacturers and suppliers, 7 biofuel industry members, one engine manufacturer, one equipment manufacturer, and one anonymous respondent. Among these, UPEI (the European Union of Petroleum Independents) stressed the importance of biofuels use in reducing GHG emissions. However, 7 fossil fuel manufacturers and suppliers commented that, in spite of the recognised benefits, costs are not at all negligible, especially regarding desulphurization, blends production and distribution costs. Moreover, the Hungarian Petroleum association, while being positive about the environmental benefits, claims that the required expenses have become too high. ACEA, an engine manufacturer, also commented on the fact that better quality fuels are key in meeting increasingly complex and sensitive vehicle emission control requirements.

Only 3 respondents, all fossil fuel manufacturers or suppliers (Total, Heide Refinery, German Petroleum Association), believe that costs of the directive outweigh its

benefits. Nevertheless, Total for example claims these costs are acceptable as long as "a level playing field for all producers is guaranteed". The Heide Refinery and the German Petroleum Association share the view that environmental and health benefits are not reimbursable to the industry, and that the "single market" objective has not been entirely fulfilled.

14 out of the total respondents state they do not know. These include respondents from several categories: 5 fossil fuel manufacturers and suppliers, 2 fossil fuel and biofuels manufacturers, 4 members of biofuel industry, 2 fuel additive manufacturers and one anonymous respondent. Among the fossil fuel manufacturers, Lukoil Neftohim Burgas finds it difficult to provide a definite answer, due to comparability issues between the real costs for manufacturers and environmental and health measures; UFIP lacks a global quantitative evaluation of environmental benefits. The Danish Oil Industry Association, while recognising the environmental benefits, also highlight the magnitude of desulphurization, blends production and distribution costs. No other major comments have been made.

Finally, no responses have been received from NGOs in relation to this question.

Summary evaluation

Due to the limitations of the available data it is not possible to provide a conclusive cost-based assessment overall. It is clear that while implementation and compliance with the Directive has imposed costs on some (on fuel suppliers and industry, and on Member State competent authorities), there have also been significant benefits from health and environmental protection. However, estimated values of the benefits depend on the assumptions underlying damage cost functions used, and the range of values in these is significant. Also, the costs of the variable transposition of the requirements into the 28 Member States are difficult to quantity, but this market fragmentation has an impact on cross-border biofuel trade. Additionally it is worth remarking that a significant proportion of capital investment in the refinery section attributed to compliance with the FQD was incurred prior to 2009.

EQ 2.6 What are the costs arising from the application of the derogations? (Articles 3 and 4)

For additional background in relation to the derogation for Member States with **low ambient summer temperatures**, or for MS intending to place petrol containing bioethanol during the summer period, see EQ 1.7 Have the derogations in Article 3 been effective? (Article 3).

Low summer ambient temperatures and bioethanol derogations (Vapour pressure)

Responses from industry stakeholders indicate that approximately one sixth (5 out of 40) of respondents state they incurred higher costs due to low ambient summer temperature derogations, or derogations in relation to bioethanol during the summer period[90] (see figure below). These five are all fossil fuel manufacturers (TOTAL S.A., UFIP, and the national associations for Portugal, Slovakia and Denmark).

Supporting commentary was provided by TOTAL, S.A. who state that the introduction of ethanol containing fuel resulted in adopting quality of fossil part to meet EN228 specifications, as this was the cost of limiting VOC emissions (TOTAL S.A. operate in Spain, which was granted a derogation in relation to the introduction of petrol containing bioethanol).

[90] Compared to Business as Usual costs

APETRO, the Portuguese oil association, state that they incurred higher costs. To the best of our knowledge Portugal has not been granted a derogation under either of the conditions (low summer ambient temperatures, petrol containing bioethanol). APETRO nonetheless state that in spite of positive vapour pressure derogation there are additional costs related with new equipment for ethanol storage, addition and other blending costs (to meet distillation and oxygenates specification). *Further clarification will be sought from APETRO at a later stage in this project.*

The Danish Oil Association state that despite the derogation for Denmark (RVP at 70 kPa due to low ambient summer temperature) the overall picture for Denmark involves higher cost. Together with lower sulphur and aromatics the derogation does not outweigh the extra cost for reduction in other petrol components with high RVP, low sulphur and no aromatics. The Danish Oil Association appears to be focussing on the overall increased costs due to compliance with FQD in other areas, rather than specifically whether their company has incurred additional costs due to providing fuel in a country with a low summer ambient temperature derogation.

The Slovak industry association has not supplied any supporting commentary to their statement that they have incurred higher costs, however as far as we are aware they have not been granted a derogation in this case.

In addition, five respondents do not believe that the benefits brought by the low summer ambient temperature derogations outweigh the costs. These are three fossil fuel manufacturers and suppliers (UPEI, the Slovak Association of Petroleum Industry and the Danish Oil Industry Association), as well as EFOA (the European Fuel Oxygenates Association), and one biofuel company (Federchimica). Additional commentary supporting their response was provided by Federchimica and EFOA, with Federchimica stating that biofuel incorporation will not increase and a derogation would only give an industrial cost advantage for one specific biofuel, limiting competition, and would therefore not lower the cost of biofuels, in fact reduced options would lead to higher prices. EFOA state that ethanol incorporation (as direct blending) will not increase as we have seen in the MS that were granted a derogation. It might give a cost advantage to the blender (only one party) but higher emissions impact society at a cost as well. Even if the blender were to pass on these cost advantages to the customer, with the disappearance of other options, the cost to the consumer will increase in the medium to longer term.

6 stakeholders responded that the vapour pressure waiver (due to low summer ambient temperature or to increase the bioethanol content of petrol) does not incur higher costs, given that manufacturing petrol with a higher vapour pressure is actually cheaper due to the higher use of butane, which reduces costs. These were two fossil and biofuel manufacturers (the Swedish Petroleum & Biofuel Institute and Nesté), UPEI, a biofuel manufacturer and an anonymous respondent. The Swedish Petroleum & Biofuel Institute added that it would be more efficient if this was allowed once and for a limited period of time, rather than via a derogation. However, it should be noted that derogations have to be requested so that the Commission can assess the impact of granting such derogation as well as verify that there is a justification based on socioeconomic grounds as described in the Guidance for requesting the waiver published by the Commission. If a higher vapour pressure was allowed by default, it is likely that most Member States would apply it, given that this decreases production costs.

EFOA (petrol additive manufacturer) mention that they do not believe that a waiver is necessary to introduce bioethanol in the market. According to them, this derogation has not brought the expected results, as bioethanol has not been introduced at the expected rate in the Member States where the waiver was granted (this is true in

Spain for instance, in view of their latest FQD national report). As a result and according to EFOA, vapour pressure was not the limiting factor for the promotion of the blend of bioethanol with petrol, given that the use of blends does not seem to increase in the countries where the waiver has been granted. According to this fuel additives manufacturer, the fact that bioethanol is explicitly mentioned in the Directive hinders the possibility to blend other additives such as bio-ETBE. Finally, 10 stakeholders did not respond (all 4 NGOs, 2 engine manufacturers, one fossil fuel manufacturer, and two others, together with Greenergy Fuels Ltd).

In relation to the derogation allowing sulphur in fuel for older vehicles, industry stakeholders have not reported any cost savings arising from this. On the contrary, some commented that there can be no cost savings in such a situation, since economies of scale are not possible.

Derogations for the Outermost Regions

Only France has availed itself of these derogations, for the island of Mayotte. France has not provided exact costs in relation to the application for the derogation, which incurred some administrative man time on behalf of France to draft and submit to the Commission.

Summary evaluation

While data on costs arising from derogations is limited and patchy, stakeholder evidence indicates that there are additional costs associated with the application of derogations in some cases. However, these costs are outweighed by the economic savings obtained, according to most of the respondents. Some respondents have indicated that these savings may not have an impact on consumers and will therefore only benefit the fuel manufacturing industry.

The benefits arising from application of the derogations are explored in the following section.

EQ 2.7 What are the benefits arising from the application of derogations? (Articles 3 and 4)

The benefits of the available derogations are cost savings to industry (low summer ambient temperature and bioethanol derogations), the reduction of the disadvantage that the Outermost regions have due to their singularity (see E.Q. 3.7), the ability to main fuel supply in the Outermost Regions without incurring high additional costs or breaching the Directive, and the granting of special provisions in case of specific market situations or lack of supply. Derogations have not been used very frequently, which explains the lack of publicly available information on their cost.

With regard to the derogation on the vapour pressure of petrol blended with bioethanol and the low summer ambient temperature, article 3(4) and 3(5) of the FQD state that the Commission has to assess the derogation requests taking into account:

- The avoidance of socioeconomic problems resulting from higher vapour pressure
- The environmental or health consequences of granting the derogation.

Table 4.7 contains a summary of the costs estimated by Member States in order to justify their request for a derogation on the vapour pressure limit on petrol, as part of their description of the possible socio-economic impacts of not having a derogation.

Table 4.7: Socioeconomic costs of complying with the vapour pressure requirements as described in the vapour pressure derogation requests

Member State	Derogation	Reported range of costs	Further information
Bulgaria	Bioethanol	€7 million (one-off investment) €3 million per year	On-going increased production costs of maintaining a vapour pressure of 60 kpa while increasing the amount of bioethanol to comply with the Bulgarian RE law
Spain	Bioethanol	€120 million to €240 million per year Additional investment costs by refiners Increase in petrol consumer prices of €0.03 and €0.04 per litre without the derogation	Higher production costs and significant investment at refineries
Denmark	Low summer ambient temperature	€150 million (investment)	Installation of alkylation facilities in Danish refineries
Estonia	Low summer ambient temperature	Not specified	Higher production costs due to having to produce a specific low vapour pressure petrol
Finland	Low summer ambient temperature	€100 million (investment) 'several' € million per year in increased production costs	
Ireland	Low summer ambient temperature	€18 million per year	Refurbishments to the only refinery in Ireland to comply with 60 kPa
Latvia	Low summer ambient temperature	Not specified	Higher production costs due to having to produce a specific low vapour pressure petrol
Sweden	Low summer ambient temperature	€22 – 34 million (investment per refinery)	3 refineries producing petrol. Therefore, the total investment would be €66 - €102 million
UK	Low summer ambient temperature	£230 million investment (€314 million[91]) £106 million per year (€145 million[91])	Cost per year relates to increased operational costs

As can be observed in the table above, Member States justified their submission stating that the required investment would be of at least **€637 million** and increased

[91] Official exchange rate from the European Central Bank: Average official exchange rate in the period 2015-2016 (01-01-2015 – 10-03-2016) according to the European Central Bank: €1 = £0.73240

operational costs of at least **€247 million per year**. This gives an indication of the benefits (savings) obtained by petrol manufacturers with these derogations.

In relation to the derogation for Outermost Regions, France has been granted a derogation for the sulphur content of fuel in Mayotte (50 mg/kg until 31-12-2016). Given the geographic location of Mayotte, fuel is supplied from a number of locations including Singapore and Africa (including but not exclusively from La Reunion). While fuel supplied from La Reunion does meet the standards of the FQD, fuel supplied from other locations does not, and establishing a direct fuel link between La Reunion and Mayotte (by tanker ship) in order to guarantee an FQD-compliant fuel supply would add €0.20/litre per litre to the sale price of fuel in Mayotte, which would significantly impact on the population and economy of the island (which is itself one of the least economically affluent parts of France). Therefore in the case of Mayotte, the benefits of the derogation are the availability of affordable fuel supply on the island, in the absence of which the economy of the island would suffer.

Spain commented that this derogation was not required in the Canary Islands, because the islands are fully integrated within Spain's fuel supply logistics systems and there is refinery in Tenerife, which processes 4.5 million tonnes of fuel per year and supplies fully compliant fuel to the islands and other parts of mainland Spain. Also, it has received funding from the Spanish government and the EU in order to compensate for the higher transport costs (as part of the ERDF programme for Outermost Regions), which facilitates trade between the Island and mainland Spain, where the owner of Tenerife's refinery has two other refineries in the south (Huelva and Algeciras). As a result and although the region has the oldest vehicle fleet in Spain[92], they did not require the application of the derogation for the Outermost Regions.

EQ 2.8 Have the costs outweighed the benefits in the application of derogations? (Articles 3 and 4)

Evidence from the stakeholder engagement indicates that one third of industry stakeholders believe the benefits of the derogations outweigh the costs (12 out of 36 responses).

Derogations for the Outermost Regions

Specifically in relation to the derogation for Outermost Regions, two of three countries with Outermost Regions (France, Portugal, and Spain) have replied to the questionnaire. These are France and Spain. In the case of France, the derogation for the Outermost regions has been applied in Mayotte, and France considers that the costs of applying the derogations are outweighed by the benefits. France highlights that there is a high cost associated with supplying fuel to Mayotte because fuel originates from a number of locations including Singapore and Africa (including but not exclusively from La Reunion). Fuel in La Reunion meet the FQD standards, however to establish a direct fuel link by tanker ship between La Reunion and Mayotte, therefore guaranteeing fuel in Mayotte meets the requirements of the FQD, would add €0.20/litre to the sale price of fuel on the island, according to French authorities. That would have a significant impact on Mayotte's economy. Therefore, the benefits from the application of the derogation (which is valid until December 2016) outweigh the costs. As for Spain and as clarified in EQ 2.8, the derogation was not required.

[92] http://www.laprovincia.es/economia/2014/06/09/canarias-comunidad-parque-movil-envejecido/613516.html

Vapour pressure derogations

As for the derogation on the vapour pressure of petrol related to the introduction of bioethanol and to countries with low summer ambient temperature, various stakeholders stated that these derogations lead to savings by definition (see E.Q. 2.7). Given that manufacturing petrol with a higher vapour pressure is cheaper, it has to be assessed whether the economic benefits outweigh other drawbacks such as higher VOC emissions and its subsequent knock-on impacts (potentially higher benzene and tropospheric ozone concentration). According to the Commission's Guidance on notifications of exemptions from the vapour pressure requirements for petrol pursuant to Article 3(4) and (5) of Directive 98/70/EC relating to the quality of petrol and diesel fuels [93], Member States that intend to apply for a derogation must fulfil certain criteria and submit a report justifying their request:

- Direct socioeconomic problems.
- Compliance with EU air quality and pollution legislation related to NMVOC, benzene and ozone. This includes past compliance, air quality plans/strategies and a thorough method to calculate the impact of the waiver, compared to a situation where the waiver is not granted.

The Commission assesses each application thoroughly and only grants the derogation if Member States demonstrate that the benefits (i.e. savings) of applying the derogation are higher than the costs to the environment, and provided that they can comply with all their pollution and air quality commitments. Therefore the fact that the Commission has granted derogations on vapour pressure in relation to low summer ambient temperatures to a number of countries indicates that the benefits have been shown to outweigh the costs to the environment.

As an example, The Commission Decision on the request from Sweden for a derogation quotes information provided by Sweden stating that, since historically a summer vapour pressure of 70 kPa maximum has been permitted, the five refineries in Sweden are designed for production of petrol with this specification. Sweden estimates that three of its five refineries would incur an estimated cost of 22-34 million per refinery in order to make modifications to enable the production of petrol with a lower vapour pressure. Sweden highlighted that these investments may not provide an adequate return on capital. This illustrates the potential scale of savings arising from the granting of the derogation in this case. Table 4.7 above (E.Q.2.8) gives the full range of cost savings in all the Member States that have applied for a vapour pressure derogation based on their estimations of the costs of not having such a derogation. As concluded above, a minimum of €637 million investment and increased operational costs of at least €247 million per year are saved due to having the petrol vapour pressure derogations. The environmental and health impacts are, in view of the Commission, insufficient to lead to non-compliance of these Member States with other EU legislation such as the NECD, although it is recognised that this is uncertain.

Moreover, in the follow-up interviews carried out in December 2015, Spain stated that their application implied significant efforts for a long period of time but that they were totally justified considering the impact that vapour pressure limits were having on the Spanish fuel manufacturing industry.

93 http://ec.europa.eu/clima/policies/transport/fuel/docs/guidance_note_vapour_pressure_en.pdf

Poland is preparing an application at present (having previously been advised by the Commission to withdraw a previous application), which has required the involvement of 1-2 persons for several weeks. The modelling and analysis that needs to be provided in support of the application has been outsourced, which increases the costs (no specific figures have been provided). However, Polish authorities estimate total savings of $40 million per year (€36.7 million as of 14th January 2016) if the derogation is granted, which justifies their investment.

Conclusion

According to the information gathered and given the thorough assessment that the Commission conducts in order to grant the derogations, the benefits arising from the derogations outweigh the environmental costs of their application and the costs of preparing and submitting the derogation.

EQ 2.9 Could the environmental gains achieved by this Article have been met against lower costs? (Article 6)

Article 6 sets out that Member States may, if they wish, 'take measures to require than in specific areas within its territory, fuels may be marketed only if the comply with more stringent environmental specification than those provided for in the FQD', so long as this is with a view to protecting the health of the population or the environment in a specific area. None of the Member States responding to the stakeholder engagement have applied Article 6, therefore there are no environmental gains achieved by this Article, and it is not possible to evaluate the above question (The member state respondents include Sweden).

It is worth noting that two of the stakeholders (biofuel producer Nesté and the Swedish Petroleum and Biofuels Institute) who responded, both based in Sweden, express the view that Sweden is applying Article 6 because there are tax incentives for certain fuels in Sweden (for paraffinic diesel fuels and alkylate based small engine petrol), which encourage the use of fuels exceeding the specification of the Directive. However, our interpretation of this would be that a tax-based incentive is not the same as a restriction on marketing of fuels, and that therefore Article 6 has not been implemented in Sweden. This has been checked in the additional interview with the Swedish authorities: these have confirmed that Article 6 has never been used. The tax exemptions raised by some of the stakeholders is a misunderstanding of Article 6.

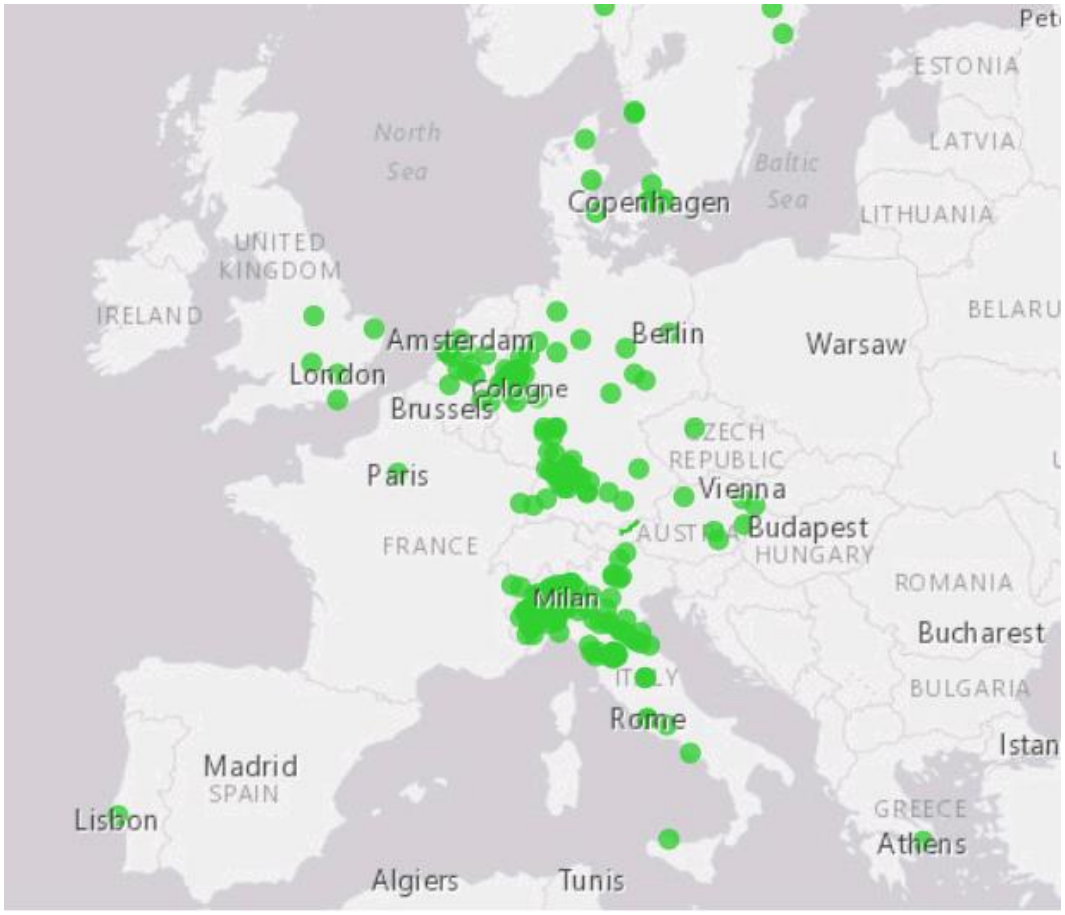
Although more stringent fuel specifications, in line with Article 6, might be necessary in the future, environmental zoning and urban access restrictions in general seem to be the preferred option today. Main aims of these restrictions are air quality improvement and congestion reduction, but liveability could also be an aim. According to a study of the IEA-RETD 'RES-T-NEXT – Driving renewable energy for transport' of November 2015 many different design options are possible in terms of primary objective, targeted vehicles, time of operation, type of enforcement and exemptions on the restrictions. Besides access restrictions road charging might be applied to discourage driving in certain areas. In terms of cost-effectiveness, the cost-effectiveness of such schemes will be higher in case the most polluting vehicles are restricted, but costs imposed on vehicle owners/users are higher in case more vehicles are restricted.[94] According to DIVV (2011)[95] the costs of implementing an access restriction are relatively low compared to other measures for improving air quality.

[94] http://www.ce.nl/publicatie/driving_renewable_energy_for_transport/1710

[95] DIVV. (2011). *Schone lucht voor Amsterdam : herijking Amsterdamse maatregelen luchtkwaliteit.* Amsterdam: Gemeente Amsterdam, Dienst Infrastructuur Verkeer en Vervoer (DIVV).

The website Urban Access Regulations includes an overview of all low emissions zones applied (see Figure 21) and shows frequent use of environmental zoning in various Member States.

Figure 21: Low emissions zones according to the website Urban Access Regulations (status on 18th of January 2016) [96]



To conclude, the above sources in combination with the questionnaire outcomes imply that the environmental gains which could be delivered by Article 6 could probably be reached at lower cost by environmental zoning targeting vehicles rather than fuels. This partly explains why Article 6 has not been applied until today.

For more insight in to stakeholders responses see also EQ 4.11.

EQ 2.10 Has the authorisation to use higher limits in case of change in supply of crude oils been justified in terms of costs? (Article 7)

Article 7 has not been applied by any Member State to date, however the UK considered applying it in response to a threatened fuel tanker strike in the UK in 2012, and discussed a potential application with the Commission. In the event, the strike was cancelled and so the application of the Article was not necessary. In the absence of examples of the application of the Article and associated information on costs, the

[96] http://urbanaccessregulations.eu/

potential costs and benefits of Article 7 were discussed with the UK in a follow-up interview during December 2015. In addition, a small number of fossil fuel manufacturers provided some limited commentary in their questionnaire responses with regards to Article 7.

Based on the UK's experience, the costs of applying the article would include the administrative time devoted by the Member State to developing their application, discussions with the Commission, etc.

The benefits of avoiding disruption to fuel supply would be hard to quantify, but would include knock-on effects from loss of supply to businesses and individuals unable to carry out their everyday activities if reliant upon fuel for road transport. Depending on the length and scale of the disruption to fuel supply these could be considerable.

In addition stakeholders were asked in the questionnaire what costs might arise from the authorisation to apply higher limits under this article, and whether they considered these costs to be justified. A low level of awareness of this article was demonstrated among non-fossil fuel stakeholders (responses from the biofuel industry, engine manufacturers, fuel additive manufacturers, NGOs and others were either blank or indicated they did not know).

Responses were received from three fossil fuel manufacturers (TOTAL Deutschland GmBH, TOTAL S.A. and UPEI (Union of European Petroleum Independents)) stating that they consider the costs are justified. In addition TOTAL Deutschland GmBH and TOTAL S.A. stated that the additional cost of applying the article would be justified in view of public health benefits and the imperative of satisfying market demand.

With regards to the types of costs arising from the application of the article, UPEI identified wholesale, logistic and retail costs as costs which would arise from the application of Article 7. Both TOTAL companies stated that the costs arising depend on the type of crude to be processed, and on the exact specifications of the temporarily allowed fuel with lower specifications. TOTAL S.A. added that the application of this article should not lead to an unjustified advantage for refineries of a Member State benefiting from such derogation. No further evidence was provided for these statements.

In addition, it considered that in the absence of the safeguard provided by Article 7, in the event that a disruption to the fuel supply occurred, the Commission might have to start infringement procedures against a Member State for non-compliance with the specifications in Articles 3 and 4, when the cause of this non-compliance is beyond the control of the Member State. This would lead to additional costs for the Commission. Conversely, the application of the Article allows Member States to continue supplying fuel, satisfying demand for fuel supply, and avoiding costly infringement procedures.

Therefore overall, on the basis of the stakeholder responses, it is considered that the benefits of applying Article 7 if the need arose are likely to outweigh the costs of applying the Article. Article 7 is therefore considered to be effective.

EQ 2.11 Are the monitoring and reporting obligations included in the FQD cost efficient? (Article 8)

Evidence from the **Member State questionnaire** delivered mixed evidence regarding the perception of cost-efficiency of the monitoring and reporting obligations.

In the questionnaire, Member States were asked whether the administrative time required in relation to monitoring and reporting was proportional to the value and benefits arising from this reporting.

Six Member States positively evaluated the relationship between the administrative time burden and the benefits arising from it. These are Malta, the Czech Republic, France, the United Kingdom, the Netherlands and Slovakia. Despite this, the Czech Republic reports having invested time in re-arranging the inter-departmental reporting process. Malta stated that the number of samples to be collected is disproportionate to the size of the country.

Member States who negatively evaluate the cost-efficiency of the article are Croatia, Estonia, Luxemburg and Sweden, considering that the reporting administrative time burden is disproportionate in relation to the benefits delivered. Sweden commented on the high costs for a large number of samples, and the high administrative time burden required in order to collate all the information into its national report. No other Member States gave further comments.

Finland did not respond indicating whether they consider the administrative burden proportional to the benefit or not, instead highlighting that monitoring and reporting is considered proportional at present but highlighting concerns regarding potential duplication in future of reporting requirements across FQD and RED.

Member States which stated they did not know are Germany, Latvia, Romania, Slovenia, Austria and Denmark, although Austria highlighted the presence of high costs.

Given the mixed responses received in the questionnaire, and the lack of supporting data on costs provided by Member States, the issue of costs in relation to monitoring and reporting, were further discussed in the **follow-up interviews** with selected Member States carried out in December 2015.

Data on the costs of monitoring and reporting was provided by Finland, France, Poland, the UK, Spain and Sweden during follow-up interviews in December 2015. A summary of the range of costs reported is presented in Table 4.8.

Table 4.8: Costs of monitoring and reporting under Article 8 of the Directive

Cost category	Reported range of costs	Further information
Administrative time required by MS Competent Authority to report under the FQD	Range between 5 man days per year and 20 man days per year	These two values are for MS where the competent authority outsources the sampling, therefore it is the time required to manage and compile reporting. The range depends on the FQMS system used, in some MS (e.g. the UK) industry has a large role in compiling the monitoring data, such that the burden on the competent authority is smaller.
Monetised cost of the administrative time expended by the MS Competent Authority in reporting	€836 – €5,190	Calculated by applying Eurostat hourly labour cost data (Member State specific) to the above data on time expended. Assumes a 37.5 hour working week.

Cost category	Reported range of costs	Further information
Fuel sampling costs	€800-€1,250 per fuel sample	France provided additional cost break down, reporting costs of €200 for taking each sample from a fuel station, together with costs of €600 (for petrol) and €700 (for diesel) laboratory analysis costs. Spain indicated a similar cost breakdown.
Overall fuel sampling and monitoring costs	€173,000-€650,000	These are annual costs estimated by Member States, and include all fuel testing costs, including costs involved in outsourcing or contracting fuel monitoring to 3rd party companies.

In addition Poland reported a time input of 4 man-months in order to analyse samples and draft the annual report. No information was provided regarding whether sampling and analysis is carried out in-house or outsourced.

These costs ranges can only be considered indicative, given that data was only provided by 6 Member States. They do however illustrate the range and variability in costs, which are influenced by a number of factors, including the choice of Fuel Quality Monitoring System (FQMS) applied by each Member State, the number of fuel samples taken and analysed, and other factors such as labour costs within each country. Table 4.9 below details the FQMS applied by each country, and the number of fuel samples taken in 2014 (the last year for which FQMS data is available).

Table 4.9: Range of Fuel Quality Monitoring System and sampling used

Member State	Country size	Fuel Quality Monitoring System Used	Petrol samples taken	Diesel samples taken
Finland	Small	EN 14274 Statistical Model A	225	117
France	Large	EN 14274 Statistical Model B	476	408
Poland	Small	EN 14274 Statistical Model B	528	403
UK	Large	National system	1,282	2,361
Sweden	Small	National system	552	684

Sources: EEA 2015, Ricardo-AEA 2014a.

To **compare** the **costs** of monitoring and reporting against the **benefits** delivered by the FQD, the estimates of quantified benefits from the Directive, as set out in EQ2.5 are used (see EQ 2.4 and EQ2.5). These include the estimate of **€196.8** million[97] per

[97] This value is a cumulative estimate for the period 2001-2011, not for a single year. These estimates are calculated using EEA damage cost values on the benefits of

average EU-28 refinery during the 2001-2011 period arising from the reduction in SO_2 emissions (JRC Refineries Fitness Check (JRC, 2015), and the calculated damage cost values of **€ 695 million** for reduction in SO_X, and **€ 8,611** million for reduction in NO_X for the period 2009-2013 (see Table 4.5 and Table 4.6 above), estimated using EEA data on emission trends and damage cost function values from CAFÉ.

At the higher end of costs reported for the monitoring and reporting by Member States (the €650,000 reported by one Member State for total sampling costs, together with the monetised value of the administrative time input required), and assuming a conservative scenario where all 28 Member States incurred this level of costs, this would equate to a value in excess of €18 million costs annually across all 28 MS.

This is significantly less than the value of benefits estimated by either of the methods cited above. Therefore the monitoring and reporting requirements are considered to be cost effective.

In addition, benefits conferred from the FQD include increased vehicle longevity due to catalyst equipment life time increasing due to the desulphurisation of fuel and the removal of lead from fuel.

In summary, and although some Member States have highlighted high costs associated with the monitoring and reporting requirements of the FQD, these costs are outweighed by the estimated benefits to health and the environment delivered by the Directive. Therefore Article 8 is considered to be effective.

EQ 2.12 Are the costs of the Commission reporting under Article 9 efficient?

The conclusion of this question is that it is not possible to assess the efficiency of Article 9 since the report has not been published yet. Bearing this in mind, there is, however, some information available on the costs associated with the preparation of the report under Article 9: the costs associated with Article 9 can be estimated as at least €380,000 as result of the studies commissioned by the European Commission to provide input to Article 9. 'Fuel specification for non-road mobile machinery (Task 1)' of January 2012 carried out by AMEC Environment & Infrastructure UK Limited, 'Permitted summer petrol vapour pressure (Task 2)' of January 2012 and carried out by AMEC Environment & Infrastructure UK Limited and Laboratory of Applied Thermodynamics (LAT) and 'Impact of higher levels of bio components in transport fuels in the context of the Direction 98/70/EC of the European Parliament and of the Council of 13 October 1998, relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC', to be published and carried out by ICF et al. In addition, the work carried out internally within the European Commission should be considered.

In terms of benefits, the report and proposal of the Commission could lead to some benefits as well, because Article 9 makes the European Commission explicitly responsible for the review process. By allowing a review and further development of the legislation continuous improvement of the aspects being part of this evaluation (effectiveness, efficiency, relevance, coherence and EU-added value) is possible. Based on the project team's expert judgement this could also form a risk: a review during the duration of such a Directive might also be a threat for the continuity of the legislation, because the review process might result in amendments.

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decreasing SO_2 intensities, and represent the difference between a baseline situation where the average sulphur content in gasoline and diesel would have remained at the level determined by the FQD in 2000 (150ppm for gasoline and 350ppm for diesel), against the actual reported sulphur levels in fuel (as illustrated in Figure 4.19 above).

The views of stakeholders on Article 9 are discussed under EQ 1.16 and EQ 4.14.

Overall, the efficiency of Article 9 cannot be assessed until the report has been published.

EQ 2.13 Could the Directive be effectively enforced against lower costs? (Article 9a)

Evaluation of this question is at present inconclusive due to limited evidence having been obtained from the stakeholder engagement questionnaire. In addition, stakeholders appear to have little knowledge of this area, with only 2 out 30 responding stakeholders stating that they consider that the requirements could be enforced with lower costs, and the remainder responding they did not know. The Portuguese National Petroleum Association (APETRO) and LUKOIL Neftohim Burgas stating 'yes' have not provided any further comments to their answer. It not completely clear to what extent stakeholders have interpreted this question as referring to all costs associated with the implementation of the FQD or only the costs associated with Article 9a (the penalties).

In order to get more insight in the penalties imposed by Member States the individual Fuel Quality Monitoring reports of 2011, 2012 and 2013 have been studied. Under EQ 1.17 an indication of the height of the penalties is already given. These FQM reports confirm the statement by Member State respondents that very few penalties have been imposed. In addition, several Member States, like Germany and Ireland, have indicated that their authorities take some steps before imposing penalties, like starting an investigation and issuing of warning letters.

Based on this investigation of Fuel Quality Monitoring reports the conclusion can be drawn that Member States aim to enforce the FQD at lower cost and aim to keep the number of fines at a proportional level.[98]

[98] https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp

4.4 Coherence

Overall evaluation of coherence

The key issue of coherence for the FQD is in regards to biofuels, in particular in relation to the objectives of the RED. In the remainder of areas the Directive is viewed as being coherent with other EU legislation, and with itself.

Further details of the analysis and evidence for this overall evaluation is presented in the subsequent evaluation questions (EQs).

- **Article 1 and 2:** no new issues, additional to those highlighted under 'effectiveness' and 'efficiency' have been identified.
- **Articles 3** and **4** are not fully coherent with Annexes I and II. In addition the FQD and the RED are not fully aligned in terms of objectives and scope. The FQD is however fully coherent with Directives 94/63/EC and 2009/126/EC.
- The RED sets ambitious targets such as fulfilling 20% of the EU energy needs with renewable energy by 2020 and having at least 10% renewable transport by the same year. According to the available data, it will not be possible to meet these RED targets by application of the upper limits of bioethanol and FAME alone, (10% for bioethanol in petrol and 7% for FAME in diesel according to Annexes I and II), and other additional measures such as use of HVO, which is not included in the 7% limit for FAME, using advanced biofuels that can be double-counted, or the electrification of transport would also need to be applied.
- There is however no evidence to suggest that the FQD would hamper meeting the targets of the RED. At present, official data indicates that most Member States are still far from reaching these permitted upper limits of FAME and bioethanol and that the FQD *per se* is not the reason for Member States not progressing on their targets, as there are other barriers to the increase of the proportion of biofuel in petrol and diesel.
- The introduction of different levels of biofuels blends does not contribute to the full delivery of a single market for fuel Article 4 states that Member States may allow the placing on the market of diesel with a FAME content above the 7% set in Annex II, so long as consumers are informed. This creates an exception to the requirement stated in Annex II that diesel fuel contains no more than 7% FAME. To date only France has allowed the placing on the market of B8 diesel (8%)[99]. The Netherlands has reviewed its transposition of the FQD to reflect this aspect of Article 4, however to date no diesel with FAME in excess of 7% has been placed on the market in the Netherlands. Spain has indicated that they may take a similar approach in order to comply with the obligations under the RED. This inconsistency between Article 4 and Annex II does not contribute to the delivery of a single market. In addition, there is a theoretical lack of coherence between Articles 3 and 4, since that Article 3 and Annex I does not allow such a flexibility regarding the bioethanol content of petrol.
- The FQD is fully coherent with Directive 94/63/EC on stage I controls for the VOC emissions arising from the storage and distribution of petrol. The objectives of the FQD and Directive 94/63/EC are complimentary and both Directives aim to reduce harmful pollutants being released into the air.
- There are potential discrepancies between the FQD and Directive 2009/126/EC on Stage II controls at service stations. However, both Directives are considered coherent in practice, as the process for allowing higher volatility petrol under the

[99] This is current the subject of discussion with the Commission

FQD takes into account the application of Stage II controls, and includes provisions for ensuring that VOC emission increases do not prevent Member States from meeting national and international emissions and air quality obligations.

- Other aspects of the specifications in Annexes I and II, mainly RON could also potentially lead to market fragmentation but the available data confirms that this has not yet been the case.
- Additionally the specifications of gas oil for Non-Road Mobile Machinery (NRMM) and e.g. inland waterway vessels are currently not coherent with the diesel specifications in the Directive, and some engine manufacturers consider that aligning the two would be beneficial and improve the single market.
- **Article 5** highlights that coherence with Article 3, 4 and 7a of the FQD and the RED is an issue, especially in relation to biofuel mandates and sustainability criteria.
- **Article 6** is assessed as being coherent with other EU legislation, as is Article 7.
- The monitoring and reporting requirements under **Article 8** are considered to be broadly coherent with those of other Directives.
- Article **8a** is coherent with the aims of the Directive, however it refers to MMT within fuel, whereas it should in fact refer to MMT in petrol, since MMT is not used in diesel fuel.
- No issues relating to coherence have been identified for the remaining **Articles (9, 9a**). These Articles are considered to be coherent with the aims of the Directive, and are coherent with other Articles within the Directive and other EU legislation.

EQ 3.1 Is the Directive coherent with other Directives and EU policies?

Comparing responses from industry and Member States authorities indicates that Member States have a more positive view regarding the coherence of the FQD. Industry stakeholders have highlighted concerns around the practical issues regarding day-to-day compliance. These issues include the possible lack of coherence between the FQD and the Renewable Energy Directive (RED) (see EQ 3.5) and interactions between engine functioning and the requirements of Annexes I, II and III (see EQ 3.6, 3.9).

The RED sets a legally binding 10% target (10% energy content, i.e. volumes vary depending on the fuel) in transport by 2020. The RED also sets a target for 'advanced biofuels' of 0.5%. In contrast, the FQD sets upper limits for the proportion of bioethanol (10%) and FAME (7%)[100] that can be blended into petrol and diesel respectively. The FQD also establishes a reduction target for the GHG intensity of fuels of 6% by 2020 (Article 7a, which is out of the scope of this evaluation).

According to ICF et al. (2015), the limitations in the FQD have not caused issues for compliance with the obligations under the RED because the fuel sold in most Member States is below these levels. This report also states that the limitations in Annex I and II could be influenced by the fact that the FQD does not restrict food-based biofuels. As the EU's 2030 energy and climate package intends to limit the role of food-based biofuels in the decarbonisation of Europe, these limitations were compromised having in mind that they could be achieved using food-based biofuels alone. According to this strategy, the Commission will propose a new Renewable Energy Package during 2016 or 2017, which will include a policy for sustainable biofuels.

[100] Although this has been interpreted as being non-binding in the case of FAME in diesel, as exemplified by the introduction of B8 (diesel with 8% biofuel content) in France, which in itself is another issue, addressed elsewhere in this evaluation.

The recently adopted Indirect Land Use Change (ILUC) Directive[101] does introduce a cap on the contribution that biofuels from food crops can make to targets in the RED, which should be taken into account when meeting the target of 10% of transport energy.

The ICF (2015) report also suggests that the introduction of fungible drop-in biofuel that can replace petrol and diesel (instead of blends) could help to achieve the 10% target in the RED without increasing the percentage of biofuel that is permitted under the FQD.

Conversely, the fact that the RED promotes the use of 'advanced biofuels' and other waste biofuels by doubling counting their contribution to the overall objective could lead to a decrease in the overall quantity of biofuel that is used in the EU, whereas the trend of an increased use of E10 and B7 that has been detected in recent years seems contradictory.

In summary, the Directive is not fully coherent with all other EU policies and in particular, it is not fully in line with the RED (explored further in EQ 3.5, 3.8).

Individual Article evaluation

EQ 3.2 Is the scope of the Directive clear? Is it coherent with other Directives in terms of fuels covered in each of them? (Article 1) Are fuels missing? Does the FQD sufficiently support alternative fuels (incl. biofuels)? (Article 1)

Most Member States indicate that the scope is clear and understandable. Some Member States respond that the scope is only 'to some extent' clear, but provide no details. The UK specifically indicates that the introduction of Article 7a made the FQD unnecessarily complicated and proposes to split the Directive. The Netherlands and Malta point at the complicated relation with the RED and the difference in scope (e.g. NRMM and rail sector) and Sweden points at fuels on the Swedish market currently not covered by the FQD.

Among fossil fuel and biofuel industry stakeholders, 75% state that the scope is clear 'to some extent'. The main comment of the fossil fuel industry is linked to the inclusion of Article 7a in the FQD. This makes "the scope too large and not always clear" (quote from FuelsEurope and its members). The comments on the application of CN-codes are already covered under paragraph 4.2 EQ1.3. Those who indicated the scope is clear 'to a large extent' have not given further details.

The same difference of opinion is observed on the issue of clarity regarding which fuels are included in the scope of the Directive. Member States authorities mostly responded that this is clear. All Member States are aware that fuels for NRMM are covered by the FQD. No Member State indicates that certain (groups of) fuel users are missing from the FQD. The Netherlands and the UK ask to include the definitions from the CN-codes to improve clarity (see paragraph 4.2 EQ1.3). The Netherlands, Slovenia, Denmark, Malta and the UK request to include either gaseous fuels, or higher biofuel blends or both categories of fuels, as the FQD gives insufficient support to those fuels.

Industry stakeholders mostly believe that the scope of the Directive is not clear. They have provided detailed commentary, although without supporting evidence, indicating a number of issues regarding clarity of scope, including: the scope of what is covered by the FQD in relation to NRMM; CN codes being used which define the fuels included in the FQD as those that consist of <70% mineral oil, while this is not

[101] OJ L 239, 15.09.2015 p 1

reflected in the legislation, and the introduction of biofuels being insufficiently supported in the scope and alternative fuels (e.g. CNG) not being covered. Industry stakeholders also believe that the latest amendments to the Directive do not necessarily reflect their needs, with half of respondents believing that the scope could be clearer with regard to the specifications for gas oil for inland waterways vessels.

Half of all stakeholders (both Member State and biofuel industry) believe that the scope of the Directive does not sufficiently support the introduction of biofuels.

All the issues mentioned are already covered under the assessment of effectiveness and efficiency of the FQD. No new issues arose from the questionnaires nor from literature. For this reason no specific assessment is added.

EQ 3.3 Is the limitation to health and environment in the scope of the FQD coherent with long term ambition on climate policy and air quality? (Article 1)

Over half of Member State authorities (10 out of 14[102]) consider that this limitation is coherent with long term ambitions on climate policy and air quality. Latvia and Slovenia ask to reconsider the requirements if more stringent air quality and/or NEC standards are introduced in the future. The Netherlands and Sweden repeat their concern about the air quality impact of alternative fuels, in particular higher biofuel blends. And in addition Sweden repeats its concern that the FQD insufficiently covers the impact of (possible) additives.

Industrial stakeholders were not asked to comment on this issue, since previous experience from similar evaluation projects has shown a low level of awareness regarding long term climate and air quality policies among industry stakeholders.

EQ 3.4 Are the definitions in line with those included in other legislation? (Article 2)

The majority of Member State respondents agree that definitions in the FQD are coherent with those used in other legislation. A small number disagree: Sweden and Slovenia cite a lack of consistency with the definitions of 'bio-components' in Directive 2009/28/EC (Renewable energy Directive), and a lack of coherence in the definition of what constitutes a "supplier" between FQD and other legislation; both issues are covered under EQ 2.2.

EQ3.5 Are the specifications in Annex I coherent with the rest of the Directive and with other legislation or standards in the EU and beyond? (Article 3)

This EQ also answers EQ 3.8 "Are the specifications in Annex II coherent with the rest of the Directive and with other legislation or standards in the EU and beyond?" (Article 4).

The coherence of the specifications in Annexes I and II has been assessed against the provisions in Article 3, 4 and other parts of the Directive, and with other legislation, specifically Directive 2009/28/EC on the promotion of the use of energy from renewable sources (Renewable energy Directive, RED), Directive 94/63/EC on the control of VOC emissions resulting from the storage of petrol and its distribution from terminals to service stations and Directive 2009/126/EC on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations.

[102] Those that think it is not coherent are Latvia, Slovenia, the Netherlands and Sweden.

RED

The RED includes the objective of supplying at least 20% of the total EU energy needs with renewable energy by 2020. For this, Member States have national targets they need to achieve for 2020. All Member States must also ensure that at least 10% of their transport fuels come from renewable sources by 2020. As seen in E.Q. 1.6 and 1.8, Annexes I and II set a maximum limit for the biofuel content that can be blended with petrol and diesel, respectively. In the case of diesel, the limit in Annex II may be exceeded as per a provision in Article 4. Therefore, both Directives are interrelated as the FQD includes specifications that contribute to the overall objective as set in the RED.

ICF et al. (2015) provides information that indicates the RED and the FQD are coherent with each other:

Current E10 petrol levels are very low in Europe, with only Bulgaria, Germany, Finland and France using E10 petrol with a bioethanol content above 5%. Four Member States only use E0 petrol (Cyprus, Greece, Malta and Portugal). As for diesel, the market penetration of B7 diesel is higher. This fuel is used in all Member States except Estonia, which only uses B0 diesel (ICF et al., 2015). It should be noted, that E10 and B7 have certain flexibility in terms of the actual proportion of biofuel that is blended with petrol or diesel, as Annexes I and II set a maximum biofuel content rather than a fixed content. This is more notable with regards to B7 (available in all Member States except Estonia), where the proportion of FAME in B7 varied from 1.68% to 7% in 2014 (EEA, 2015).

When current levels of market penetration of E10 and B7 are assessed, there is still significant additional blending potential in the EU, equivalent to a 23% increase of the EU-wide use of B7 and an 85% increase in the use of E10. ICF et al. (2015) explored whether the 2020 targets can be met with this potential. According to the study, full penetration of B7 is not sufficient to meet the targets set up in the Member States' National Renewable Energy Action Plans, which describe how the renewable energy objectives will be met in each country. Member States will need to implement additional measures such as increased use Hydrotreated Vegetable Oils (HVO), increase the proportion of FAME in the diesel used in NRMM, or increase the use of 'advanced' biofuels, which are counted as double under the RED criteria.

The use of HVO is expected to be significantly relevant for meeting the targets set in the RED, as it is fully compatible in diesel cars and there are no limits on its use set in the FQD. According to Aatola et al. (2008), diesel which already contains FAME can be blended with small percentages of HVO to increase the use of biofuels without exceeding the limits set in Annex II of the FQD. Currently, the only HVO producer in Europe is Nesté, although other fuel producers such as Eni are planning to produce it soon. (European Biofuels Technology platform, 2014; ICF et al., 2015). HVO production will increase during this decade, but its potential is limited by cost and production capacities (Aatola et al., 2008; ICF et al., 2015). Also, it should be noted that only the HVO from used cooking oil and tall oil[103] have a low risk of indirect land use change (ILUC), which has been targeted by the Commission in Directive 2015/1513.[104]

As for petrol, the gap between what would be required in order to meet RED targets and what can be achieved by using the full E10 potential is estimated to be smaller. The targets in the RED could be achieved using higher petrol blends in activities not

[103] Tall oil is a by-product of the Kraft process of wood pulp manufacture
[104] OJ L 239, p. 1–29

covered by the FQD or by increasing the amount of advanced fuels used (which count double in terms of meeting the RED target). Furthermore, the RED includes a provision that gives a higher weight to the proportion of transport energy that is originated from renewable electricity used in road and rail (similar to the double counting of the percentage originating from advanced biofuels) which will limit the biofuel volumes needed (ICF et al., 2015).

Additionally, captive fleets have high potential to contribute to the global renewable transport target, as they represent around 25% of the total fuel used in Europe, according to ICF et al. (2015). These fleets have the potential to act as a vector for the introduction of higher biofuel blends, as higher quality monitoring standards for both vehicles and fuels are required. Moreover, new conversion routes are being researched. In this sense, it is more practicable for blends with a proportion of biofuel above 30% to be used in captive fleets than in privately owned vehicles to meet the 10% target set up in the RED (ICF et al., 2015).

This analysis shows that the limitations established in Annex I and II of the FQD do not compromise the ability of Member States to comply with the targets set in RED. In addition, the majority of Member States are still far from meeting the maximum limits on bioethanol and FAME in petrol and diesel respectively (France is an exception). In order to assess possible reasons for this, stakeholders have been asked if Article 3 hinders the introduction of alternative fuels.

Most industry and NGO stakeholders responded that biofuel content in fuels has historically been low, and that current requirements in Annexes I, II and III do not support high biofuel blends in becoming commercially viable and treated as general market fuels. Two respondents from the biofuel sector (ePure and Ethanol Europe) believe that excluding high biofuel blends (bioethanol content above 10%) from the scope of the Directive hinders the introduction of biofuel in the market. ePure has commented on this further, stating that there is so little flexibility with regards to the introduction of biofuels that no incentive is given for Member States to do so: new fuels and higher blends (with a biofuel content between 10% and 30%) are hindered by the scope of the Directive and the restrictions of article 3. ePure expressed their opinion that the objectives set up in the RED may not be met if these restrictions exist.

Among Member States, most (14 out of 18 responding) consider that the specification of Article 3 has not impeded the introduction of biofuels. This includes Sweden, which has interpreted that it is still possible to introduce non-binding specifications for alternative fuels at a national level. The UK does not consider that there are any contradictions between the FQD and the RED. The response indicated that the UK has not introduced E10 yet, because vehicle manufacturers have expressed concerns regarding compatibility and market acceptance of E10. The UK does not believe the introduction of higher blends are limited by the Directive, because they are significantly below the EU level 2020 targets.

France has stated that they do not consider that the RED and FQD have contradictory targets, although the targets themselves are not easy to achieve.

Only the Netherlands state that Article 3 has impeded the introduction of biofuels, since HE15 had to be removed from the market as a consequence. HE15 is an 85% petrol: 15% hydrous ethanol blend. Hydrous ethanol is produced similarly to the ethanol used in current petrol blends (dry ethanol), but is not dehydrated. Dry ethanol has traditionally been used because of concerns about the presence of water in the

ethanol-petrol blend. HE blends[105] (2016), the company that has patented the use of hydrous ethanol as a petrol blending component, states that over a decade of research indicates that these concerns are unjustified and HE15 does not lead to malfunctioning.

Spain indicated that current maximum biofuel requirements are not sufficient for Spain to meet the objectives of the RED, and that they will need to increase bioethanol and FAME content as much as the FQD allows in order to meet RED targets. National legislation approved in December 2015 includes specific objectives to increase the proportion of biofuels in transport fuel from 4.3% in 2016 to 8.5% in 2020 (energy content).

Other Member States have introduced fuels with a higher biofuel content in order to comply with the targets of the RED. Some Member States (the Czech Republic, France, and Latvia) have decided to allow the placing on the market of higher blends such as B31 or E85 in their legislation (out of the scope of the FQD). Previously both Lithuania and the Netherlands have permitted the placing on to the market of petrol with an ethanol content higher than 10% (RON98E15 in Lithuania, HE15 in the Netherlands as previously discussed), potentially driven by the targets in the RED, however in both cases these fuels were not compliant with the FQD and have been withdrawn from the market following intervention by the Commission.

ICF (2015) also modelled multiple scenarios to assess the impact of the introduction of a higher proportion of biofuel in petrol and diesel on refineries economics. Two of the four ICF scenarios (ICF, 2015) include higher bioethanol blends than those currently permitted and B10 is introduced as well (permitted under Article 4 but not currently available in any Member State). According to the findings, higher biofuel supply and demand in the EU will have adverse impacts on the EU and non-EU refining sectors in terms of decreased annual throughput. Moreover, the impacts on refineries of increases in biofuel energy share are greater than the impacts of expected general trends in road fuel demand. However, it also concluded that, although the impacts would be noticeable and that throughput and revenue are estimated to be reduced, the overall impact on refineries gross margin in the future (2020/2030) is relatively small compared to the base case scenario used in the studied models[106]. A primary impact of higher biofuel demand is to reduce diesel/gasoil imports into the EU such that the bulk of the refinery impacts are projected to be felt in regions outside the EU. In the scenario with B7 and E10, the closures in the EU compared to total closures is around 20% (0.4 million bbl/day globally of which 0.08 million bbl/day occur in the EU). However, this is obviously dependent on the assumptions, given that the base case scenario implied higher demand for petrol in the EU, then a greater proportion of the total refinery throughput reductions and implied closures due to higher biofuels would occur in the EU and not in non-EU Member States). As a result, it seems that the expected market trends will play a larger role on the financial performance of refineries than the increase of biofuel content in fuel blends.

Apart from the legislative issues highlighted out above, there are technical and non-technical barriers which may affect the introduction of higher blends in the EU (ICF, 2015). The technical barriers are:

105 http://www.heblends.com/index.php?option=com_content&task=view&id=21&Itemid=25

106 The base case scenario was based on EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013. It implies a further reduction in EU petrol demand and some increase in diesel demand, alongside a higher pressure in the market due to a more competitive environment and higher energy costs.

At refinery level:

- **Blendstocks for oxygenate blending**: Higher blends may require a different blendstock, given that the addition of biofuel changes fuel properties, whereas the final blend must comply with the fuel specifications in Annex I.

At service station level:

- **Practical problems in relation to fuel supply:** Large refuelling stations may offer both higher blends and lower blends, as they typically offer up to three or four petrol grades and two diesel grades. However smaller refuelling stations may only have the capability to offer one or two grades. These stations would have fuel availability issues in the transition period in which newer cars would be able to use E10 and above but older cars would still use E5. Smaller operators may decide to refurbish their service stations to offer more petrol and diesel grades, but this would increase costs. Also, it is relevant to note that existing stations with an annual throughput below 3,000 m^3 do not have to install stage II petrol vapour recovery systems (as per Directive 2009/126/EC) until there is a 'major refurbishment'. As a result, most of the operators of medium- and small-sized service stations would have to consider this additional investment when deciding whether to offer more fuel grades.
- **Material and equipment compatibility:** Regardless of a potential refurbishment in order to be able to offer more petrol grades, operators will have to ensure that the equipment and material used is fully compatible and safe. These materials may not be the same used in the other dispensers, as an increased proportion of bioethanol in petrol increases the need of preventing corrosion. This means that operators would potentially have to install new tanks and/or additional infrastructure.
- **Quality control:** FAME ages faster than conventional fuels, which could cause fuel quality issues.

According to ICF et al. (2015), the non-technical barriers to the introduction of higher blends are the following:

- **Information provision and consumer acceptance**
- **Differentiation of products:** Fuel suppliers often opt for offering premium fuels to differentiate their products and improve their market position. When a new blend is introduced, they have the choice of replacing their premium fuels with the blend but this reduces the opportunities for branding.
- **Price barrier:** Biofuels have a higher cost, and consumers would need an incentive to purchase higher blends instead of lower blends, as it will be the main driver for the change in current consumption patterns.

EN standards

CEN standards 228 and 590 contain the specifications in the FQD and other technical specifications. Each update is agreed by working groups of experts and not via a legislative process, but they do not confer immunity from legal obligations (BSI, 2012). Standards must include the specifications of the FQD (CARS 21, 2012). In fact, the preparation of these standards was originally mandated by the European Commission and the European Free Trade Association, and standards are intended to be complementary to the regulatory measures contained in the FQD and other Directives (BSI, 2012).

Member State authorities were also asked whether the specifications in Annex I are in line with any EN standard. 12 out of 20 state that they are not aware of any

discrepancies between specifications in Annex I (Germany, Italy, Spain, Poland, Malta, Latvia, the UK, Croatia, France, Denmark, Sweden and Finland). Conversely, the Czech Republic and Slovenia state that they are aware of discrepancies. Additional commentary on a specific discrepancy is provided by Slovenia, which states that standard EN 228 sets limits for vapour pressure for transition periods, which is not, according to them, permitted under the FQD. This appears to be a misunderstanding on behalf of Slovenia, since the FQD does not explicitly prohibit transition periods. The 60 kPa limit applies to the summer period, which is defined in the same way as the standard but transition periods are not defined and/or banned. The remainder of respondents do not have sufficient knowledge on the subject to respond and state they do not know.

VOC emissions and vapour pressure

Member States also highlight that the environmental effects of higher biofuel content should be considered (i.e. a higher bioethanol content leads to higher vapour pressure, which in turn increases VOC emissions).

As regards the coherence of the FQD and Directive 94/63/EC the objectives of both Directives are in line and complementary, as the FQD regulates the contents of certain VOC including benzene (1% v/v) and oxygenates (e.g. ethanol, methanol) in motor fuels, as well as other fuel quality parameters such as petrol vapour pressure (RVP), which is a key determinant in the extent of emissions from petrol storage and distribution. Both pieces of legislation aim to reduce harmful pollutants being released into the air.

Furthermore, the FQD allows the potential incoherence with Directive 2009/126/EC, as the FQD establishes derogations to allow bioethanol and low temperature waivers, which may hamper the overall effectiveness of Stage II controls. These derogations result in higher RVP of petrol, which may hamper the overall effectiveness of Stage II controls (and Stage I controls). The latest amendment of the FQD proposes new standards for transport fuels that will reduce their contribution to climate change and air pollution, including through greater use of biofuels. In particular, it facilitates the blending of ethanol in petrol through an increase in the maximum ethanol content to 10% and foresees the possibility for Member States to apply for an exemption from the maximum permitted petrol vapour pressure. The rationale behind this is that a new petrol blend that allows higher content of the biofuel ethanol reduces emissions of dangerous dust particles. However, increased use of ethanol is likely to lead to higher VOC permeation from vehicles (European Commission, 2008).

Furthermore, overall emissions of VOC associated with petrol refuelling operations depend on the vapour pressure of the fuel and the ambient temperature. Changes in ambient temperature and vapour pressure can have a significant impact on VOC emissions from vehicle petrol refuelling. Therefore, to compensate for an increase in emissions of polluting vapours that result from greater use of ethanol, the Commission introduced the VOC-II Directive to cover vapour recovery equipment at filling stations. In parallel, the amended FQD includes provisions to reduce petrol evaporative emissions and therefore VOC, by setting a maximum limit on the vapour pressure of petrol of 60 kPa. As the vapour pressure of the petrol is linked to the ambient temperature Member States with a low ambient temperature can have petrol during summer time with a higher vapour pressure of a maximum 70 kPa. Furthermore, petrol that has a higher RVP during months with colder temperatures allows the fuel to evaporate at low temperatures in order for the engine to operate properly, especially when the engine is cold. Having a lower RVP in summer prevents excessive evaporation when outside temperatures rise. Therefore, reducing the volatility of summer petrol decreases emissions. These Member States are Denmark, Estonia, Finland, Ireland, Latvia, Sweden and the UK. When ethanol is blended into petrol, the

vapour pressure can increase by up to 8kPa and under normal circumstances go well over the 60kPa limit stipulated by the FQD. Therefore, allowing the use of ethanol under the FQD could create some implementation challenges in relation to Directive 2009/126/EC as the higher RVP will result in increased VOC emissions. In consequence, due to an increased amount of VOC emissions, certain Member States may need to make greater efforts to fulfil the 85% recovery rate of petrol vapours from refuelling under Directive 2009/126/EC.

Nonetheless, in practice these instruments can be considered coherent as the FQD takes into account Stage II controls and includes provisions to ensure that, despite possible increases in VOC emissions as a result of higher vapour pressure fuel (with bioethanol), Member States are still able to (and required to) meet national and international air quality obligations. Therefore, based on the analysis carried out, no significant overlaps exist between Directive 2009/126/EC and the FQD in terms of fulfilling the objectives of both Directives.

Internal coherence

Specifications in Annexes I and II and in Articles 3 and 4 do not fully contribute to the delivery of a single market, as set out in E.Q. 1.3. With regard to the biofuel content of petrol and diesel, the maximum bioethanol and FAME limits permitted in Annexes I and II allow Member States to introduce multiple petrol and diesel blends that are all compliant with the FQD. Moreover, Article 4 states that Member States can allow the placing on the market of diesel with a FAME content above the 7% maximum limit established in Annex II (see E.Q. 1.6 and 1.8). UPEI (2014) highlighted that this has led to different Member States applying the Directive differently, thus not being coherent with the objective of the single market as set out in the FQD. In this sense, refineries also state (as noted by CONCAWE, Fuels Europe and as stated in ICF et al., 2015) that the availability of various types of blends is not coherent with this objective. Biofuel manufacturers also agree that this is the case but consider that harmonisation should be established at 10%, not at 5%.

Other specifications of Annexes I and II also potentially inhibit the delivery of a strong single market, as they set minimum and maximum limits on certain parameters (as described in E.Q. 1.6 and E.Q. 1.8). The clearest case is RON, for which there is a minimum of 95 in Annex I but a footnote states that RON 91 may be permitted. Despite some Member States selling RON91 petrol and/ or RON98, more than 70% of the petrol sold in the EU is RON95 (Ricardo AEA(2012, 2013, 2014a, 2014b; and EEA, 2015). Stakeholders and Member States have not indicated that RON was causing issues at EU level.

Air quality policies

ICF et al. (2015) indicates that uptake of higher biofuel blends does not lead to increased air pollution from refineries and will have little negative impact on air emissions overall. This is because the scenarios assessed by this source assume a reduction of fuel demand and therefore a reduction of the annual throughput at refineries, which will reduce emissions.

A source of potential conflict are the petrol vapour derogations as set out in Article 3(4), given that a higher summer vapour pressure could compromise the ability of Member States to comply with other air quality legislation. However, Article 3(5) establishes a mechanism in which Member States need to submit a request to the Commission in which they have to demonstrate that the derogation will not lead to non-compliance with European air quality legislation.

EQ 3.6 provides an assessment of coherence between Annexes I and vehicle standards. EQ 3.9 provides an assessment of coherence between Annex II and vehicle and NRMM standards.

Based on available information, the main conclusions for this EQ are:

- **The FQD and the RED are not fully consistent in their objectives, however the FQD does not hinder the achievement of the targets established in the RED.** This relates to the upper limits on biofuel content set in the FQD. Application of the upper biofuel limits in the FQD alone is unlikely to be sufficient to meet the targets of the RED, however the FQD does not impede the achievement of the RED objectives (in order to meet the RED objectives, use of additional measures such as HVO, electrification, use of FAME in NRMM and others would be required). It is the view of the biofuel industry that the upper limits for biofuels established in the FQD slow down the progress towards the RED targets, however research indicates that there a number of other factors (political, technical and non-technical factors) inhibiting progress in this regards (as described above).
- It is noted that petrol and diesel currently sold in most Member States are far from reaching the upper biofuel limits established in the FQD with only a few examples (Bulgaria, Finland, France, Germany) where petrol with a bioethanol content above 5% is available. Although B7 diesel is widely introduced, the FAME content is variable and many Member States are still below the maximum limit of 7%. As a result, the Directive does not prevent Member States from meeting the targets established in the RED.
- **The FQD and Directive 94/63/EC are coherent.** They have complementary objectives and the FQD regulates the content of certain VOC and other fuel quality parameters such as vapour pressure, which are key determinants in the extent of emissions from petrol storage and distribution.
- **There are potential inconsistencies with the FQD and Directive 2009/126/EC, but in practice they are considered coherent.** The rationale is that the process for allowing higher volatility petrol under the FQD takes into account the application of Stage II controls, and includes provisions for ensuring that VOC emission increases do not detract from meeting national and international emissions and air quality obligations.
- **Article 3 and Article 4 and their respective Annexes I and II are not fully coherent.** This is mainly related to the biofuel content. Whereas the scope and objectives of the FQD include the promotion of the single market, Articles 3 and 4 potentially allow the placing of fuel with various proportions of biofuel in the market. Regarding the permitted level of FAME in diesel, Article 4 and Annex II are not fully coherent, since Annex II states that diesel with a maximum FAME content of 7% may be placed on the market, whereas Article 4 states that diesel fuel with a FAME content in excess of 7% may be placed on the market. This has raised concern among refiners and vehicle manufacturers, who have formally complained about the B8 diesel introduced in France. However in practice, it is only in France where B8 diesel has been placed on the market to date.
- The specifications of Article 4 and Annex II also introduce a difference in the treatment of diesel and petrol, since there is no such flexibility regarding the bioethanol content permitted in petrol. This has led to apparent misinterpretations of the scope of the FQD and Article 3 from the Netherlands and Lithuania, which permitted HE15 and RON98E15 respectively in their national markets. This led to infringement procedures by the Commission, and the Netherlands and Lithuania have been obliged to remove these from the market.

- There are also other specifications that have this characteristic, such as the minimum RON limit in petrol (95). A footnote in Annex I allows the placing on the market of RON91 petrol and RON98 is commonly sold in various Member States. However, more than 70% of the petrol sold in the EU is RON95 and the data available from the literature review and consultation does not indicate that the availability of different RON grades has been problematic.

EQ 3.6 Are there interactions between Annex I requirements and vehicle standards? (Article 3)

Concerns of the EU refining industry in relation to changes in fuel quality are generally related to the higher production costs associated with the production of higher quality fuels (European Commission, 2007). This is in contrast to the position of engine manufacturers who are concerned with ensuring that their products are used with fuels that facilitate effective functioning of their products from both a general performance and environmental performance perspective. This was reflected in the FQD impact assessment (European Commission, 2007), in that vehicle manufacturers would for example be reluctant to deploy technologies that need 10ppm sulphur diesel, or that may be damaged by higher sulphur levels, if it was not certain that this fuel would be widely available. Therefore vehicle emission standards (EURO for on-road and NRMM Stage limits) have been developed alongside with fuel quality specifications, with the intention of optimising the costs and benefits across the fuel production-consumption cycle.

In the case of sulphur, its effects on engine performance have been widely reported (MECA, 2013). Sulphur in petrol inhibits the emission control performance of catalyst technology, which compromises the ability of this equipment to achieve mandated emission levels. Advanced combustion engines are equipped with PM traps and NO_X abatement (selective catalytic reduction). If the fuel sulphur content is high the sulphuric compounds in the emissions corrode or contaminate the after treatment technologies which would consequently need to be replaced significantly more often, at cost. As a result, the reduction of sulphur is key in the deployment of the latest vehicle standards, as also stated in the Worldwide Fuel Charter 2013 and the Diesel Emission Control-Sulphur Effects (DECSE) project, a collaborative program conducted by the US Department of Energy (DOE), Engine Manufacturers Association (EMA) and Manufacturers of Emission Controls Association (MECA) (ACEA, 2013b).

The EU refining industry has also expressed concerns on the increased use of biofuels in petrol and diesel blends and how this can impact production costs and their revenue. According to ICF et al. (2015), refineries will not be impacted more significantly due to the introduction of higher biofuel blends than they would have been in the baseline studied in their research[106]. This means that market conditions and petrol sales trends are likely to have a higher influence on refineries gross margins than changes in the proportion of biofuel that is blended with petrol and diesel (see E.Q. 3.5).

Stakeholders were asked a number of questions in relation to this.

Industry stakeholders were asked whether the latest amendment to the Directive, which confirmed the mandatory introduction of sulphur free fuel, influenced engine functioning. 19 (48%) state they do believe this influences engine function (these include ACEA, the automobile manufacturers association, together with EFOA, Afton Chemical, Fuels Europe, a biofuel industry stakeholder, the NGO Transport & Environment, and 11 fossil fuel manufacturers). 4 stakeholders, all fossil fuel manufacturers, state they believed it did not affect engine functioning (Lukoil, UPEI, the Hungarian Petroleum Association, Nesté). It is worth noting that both the Slovak

and German petrol associations and Heide Refinery comment that this question should be answered by engine and vehicle manufacturers.

Industry stakeholders were also asked whether the amendment reducing aromatics content to 35% impacted on engine functioning. Many of them (14) think it does, including 11 fossil fuel manufacturers, the Swedish Petroleum and biofuels association, ACEA and EFOA. The seven who think the change in aromatics does not influence engine functioning were 6 fossil fuel manufacturers and Nesté. The 14 who state they do not know were comprised primarily biofuel industry stakeholders, but also the Hungarian and Portuguese national petroleum industry associations, INEOS and the Forecourt Equipment Federation. A common position paper from AECC, CLEPA, EUROMOT and OICA indicates that aromatics have a negative effect on engines (AECC et al 2014). Moreover, ACEA would be in favour of reducing aromatics concentration levels further.

There are conflicting views regarding the impact of aromatics content on engines among stakeholders. Most of the stakeholders who believe that it has an effect on engine performance state that the effect is negligible and cite a CONCAWE report (2004)[107]. However, two industrial stakeholders (EFOA, the European Fuel Oxygenates Association and ACEA) stated that aromatics have negative impacts on engines. ACEA cites the Worldwide Fuel Charter but does not justify their statement further. EFOA cites the Worldwide Fuel Charter as well as the US AQIRP as sources of studies that demonstrate aromatics such as PAH and benzene, are linked to the formation of deposits in the engine. It is also stated that South Korea and California have already reduced the aromatics content to 24% v/v and 22% v/v respectively.

Responses from the stakeholder engagement exercise do not provide detailed commentary supporting the above responses. However, position papers have been published by industry associations including EUROMOT and ACEA, which state that engine and fuel quality standards should be aligned, to avoid hindering compliance with other legislation, and potentially damaging engines. According to EUROMOT, the fact that stage IIIB standards were introduced and entered into force before the FQD limit on the sulphur content of fuel for NRMM gas-oil entered into force was not fully in line, as there was the possibility of vehicles being unable to comply with the required standards and engines potentially risking being damaged. However, no evidence of this occurring was provided.

EQ 3.7 Is the derogation for the Outermost regions coherent with the approach taken by other Directives? (Article 3)

This EQ also addresses EQ.10 "Is the derogation for the Outermost regions coherent with the approach taken by other Directives? (Article 4)

The European Commission has a strategy for the Outermost regions which grants them specific provisions and derogations, which are designed to address the challenges caused by their remoteness, insularity, small size, difficult topography and climate, and economic characteristics. These regions benefit from Cohesion Policy funding which includes infrastructure projects (ports, roads, terminals, power stations), environmental and health R&D, education, or employment initiatives.

The limited information available on the derogations in Articles 3 and 4 indicates that the derogations set up for the Outermost regions comply with the aims described in the EU strategy for these regions, are compatible with and benefit from other funding

[107] Fuel effects on emissions from modern gasoline vehicles, part 2- aromatics, olefins and volatility effects. CONCAWE special task force, 2004.

as described in E.Q. 2.8 (European Regional Development Fund (ERDF) related to the compensation for the higher cost of trade and logistics). The derogations of the FQD are also in line with those in similar Directives. For example, Directive 2005/33/EC amending Directive 1999/13/EC which limits sulphur content in marine fuels, in which Outermost regions are exempt from complying with the limits provided that "air quality standards are respected", and "heavy fuel oils are not used if their sulphur content exceeds 3 % by mass".

Therefore it is concluded that the derogation for the Outermost Regions is coherent with the approach taken by other Directives in regards to the Outermost Regions.

EQ 3.8 Are the specifications in Annex II coherent with the rest of the Directive and with other legislation or standards in the EU and beyond? (Article 4)

Addressed under E.Q. 3.5.

EQ 3.9 Are there interactions between Annex II requirements and vehicle standards? *(Article 4)*

Industry stakeholders were asked to give their views on whether engines will be affected by the latest amendments of the Directive (limit to below 10 ppm sulphur in diesel and 10 ppm sulphur in gas oil). There was not a consensus agreement from industry stakeholders in this regard, with 17 believing there is an effect, and 14 believing there is not.

Those stating that there is an impact include ACEA, and a number of fossil fuel manufacturers and biofuel industry stakeholders. Euromot and Scania Engines, the other two engine or vehicle manufacturers which responded to the questionnaire, did not reply to this question.

ACEA state that low sulphur (10ppm max) is needed to limit effect on engine performance (e.g. oil degradation) and limit engine-out sulphate emissions that poison after treatment systems and therefore reduce pollutant conversion efficiency. They refer to the Worldwide Fuel Charter document, which addresses effect of sulphur in petrol (ACEA 2013). Afton Chemical mentions the after-treatment systems as well.

The Swedish Petroleum and Biofuels association state that in most parts of the EU there would be an impact, however since Sweden has had sulphur free diesel fuel for both on and off road vehicles prior to the introduction of the FQD requirement, it did not make any difference in Sweden. UPEI state that there is no substantial difference in engine functioning with a sulphur content of 50 or 10 ppm, but do not provide any supporting evidence for this statement. However, ACEA (2013b), MECA (2013) and the Commission's Impact Assessment of the current amendment of the FQD (European Commission, 2007) contradict this view, stating that sulphur damages engine performance related to after-treatment equipment and control of the emissions of other pollutants such as NO_X and PM. Nesté states that reducing sulphur below 1,000 ppm helps engine oil operation, due to less acidic combustion products going in the oil.

The general statement from those which believe there is an effect, is that sulphur provides a lubricant effect to diesel, and when sulphur-free fuel is used this lubrication is achieved by the use of other chemicals and additives which may have environmental effects. Also, the reductions of sulphur limits for gas oil (1000 ppm to 10 ppm) seem to have an impact on after treatment systems (the stakeholder highlights that this is especially relevant for NRMM), in line with ACEA (2013b) and MECA (2013).

Stakeholders stating that there is no impact are primarily fossil fuel manufacturers, and a co-ordinated response has been received from Fuels Europe and eight national petroleum associations, all of whom have stated that grades containing more than 7% v/v FAME require specific information so long as such grades are not declared compatible with all diesel vehicles, that there is no effect of the indicated sulphur level on engine function, and that there is however an impact on the functioning of the de-NO_X – catalyst system. No supporting reference material has been provided with these statements. ACEA would also be in this line, indicating that higher FAME blends should be properly labelled and that they lead to the fragmentation of the European fuel market.

There have also been issues reported of diesel blends containing FAME blends in cold weather leading to filter clogging issues. It is thought that in cold temperatures FAME solidifies into a waxy substances which can block engine fuel filters. This may also lead to safety issues as ACEA is aware of cases in which an extra demand on an engine (e.g. to overtake) led to filter blockage and malfunctioning of the engine. According to ACEA, the issue has been traced back to the use of cooking oil or animal fat for the production of FAME.

Both Sweden and the UK indicated the issue of FAME in lower temperatures leading to filter blocking as an issue. During follow-up interviews with Member State authorities this issue was discussed further. The UK stated that these problems occur in very cold temperatures (1-2ºC) and that research is currently being carried out to identify the exact element that causes this. On the other hand, France indicated that there are no technical issues related to filter clogging in winter because France has set out requirements for the cold filter plugging point (CFPP) limit and limits on monoglicerides and saturated esters in its national legislation. French authorities believe that the CFPP limits set in France are more severe than in other countries such as the UK: 0°C in summer, -5°C in winter, and this may be the reason why this problem does not occur in France. France also pointed out that the levels of monoglicerides and saturated esters set are linked to the level of use of waste fats and oils, and that only low levels of waste fats and oils are incorporated into fuel manufacture in France.

During follow-up interview with Euromot, they stated in particular with focus on fuels used in NRMM that it would be advantageous for NRMM fuel to have the same specifications and requirements as petrol for on-road vehicles. The fact that at present NRMM fuel can be of varying specification (compared to on road petrol fuel) impacts negatively on engine manufacture, reducing the ability to optimise engine performance and efficiency to some degree. Importantly, in-service emissions from the engines may be higher than the engine manufacturer intended if the engine is provided with lower quality fuel.

Regarding the 8% limit for PAHs, the opinions of industrial stakeholders are similarly divided. Approximately a third of the respondents state that this amendment has an effect on engine performance, whereas 31% stated that this is not the case. Those who state that there are no effects mention that whereas engine functioning may not be affected, the 8% PAH limit can lead to higher NO_X emissions.

On the other hand, those that argued that it has an influence include ACEA, a few fossil fuel manufacturers, biofuel industry stakeholders and one anonymous respondent.

ACEA states that diesel fuel aromatics content influences flame temperature, and therefore, NO_X emissions during combustion, and that PAH in the fuel affects the formation of particulates and PAH emissions from a diesel engine. They again refer to the World Wide Fuel Charter (ACEA, 2013). The Swedish Petroleum and Biofuels

institute states that older vehicles are more sensitive to fuel quality while newer vehicles are not. They do not believe the 8% PAH limit affects engine function, but it could influence emissions.

Of the 14 industry stakeholders that believe the PAH limit does not impact engine function, seven are Fuels Europe member and have provided a common response with Fuels Europe. They all state that no effect is observed on engine function, and that the widespread use of diesel particulate filters means that PAH levels are less relevant than before (however no further supporting reference material is provided).

In summary, there are divergent opinions from different industry sectors regarding the impact of the provisions of Annex II on engines. Engine manufacturers state that there has been a positive impact given the effects that PAH and aromatics have on engine performance, whereas most fuel manufacturers state that the effect on performance is negligible, while expressing their concerns on possible diesel blends with a proportion of FAME higher than 7%.

However, it is certain that the limits on sulphur content imposed under the FQD have had a positive on engine performance and are coherent with after treatment technology deployed in order to comply with the latest vehicle standards.

EQ 3.10 Is the derogation for the Outermost regions coherent with the approach taken by other Directives? *(Article 4)*

See E.Q.3.7.

EQ 3.11 Is the free circulation of fuel compliant with the requirements of the FQD coherent with other EU legislation? (Article 5)

Under EQ 1.9 it has already been discussed that the national implementations of the various Member States of the fuel specifications of the FQD, Article 7a of the FQD and the 10% transport target of the RED form barriers for the free circulation of compliant fuels. The provision as laid down in Article 5 itself, however, does not contradict other legislation. Therefore, amendments to seek to better achieve the single market should be focused on the provisions in other Articles that allow the large differences in national implementation between Member States rather than an amendment of Article 5. Allowing less differences within the implementation of the RED and FQD should, however, be a point for discussion, because it would limit the freedom of Member States to take into account national circumstances and local conditions.

7 out of 17 Member States have replied positively to this question, while 10 replied 'do not know'. The Member States that think Article 5 is coherent with other legislation are the Czech Republic, Croatia, France, Germany, Latvia, the Netherlands, the United Kingdom, while Austria, Denmark, Estonia, Finland, Luxemburg, Malta, Slovak Republic, Slovenia, Sweden and Romania disagreed.

Among stakeholders 23 out of 32 respondents responded 'yes' to the question 'Is the free circulation of fuel compliant with the requirements of the FQD coherent with other legislation?' 8 respondents answered 'no' and the remaining respondent answered 'do not know'.

The respondents replying positively are: ePURE, ACEA, Unione Petrolifera, Asociación Española de Operadores de Productos Petrolíferos (AOP), Polish Organisation of Oil Industry and Trade, VNPI, Ethanol Europe, UFIP, Hungarian Petroleum Association, Danish Oil Industry Association, FuelsEurope, Nesté, The Swedish Petroleum & Biofuels Institute, LUKOIL Neftohim Burgas, Bulgarian Petroleum and gas association, UPEI, TOTAL S.A, Austria Petroleum Industry Association (APIA), APETRO- Associação Portuguesa de Empresas Petrolíferas, Forecourt Equipment Federation, Anonymous, ,Association of the German Biofuel Industry (VDB) and APPA Biocarburantes..

The respondents stating 'no' are: Agroinvest SA, Anonymous, Bio-Oils Energy SA, EBB European Biodiesel Board, Ineos, Centre Ouest Céréales, Verbio Vereinigte Bioenergy AG and the Slovak biofuels association. The respondent stating they 'do not know' is Afton Chemical limited (fuel additives manufacturer).

In the detailed commentary both the respondents stating 'yes' and 'no' have provided similar feedback. Mainly fossil fuel companies point at the differences in sustainability requirements between Member States as result of the flexibility allowed under the RED/FQD. National fuel associations (together with FuelsEurope) all include the following statement: 'However, the way in which flexibility was allowed to implement the RED, has led to contradictions with Article 5 (e.g. national mandates requiring the same biofuel content per litre of fuel).' In the additional interview FuelsEurope has raised the following issues in relation to the incoherence:

- a volume objective under the RED, while FQD has set intensity targets.
- differences in methodologies, like the double counting under the RED, while the FQD does not allow double counting.
- the cap on food based biofuels as introduced by the ILUC Directive, which use is not compulsory under the FQD.

As result of these incoherencies national legislation differs: some countries apply both the FQD and RED, some countries, like Germany, changed from an RED target to a FQD target, and finally, some countries have different fuel grades.

ACEA refers to the availability of B7 and E10. According to ACEA the car industry emissions laws at the EU level require CO_2 vehicle testing on B7 diesel and E10 petrol, while these blends are not fully available across the EU28. So in fact, the vehicle emission limits and CO_2 laws require these fuels, while these fuels are not on the market in various Member States. This might result in differences between the CO_2 emissions as outcome of vehicle testing and real-world CO_2 emissions.

The biofuel industry companies express their concerns in relation to the consistency of the 10% biofuels target of the RED and the maximum blends allowed. However, this seems to be more related to Article 3 and 4 rather than Article 5.

Some other stakeholders (EFOA and Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec) refer to the multiplication factors in the RED and the 6% target of the FQD. However, Article 7a is not within the scope of this evaluation and therefore also not within the scope of this question.

Overall, it can be concluded that the provision itself is coherent with other legislation, while the freedom under other Articles of the FQD (especially Article 3 and 4), Article 7a and the 10% target of the RED does not seem to be coherent with Article 5.

EQ 3.12 Is the provision of the Article coherent with the rest of the Directive? *(Article 7)*

Article 7 (in relation to change in the supply of crude oils) has not been applied by any Member States to date.

To evaluate the coherence of the Article with the Directive overall, the aims of the Article and the Directive are compared. The aim of Article 7 is to ensure that if due to circumstance beyond their control, Member States are temporarily unable to enforce the requirements of Articles 3 and 4 due to disruption in the fuel supply, they can apply to the Commission for permission to temporarily exceed one or more of the parameters regulated by the FQD (and consequently the Commission is not obliged to start infringement procedures against a Member State for a situation outside of their

control). In this regards, Article 7 is coherent with the rest of the Directive and its overall aim.

The existence of an article or clause to highlight the role of disruption outside of a Member States' control and consequent temporary suspension of environmental requirements is also included in other environmental directives such as the Industrial Emissions Directive[108] and the Air Quality Directive[109] (Directive 08/50/EC).

The Industrial Emissions Directive contains such a safeguard in Article 30, where it is specified that the competent authority may grant a derogation for a maximum of 6 months from the obligation to comply with the emission limit values for sulphur dioxide in respect of a combustion plant which to this end normally uses low-sulphur fuel, in cases where the operator is unable to comply with those limit values because of an interruption in the supply of low-sulphur fuel resulting from a serious shortage.

The Air Quality Directive contains Article 20 *Contributions from natural sources*, which sets out that Member States shall communicate to the Commission a list of zones where exceedances of limit values for a given pollutant are attributable to natural sources, and when the Commission has been informed of an exceedance attributable to natural sources this *exceedance shall not be considered an exceedance* for the purposes of the Directive.

Therefore Article 7 is coherent with the aims of the FQD overall, and coherent with the approach taken by other Directives.

EQ 3.13 Are the monitoring and reporting obligations aligned with other related monitoring and reporting obligations? (Article 8)

Based on the outputs of the consultation exercise, neither Member States nor stakeholders have identified inconsistencies or contradictions between the monitoring and reporting obligations of the FQD and those of other Directives.

Member States were asked in the questionnaire whether the monitoring and reporting requirements under Article 8 of the FQD contradicted other reporting requirements they are required to comply with. A majority response from Member States indicated that there is no lack of coherence identified (15 out of 17 stated there is no incoherence, the remaining two stated they do not know (Estonia and Latvia)).

Stakeholders were also asked whether the monitoring and reporting requirements of Article 8 contradicted other reporting obligations with which they had to comply. The majority of responses again stated that there was no lack of coherence, although with a lower level of awareness among some stakeholders: 25 stakeholders stated there is no lack of coherence between the requirements of Article 8 and other reporting requirements[110] , 14 stakeholders replied that they did not know[111], and 11 stakeholders did not respond to the question[112].

[108]OJ, L 334, 17.12.2010, p.334, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0075&from=EN

[109]OJ, L 152, 11.6.2008, page 1, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=EN

[110] The 25 included 16 fossil fuel manufacturers, 6 biofuel industry stakeholders (Verbio Vereinigte Bioenergie, European Biodiesel Board, Agroinvest SA, Bio-Oils Energy SA, Centre Ouest Cereals and an anonymous biofuel stakeholders), the Forecourt Equipment Federation and two fossil and biofuel manufacturers (Nesté and the Swedish Petroleum & Biofuels Institute)

UPEI provided additional commentary, stating that in order to avoid additional monitoring and reporting costs, it will be necessary to harmonise the requirements of the FQD (Article 7a, 8) with the RED and the Indirect Land Use Change (ILUC) Directive.

In addition, the monitoring and reporting requirements of other Directives have been identified, in order to compare them with the requirements of the FQD. This review has identified a range of differing requirements in terms of report periodicity and whether templates are provided at the EU level, however no direct contradictions to the reporting requirements under Article 8 of the FQD have been identified. Examples of reporting requirements under other Directives are as follows:

- Directive 1999/32/EC on sulphur content of liquid fuels requires Member States to report to the Commission, annually by 30th June, on the basis of the results of sampling and analysis carried out (as set out in Article 6 of the Directive). The reporting requirements under this Directive are not dissimilar to those of the FQD with regards to timelines.
- Directive 2009/28/EC, the Renewable Energy Directive, set outs reporting requirements for Member States in Article 22. Member States are required to submit progress reports by the 31st of December, every two years starting in 2011. Member States can require energy suppliers to provide evidence or guarantees of origin for the renewable portion of the energy they have supplied. This is in-line with the reporting requirements under Article 7a of the FQD, which require suppliers to report annually to the Member State on the GHG intensity of fuel and energy supplied within each Member State.
- Directive 1994/63/EC on the control of volatile organic compounds (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations (aka VOC-I Directive) and Directive 2009/126/EC on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations (aka VOC-II Directive) – do not have requirements upon Member States to report annually.

To summarise, Member States consider that the reporting requirements of the FQD are coherent with other reporting requirements under EU legislation. Stakeholders likewise consider there is no lack of coherence. This is supported by the brief review of reporting requirements under other Directives in the policy area environmental policy arena. In conclusion, Article 8 is assessed to be coherent with the approach taken by other EU legislation.

EQ 3.14 Do the requirements related to the review process contradict other legislation? *(Article 9)*

Most of the Member States authorities (9 out of 16; Croatia, the Czech Republic, Denmark, France, Germany, Malta, Latvia, United Kingdom, the Netherlands) state that the review process described in this Article does not contradict other legislation. The rest do not know (Austria, Estonia, Luxemburg, Romania, Slovakia, Slovenia, and Sweden). No further comments have been provided.

Stakeholders were not requested to respond.

[111] This included 6 fossil fuel manufacturers, 5 biofuel industry members, two fuel additive manufacturers (Afton and EFOA) and an engine manufacturer (ACEA).
[112] Statoil Fuel & Retail Lietuva, Alliance for Synthetic Fuels in Europe, Inland Navigation Europe, ePURE, EUROMOT, Scania engines, Greenergy Fuels Ltd, Transport & Environment, EEB, BirdLife Europe and Oxfam international

There no other signs that this review process contracts other legislation. Overall it is therefore considered that the requirements of article 9 are coherent with other legislation.

EQ 3.15 Do the penalties established by the Article contradict or contribute to the objectives set by other legislation? *(Article 9a)*

10 Member States responded 'no' to the question whether the penalties established by Article 9a contradict the objectives. These Member States are: Austria, Denmark, the Czech Republic, Croatia, Denmark, France, Latvia, Malta, the Netherlands, Romania and the United Kingdom. 5 Member States replied 'do not know', including Finland, Luxemburg, Slovakia, Slovenia and Sweden. No additional information was provided in comments.

To the question whether the penalties contribute to other legislation 3 Member States answered 'yes' (the Czech Republic, Croatia and Romania). The Czech Republic refers to the amendments of national legislation as being other legislation that benefits from Article 9a. Two Member States replied in the negative (Latvia and Malta), and eight stated they do not know (Denmark, Finland, France, Luxemburg, the Netherlands, Slovakia, Slovenia, Sweden and United Kingdom), without giving any further comments.

Industrial stakeholders were not requested to respond.

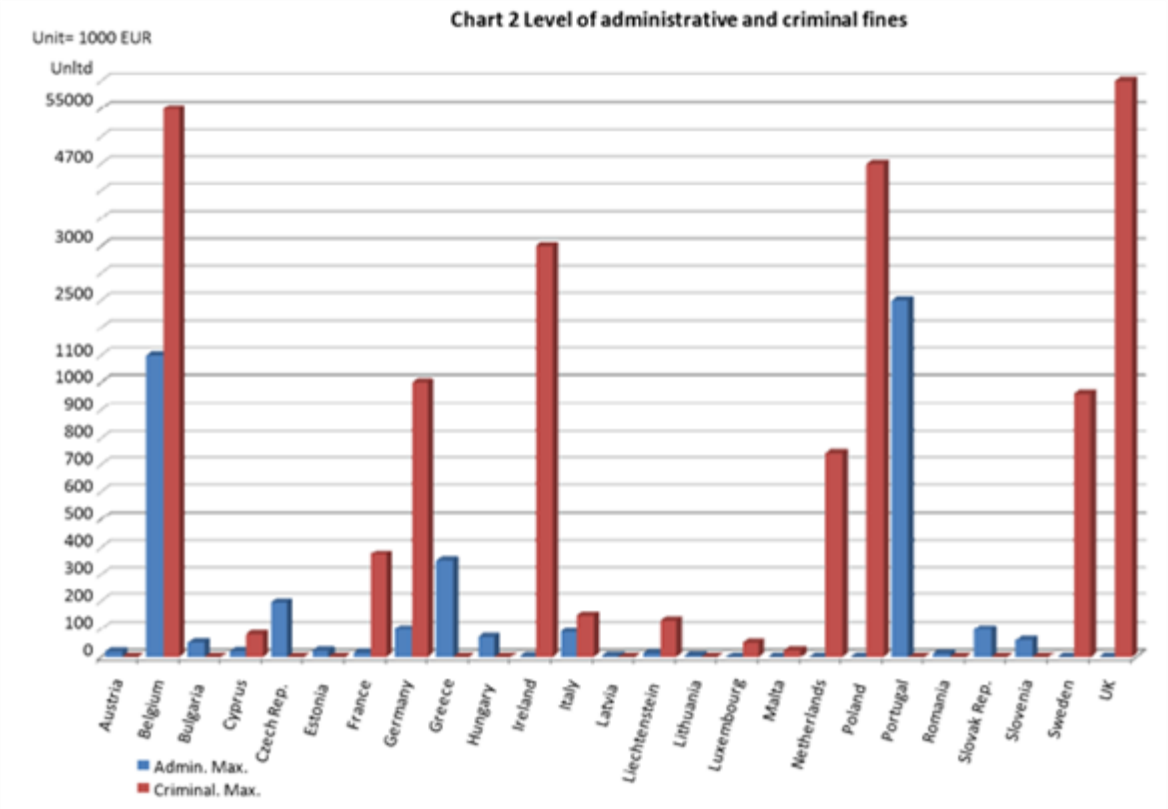
Besides for the FQD, Member States are also responsible for the enforcement of other policy provisions, like of the REACH provisions (Art 126). Like with the FQD, each Member State must also determine the penalties to apply and must also be 'effective, proportionate and dissuasive'. In a report prepared or the European Commission a contractor has investigated the level of penalties under REACH (the framework for the control of chemicals).[113] As with the FQD, this report also found differences between Member States in the level of penalties. In the next Figure the level of fines is depicted under REACH. The fines depicted in the graph seem to be higher compared to the FQD: however, penalties are hard to compare, because incompliance might be different in terms of size, risk (on the environment and health) and severance. This is also valid for the penalty payments car manufacturers have to pay in case the average CO_2 emissions of a manufacturer's fleet exceed its limit value in any year from 2012. The excess emissions premium should be paid for each car registered and amounts to:

- €5 for the first g/km of exceedance
- €15 for the second g/km
- €25 for the third g/km
- €95 for each subsequent g/km

From 2019 onwards the cost will amount €95 from the first gram of exceedance onwards.[114]

Figure 22: Level of administrative and criminal fines in EU Member States

[113] http://ec.europa.eu/environment/chemicals/reach/pdf/report_reach_penalties.pdf
[114] http://ec.europa.eu/clima/policies/transport/vehicles/cars/index_en.htm



Overall, it can be concluded that the penalties established by Article 9a do not contradict or contribute to the objectives set by other legislation, other than the contribution to the national implementations of the FQD.

4.5 Relevance

Overall evaluation of relevance

Overall the directive is considered to be relevant, although some Articles are considered by stakeholders to be less relevant than others, as can be seen in the evaluation of individual Articles below.

Further details of the analysis and evidence for this overall evaluation is presented in the subsequent evaluation questions (EQs).

- **Article 1 and 2:** no new issues, additional to those highlighted under 'effectiveness' and 'efficiency' have been identified. A considerable group of stakeholders repeat its position that the FQD lacks relevance in that is has not supported sustainable alternative fuels.
- **Articles 3** and **4** are considered to still be relevant, and the limitations on the petrol and diesel fuel placed in the market are considered to still be necessary in order to ensure health and environmental protection, and to facilitate correct functioning of vehicle engines. There is not enough evidence to draw a conclusion on whether the specifications in Annex I are adapted to the latest technical and scientific progress.

  In addition the derogations in relation to **Articles 3 and 4** are also considered to still be relevant at present, and their removal would be detrimental the implementation of the Directive. The removal of the derogations for the Outermost Regions would impose significant additional costs on Mayotte. As for the vapour pressure derogations, they are still necessary to provide an adaptation period to the FQD until 2020 and avoid an insurmountable socioeconomic burden for those Member States with a low summer ambient temperature and those for which increasing the bioethanol content of petrol compromises their ability to comply with Annex I. The vapour pressure derogations are conditional on compliance with other air quality legislation.
- **Article 6** has not been used to date. In follow-up interviews stakeholders considered the article to be relevant and believe it should be maintained. However these same stakeholders identified barriers to bringing on to the market fuels which meet other specific requirements for a certain time period and in a certain location. For these reasons, the relevance of Article 6 is under question.
- **Article 7** has not been applied to date, however it is considered by Member States that it continues to be relevant and should be maintained as a safeguard in case it is required in future.
- **Article 8a** is considered to still relevant, although Member States consider that MMT would not be used in the absence of the Article, it acts as a safeguard.
- **Article 9** is considered relevant, however there is a low level of awareness among Member States, because the review report has not been published yet.
- **Article 9a** is considered relevant, but there are doubts regarding to what extent it is necessary to have an Article at the EU level. Member States believe that penalties can also be dealt with at a national level.

EQ 4.1 Is the FQD still relevant? (General)

The FQD is still relevant overall for the protection of environmental and health impacts. Although some Member States had legislation which already banned or limited the presence of e.g. lead, sulphur in fuel, this was not the case for all Member States, and the current reductions in emissions from transport could not be

guaranteed in the absence of the Directive. However, some suggestions have been put forward by stakeholders regarding the scope of the fuels included, suggesting that the Directive would benefit from broadening its scope.

Individual Article evaluation

EQ 4.2 Does the scope bring unwanted restrictions? If so, what should be changed? (Article 1)

The consultation highlights a difference of opinion between Member State authorities and fossil fuel and biofuel stakeholders.

While the majority of Member State authorities (9 out of 16) state that the Directive has not brought unwanted restrictions, most industry stakeholders believe it has (33 out of 40).

In general, the reasons for stating that the Directive brings unwanted restrictions is in relation to high biofuel blends and alternative fuels, which are out of the scope of the FQD. The environmental NGOs however emphasise that "the FQD has not supported sustainable alternative fuels that deliver genuine climate benefits. Matter is not only the quantity but the quality of biofuels. With mainly food-based biofuels on the market and no accounting of ILUC (Indirect Land Use Change) emissions, higher blending levels should be out of question. The FQD does not sufficiently support the introduction of renewable electricity and renewable hydrogen in transport." Poland highlights that support of alternative fuels is not the aim of the FQD Articles under review, but of the RED and Clean Power for Transport Directive.

In paragraph 4.2 under "Effectiveness" it was already assessed that "there's no evidence that the introduction of biofuels and alternative fuels to the extent of current EU and Member States (2020) ambitions is hampered by the scope of the FQD, but this might become an issue if targets are increased for the post-2020 period."

EQ 4.3 Are the definitions still adequate? (Article 2)

This question is another example of the different views occurring between Member State authorities and industrial stakeholders. Most Member States (12 out of 14) believe that the definitions are still adequate. Under this question the Netherlands and Slovakia repeat the point made under paragraph 4.4 EQ3.2.

Conversely, over half of industrial stakeholders (18 of 35, primarily fossil fuel manufacturers and biofuel industry, together with ACEA and EFOA) believe that definitions are no longer adequate. From stakeholders side this question brings no new information as all respondents refer to the answers on questions covered by paragraph 4.5 EQ4.2 and paragraph 4.3 EQ 2.2.

EQ 4.4 Is the limitation of petrol fuel placed on the market still necessary? (Article 3)

The limitations on petrol placed on the market are still necessary to ensure the health and environmental protections are delivered by the FQD. As can be seen in EQ 1.2, the emissions of transport pollutants affected by the FQD have decreased very significantly since the introduction of the FQD. The latest amendment of the FQD represents the continuation of these trends and ensures that the fuel placed in the EU market complies with all the limitations set out in the Directive. Although some Member States had fuel quality specifications prior to the FQD, it seems unlikely that these would be consistent if the FQD did not exist. Given the transboundary nature of some of the pollutants such as sulphur, a common approach at EU level ensures the same level of environmental protection across Europe. Also, engine functioning benefits from these limitations, as some of the components may affect engines as

pointed out by engine manufacturers (see E.Q. 3.6). The limitation on which stakeholders have commented the most has been the maximum limit on the bioethanol that can be blended with petrol (10%). As seen in E.Q. 1.6, 2.4 and 3.5; this limitation may potentially be problematic and hinder the ability of Member States of meeting the targets of the RED. Biofuel producers have especially been critical of this limitation and are of the opinion that the blending of bioethanol with petrol would be promoted if the maximum limit was raised or if the maximum limit was a minimum. However, it should be noted that Annex I contains environmental specifications and an increase of the maximum limit could compromise the ability of operators to comply with the vapour pressure limit for the summer period (60 kPa for Member States without a derogation and 70 kPa for the rest). This issue is addressed in further detail in EQ 4.6 Are the derogations still relevant? (Article 3).

EQ 4.5 Are the specifications in Annex I adapted to the latest technical and scientific progress? (Article 3)

A common position paper from AECC, CLEPA, EUROMOT and OICA (AECC et al, 2014) stresses the importance of maintaining the current specifications once vehicle manufacturers are adapting to EURO 5, V, 6 and VI standards, since engine performance can be affected by changes in fuel specifications.

According to a report by ICCT (ICCT, 2013), each vehicle standard needs a specific technology, for which certain specifications are recommended for the correct functioning of engines. As a result and given that new vehicles are compliant with the latest standards, vehicle performance benefits from the alignment of vehicle and fuel standards.

The common opinion in this regards is that alignment of engine development with fuel specifications permits the best development of engine technology.

EQ 4.6 Are the derogations still relevant? (Article 3)

Low summer ambient temperature and bioethanol derogations

The vapour pressure derogation for countries with low summer ambient temperatures is currently in use by a number of countries, one of which is the UK. The UK stated elsewhere in the questionnaire that they would like to extend the derogation once it expires, indicating that they still consider it relevant. E.Q. 2.8 describes the main benefits of this derogation.

As for the vapour pressure waiver related to the introduction of bioethanol in petrol blends, Spain commented that preparing the application for the derogation implied a significant effort but that benefits outweighed costs significantly. The Spanish fuel industry was satisfied with this derogation, as they consider it will lead to significant savings in the next five years. Poland is preparing an application for derogation at the moment and estimates total savings of $40 million per year and Bulgaria and Spain calculated total savings of €7 million (investment) and between €123 and €243 million per year (additional production costs). ICF et al. (2015) analyse the effects of the derogation. As expected and already discussed in the Commission's guidance for the request of this derogation, it is recognised that an increased vapour waiver increases evaporative emissions. Moreover, there are two cumulative effects that should be considered; commingling and splash blending.

Commingling is related to the fact that areas where petrol blends at different bioethanol concentrations are available are more likely to have more evaporative emissions from vehicles than areas where a homogeneous blend is sold. This is because the vapour pressure of refuelling with petrol that contains different proportions of bioethanol is higher than when only a uniform ethanol level is available. The Splash blending is related to how ethanol is added to petrol. If ethanol is simply

added to what is otherwise an already finished petrol grade (instead of to a specifically prepared petrol-base stock), this is called "splash" and it leads to higher evaporative emissions.

With these considerations, various US states have opted out the waiver or it does not apply to certain types of petrol. When the USA finalises the transition from E10 to E15, it is expected that the vapour pressure specifications for E15 will be reduced to comply with the maximum vapour pressure established by law (ICF et al., 2015).

Member States that have requested this derogation expect to opt out at the end of 2020, which coincides with the year in which several objectives in the 2030 energy and climate package have to be met. Therefore, this waiver may be seen as an instrument for the transition to E10 in countries where compliance with the vapour pressure limits is an issue (see E.Q. 2.8). As indicated in E.Q.3.5, most Member States are still far from their targets and the waiver is likely to be an incentive for the penetration of E10. On the other hand, these Members shall be scrutinised so as to assess whether bioethanol is introduced at the stated rate, or whether this does not occur. Also, ICF et al. (2015) propose an amendment of Annex III that would establish a waiver for bioethanol blends above 10%. This would aim to encourage Member States to increase the proportion of bioethanol that is blended with petrol. As noted in this source, when the proportion of bioethanol is higher than 30%, vapour pressure stabilises and higher blends would not result in higher evaporative emissions.

Outermost regions

The stakeholder engagement exercise with Member States and industry stakeholders did not provide much information on this topic. One example has been given by France of the derogation for Outermost Regions being applied in Mayotte (Mayotte is allowed to place on the market petrol with a sulphur content of 50 mg/kg until 31 December 2016), and France states that this derogation is still very much relevant. France has stated the financial implications of not being able to apply for a derogation would be significant and impact negatively on the economy of Mayotte. There are no changes foreseen to fuel supply chain in the Mayotte area in the near future, therefore the limitations which mean that the derogation is needed will continue to apply.

The other two countries with Outermost Regions (Portugal and Spain) have not applied this derogation. Spain has commented that the derogation was not necessary as the Canary Islands are fully integrated into the country's fuel logistics and there is a refinery in the Canary Islands which supplies fully FQD compliant fuel. Spanish authorities were not aware of any particular issue that would make them reconsider this position.

Summary evaluation

In conclusion, the derogations continue being relevant, as they have several functions:

- Protection of the Outermost regions given their economic disadvantage.
- Minimisation of the socioeconomic impact of maintaining current summer vapour pressure restrictions in specific circumstances and when this does not compromise Member States' ability to comply with other environmental requirements.
- Promotion of biofuels.

The derogation related to the bioethanol content in fuels may be regarded as a transitional derogation as it finishes in 2020. By then, bioethanol shall be more commonly blended in the EU and it is expected that most of the current barriers to the increase of their market share will have been overcome. Also, vapour pressure

stabilises with higher blends. If the market, the EU vehicle fleet and consumers are ready for blends above 30%, vapour pressure will not be an issue.

EQ 4.7 Is the limitation of diesel placed on the market still necessary? (Article 4)

The limitations on diesel placed on the market are still necessary to ensure the health and environmental protections are delivered by the FQD. As can be seen in section 4.2, the emissions of the pollutants relevant to the FQD have decreased very significantly over the last two decades. The latest amendment of the FQD represents the continuation of these trends and ensures that the fuel placed in the EU market complies with all the limitations set out in the Directive. Although some Member States had fuel quality specifications prior to the FQD, it seems unlikely that these would be consistent if the FQD did not exist. Given the transboundary nature of some of the pollutants such as sulphur, a common approach at EU level ensures the same level of environmental protection across Europe. Also, engine functioning benefits from these limitations, as some of the fuel components can affect engines as pointed out by engine manufacturers (see E.Q. 3.9 for detailed discussion).

EQ 4.8 Are the derogations still relevant? (Article 4)

There is little evidence of the application of derogations under Article 4. Only one stakeholder in each group is aware of the use of the derogation for the Outermost regions and the example highlighted is the same as in that question (France, which has applied the derogation for the Outermost Regions to Mayotte). In this case, Mayotte is allowed to place in the market of gasoil with a maximum sulphur content that will not be below 50 mg/kg. Therefore it is considered that this derogation is still relevant.

Nothing has been stated of the derogation for NRMM that allows the use of diesel with a maximum sulphur content of 20 mg/kg at the point of final distribution to end users, or on the derogation that allows Member States with severe winter conditions to place on the market diesel with a maximum distillation point of 10% at 180°C instead of 65% at 250°C.

The derogation for severe winter conditions is justified in that engines would not perform properly in these Member States, and therefore this derogation is necessary.

As for the derogation on the sulphur content of the diesel used in NRMM, it was envisaged for accommodating minor contamination in the supply chain. It may be possible that the market is now sufficiently adapted to the new specifications and this derogation is not necessary, but no information has been obtained in this regard.

EQ 4.9 In the absence of this Article, would any Member State prohibit, restrict or prevent marketing of fuels complying with the Directive? (Article 5)

The questionnaire responses did not provide much insight in the answer to this evaluation questions: the majority of respondents state that they do not know the answer to this question (5 out of 16 among authorities and 29 out of 33 among stakeholders from the industry). Croatia, Finland, Germany, Latvia, the Netherlands, Sweden, Slovak Republic and Romania responded in the negative, Austria, Denmark, Luxemburg, Slovenia, Malta and the United Kingdom have stated they do not know. The two Member States which think they will prohibit, prevent or restrict the marketing of FQD-compliant fuels in the absence of Article 5 are Estonia, the Czech Republic and France. Unfortunately no further comments have been provided.

Among industry respondents, the majority (29/33) state they did not know. TOTAL SA has replied in the affirmative ('yes'), and four stakeholders from the fossil fuel industry (Association of the German Biofuel Industry (VDB), UPEI, LUKOIL Neftohim Burgas and the Bulgarian Petroleum and Gas Association) responded in the negative ('no').

Because the questionnaire responses do not provide much insight, we refer here to the analysis carried out under the other evaluation questions for Article 5. The conclusion of EQ 1.9 and EQ 3.11 is that the differences in national implementation of the FQD and RED result in barriers to the free circulation of compliant fuels. (See also the text under EQ 1.9 and EQ 3.11). Logically, if the conclusion of EQ 1.9 and EQ 3.11 is that even in the presence of Article 5 barriers to the free circulation exist, one should also conclude that these barriers should also exist in absence of Article 5. It must, however, be noted that these barriers are the result of differences between Member States and not the result of individual Member States intentionally prohibiting, restricting or preventing marketing of fuels complying with the Directive.

Article 5 is assessed to be very relevant given the various identified market fragmentation issues as discussed under EQ 1.9 and EQ 3.11.

EQ 4.10 Have any Member States used this Article since 2009? (Article 6)

The European Commission has confirmed that this derogation has not been applied by Member States.

This has also been confirmed by the information provided in the consultation process, Member State authorities also state that this derogation has not been used. Most of the respondents from industry (19 out of 33) state that a derogation pursuant to this Article has not been in place, whereas 13 do not know. Note that stakeholders from the fossil fuel industry sector have responded in the negative to this question and respondents less or not involved in the fuel industry have stated they do not know (e.g. biofuel producers and ACEA). Stakeholders from the fuel industry appear to be better informed on this matter, which could be expected based on their role in the market and in their relation to the FQD. Only 2 respondents (the Swedish Petroleum & Biofuel Institute and Nesté) state that Article 6 has been applied, however as discussed above, this relates to a tax incentive which is in place in Sweden, which according to our understanding does not constitute the application of Article 6. This has been confirmed by the Swedish authorities.

EQ 4.11 Are more stringent environmental fuel specifications still relevant in some cases? (Article 6)

Since there are no cases of Article 6 being applied, the relevance of Article 6 can be questioned. In the additional interview Sweden has expressed that Article 6 should be maintained, because it might be needed in the future. Emission cleaning devices and environmental zoning might not be sufficient and therefore, especially big cities and harbour areas, might need Article 6. It approximately takes a couple of weeks at the national level to implement Article 6.

The United Kingdom and France both agree with the relevance of Article 6: according to these Member States the logic behind Article 6 is still applicable. Both of them have, however, also mentioned the main barrier to implement Article 6: it is very challenging to introduce fuels with different requirements on the market for a specific period and specific location. According to the UK it will take 1 man-month of administrative time within a 6 month period. The need to carry out an impact assessment at the national level will be a greater administrative burden compared to the application to the European Commission itself.

More background information on environmental zoning is provided under EQ 2.10.

Based on the Member States responses and based on information on environmental zoning, more stringent environmental requirements are still relevant, but more stringent environmental fuel specifications are not the preferred option and are therefore less relevant, although the logic is still applicable.

EQ 4.12 Is the safeguard to prevent disruptions to fuel supply still necessary? How often were MS authorised to use this Article? (Article 7)

This article has not been applied by any Member States to date. The UK considered applying the article in response to a threatened fuel tanker strike in 2012, and discussed a potential application with the Commission, however in the event the fuel tanker strike was cancelled and therefore the application of the article was not required.

Since this article has not been applied, the evaluation of its relevance is based on the information gathered through the consultation exercise carried out for this evaluation project. Since responses to the questionnaire were lacking in detail, Member State perception of the Article was investigated further in the follow-up interviews carried out with selected Member States in December 2015. Spain, France, the Netherlands and Poland all consider that Article 7 should be retained.

In addition, although the situation envisaged by the article (disruption to fuel supply) has not occurred to date, this does not preclude it occurring in future, and the existence of Article 7 provides a safeguard to ensure that the Commission will not have start infringement procedures on a Member State if circumstances outside of its control (disruption to fuel supply) temporarily affect the quality of fuel.

Therefore on the basis of Member State feedback, this Article is considered to be relevant.

EQ 4.13 Is the use of metallic additives still regarded as relevant option? (Article 8a)

Member States authorities have been asked whether the use of metallic additives would be different in the absence of this Article. According to just under half of respondents (7 out of 16; Austria, the Czech Republic, France, Germany, Luxemburg, Slovakia and United Kingdom), the use of MMT additives would not change in the absence of the Article. The remaining 9 respondents (Croatia, Denmark, Estonia, Finland, Malta, the Netherlands, Romania, Slovenia and Sweden) state that they do not know if use of MMT would have been any different.

In further comments, the UK Department of Transport states that it hasn't been aware of the use of MMT before the limits have been introduced. This is seen as an indication for the negligible use and impacts of MMT. Slovakia indicated that fuel suppliers operating at their national market do not use MMT at all. In addition, Sweden states that the vehicle and fuel industry are not in favour of MMT and there are other and better alternatives available to raise octane numbers in fuels. This would be another reason why the use of MMT additives would not change in the absence of the Article.

However, since MMT is still in use in other parts of the world, the provisions of Article 8a are still relevant to ensure the control of MMT within Europe, and maintaining a limit for MMT is assessed to be still relevant.

Please see EQ 1.15 for the full context of Article 8a (including detail on its use in other countries).

EQ 4.14 Was this Article necessary for the reporting and preparation of a proposal by the EC? (Article 9)

First of all, it should be mentioned that the report and the proposal have not been published yet. In summary there is limited awareness of the relevance of this article among Member States.

Responses from Member States indicate that 8 out of 16 (the Czech Republic, Croatia, Estonia, Germany, Latvia, Malta, Slovenia and United Kingdom) state that Article 9 is necessary to ensure reporting, and 8 out of 16 (Denmark, Finland, France, Luxemburg, the Netherlands, Romania, Slovakia and Sweden) state they do not know.

The additional commentary provided for this question has been very general. The United Kingdom concludes that a review is always a necessary step for the Commission in the process of drafting a proposal. The Czech Republic stresses the relevance of reviewing the FQD. According to the Czech Republic a review is necessary to respond to changing conditions. Latvia only states that this Article is only 'possibly' necessary without giving any further explanation. The Netherlands state that the question was not targeted enough.

Industry was not consulted in relation to this Article.

Overall, this evaluation question is hard to answer in absence of the report and proposal. Stakeholders do not agree on Article 9 being a necessary condition for review and further development of the Directive. From our expert judgement Article 9 obliges the European Commission to take responsibility for continuous improvement of the FQD and that Article 9 recognises changing market conditions of the fuel market.

On the one hand one could argue that the procedures for review and drafting of proposals are sufficiently covered by the general policy making rules within the European Commission. On the other hand, one can argue that an article like Article 9 is an important signal to stakeholders being not convinced of the proper functioning of provisions at the moment of entering into force of the Directive.

EQ 4.15 Are penalties necessary for meeting the objectives of the Directive? (Article 9a)

Both Member State and stakeholders mostly believed that penalties are necessary in order to meet the objectives of the Directive. The majority of Member States consider that penalties necessary for meeting the objectives (14 out of 16). Denmark and Luxemburg are the two countries which state that they did not know, and they have not provided additional commentary.

Over half of stakeholders also agree that penalties are necessary (23 out of 38), although 12 out of 38 stakeholders disagree. Three respondents did not know.

The stakeholders which agree are those from the biofuels sector (Agroinvest SA, APPA Biocarburantes), Association of the German Biofuel Industry (VD), Bio-Oils Energy S.A, EBB European Biodiesel Board, Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec, Centre Ouest Céréales, EFOA, the Slovak Biofuels Associations, Ethanol Europe, Verbio Vereinigte Bioenergy AG) but also fossil fuel manufacturers and suppliers (LUKOIL Neftohim Burgas, Nesté), and some national oil industry associations (the Bulgarian, Polish, Hungarian and Slovak national oil associations, UPEI), as well as one NGO (Transport & Environment) and two anonymous respondents.

The stakeholders which disagreed include a number of the national oil associations and integrated fossil fuel manufacturers and suppliers (Unione Petrolifera, TOTAL SA, Asociación Española de Operadores de Productos Petrolíferos (AOP), OMV Deutschland

GmbH, OMV Refining & Marketing GmbH, Austria Petroleum Industry Association, VNPI, UFIP, APETRO- Associação Portuguesa de Empresas Petrolíferas, Forecourt Equipment Federation, Danish Oil Industry Association and FuelsEurope). Therefore it seems there is not a single view among fossil fuel manufacturers and suppliers.

Member States see penalties as a common tool to meet obligations under a law (the Czech Republic and Croatia). According to Finland penalties are necessary to prevent fraud and malpractice. On the other hand, softer measures can be implemented in case of individual cases and minor deviations. The Netherlands and Finland both referred to the objective of Article 7a, which is, however, not part of the scope of this evaluation.

The statement that softer measures can also be implemented in case of individual cases and minor deviations is also in line with the findings based on the Fuel Quality Monitoring summary Reports 2011-2013 (AEA reports). In these summary reports Member States describe sampling procedures and actions taken in case of non-compliance.

Soft measures applied include:

- increased frequency of sampling;
- repetition of sampling; and
- issuing warning letters or letters requesting explanations.

Only in some cases penalties have been imposed. This is in line with the results of the questionnaire. More information on the height of the penalties can be found under EQ 1.17.

In the case of stakeholders, answers are more diverse. According to the understanding of FuelsEurope and its members (fossil fuel manufacturers and suppliers) there are no penalties related to the FQD (except for Article 7).

Fossil fuel manufacturer and supplier TOTAL S.A. disagrees that penalties are necessary to meet the objective of the Directive. According to TOTAL S.A. fuel companies are responsible for bringing on-specification fuels on the market. For this reason penalties are not deemed necessary in the opinion of TOTAL S.A.

UPEI and the Hungarian Petroleum Association find a well-functioning control system a requirement to ensure protection from excise tax fraud, to meet environmental obligations and to protect consumers.

Biofuel related respondents, like Agroinvest SA, Bio-Oils Energy S.A. and Centre Ouest Céréales, expressed the need for penalties to meet the objectives of the Directive, but in their answer these respondents refer to Article 7a in particular. This has also been mentioned by two Member States, including the Dutch Ministry of Infrastructure and Environment. This Article is, however, not part of this evaluation.

According to NGO Transport & Environment penalties are necessary, because a lack of penalties would result in a high risk of (unpunished) non-compliance. This non-compliance might endanger the realisation of the overall objectives of the FQD, especially in relation to environmental and health impacts. Penalties should, however, be strict enough and effectively be implemented.

Based on above finding it can be concluded that penalties are in principle a good instrument to reach compliance, although softer measures should be preferred. Overall, a control system should be strict enough to not endanger the objectives of the FQD.

EQ 4.16 Is this Article necessary for Member States to set penalties? (Article 9a)

Over half of Member States authorities agree that the Article is necessary in order to ensure penalties are set (8 out of 17: Austria, Croatia, Denmark, Malta, the Netherlands, Romania, Slovakia, Sweden), however a third disagree (7 out of 17: the Czech Republic, Estonia, France, Germany, Latvia, Slovenia. United Kingdom). Finland and Luxemburg do not know. Given that Member States responded differently to the previous question (are penalties necessary in order to meet the objectives of the Directive?) this suggest that authorities believe that penalties are required but that it is not necessary to have a specific Article with provisions on this, suggesting that national Regulations would be put in place to enforce the Directive in the absence of Article 9a (see EQ1.9 and 3.11).

Because the questionnaire responses do not provide much insight, we refer here to the analysis carried out under the other evaluation questions for Article 5. The conclusion of EQ1.9 and EQ3.11 is that the differences in national implementation of the FQD and RED result in barriers to the free circulation of compliant fuels (see also the text under EQ 1.9 and EQ 3.11). Logically, if the conclusion of EQ 1.9 and EQ 3.11 is that even in the presence of Article 5 barriers to the free circulation exist, one should also conclude that these barriers would also exist in the absence of Article 5. It must however be noted that these barriers are the result of differences between Member States and not the result of individual Member States intentionally prohibiting, restricting or preventing marketing of fuel complying with the Directive.

Article 5 is assessed to be very relevant given the various identified market fragmentation issues as discussed under EQ 1.9 and EQ 3.11 above.

Because the questionnaire responses do not provide much insight, we refer here to the analysis carried out under the other evaluation questions for Article 5. The conclusion of EQ 1.9 and EQ 3.11 is that the differences in national implementation of the FQD and RED result in barriers to the free circulation of compliant fuels. (See also the text under EQ 1.9 and EQ 3.11). Logically, if the conclusion of EQ 1.9 and EQ 3.11 is that even in the presence of Article 5 barriers to the free circulation exist, one should also conclude that these barriers should also exist in absence of Article 5. It must, however, be noted that these barriers are the result of differences between Member States and not the result of individual Member States intentionally prohibiting, restricting or preventing marketing of fuels complying with the Directive.

Article 5 is assessed to be very relevant given the various identified market fragmentation issues as discussed under EQ 1.9 and EQ 3.11.

The Netherlands argue that Article 9a is necessary for Member States to set penalties, because it provides the legal basis required. Other Member States that do not see the need to arrange penalties at the EU-level argue that penalties can be set at the national level without a European provision (the Czech Republic, United Kingdom and Latvia).

Stakeholders were not asked to comment on the specific need for Article 9a.

In summary, Article 9a is considered relevant, but there are doubts regarding to what extent it is necessary to have an Article at the EU level. Member States believe that penalties can also be dealt with at a national level.

For more information on the level of penalties see EQ 1.17.

4.6 EU-added value

Overall evaluation of EU-added value

The EU added value of the Directive overall is considered to be good, however for some individual Articles the EU-added value is under question as summarised below.

Further details of the analysis and evidence for this overall evaluation is presented in the subsequent evaluation questions (EQs).

- **Article 1:** It is assessed that a single market could not be delivered in the absence of the Directive, therefore the scope of the Directive is considered to have added value, however the industrial stakeholders (fossil fuel and biofuel producers and suppliers, as well as the car industry) are convinced that a single market established via the FQD does not bring competitive advantages. This raises the issue of whether Article 95 of the Treaty is still an adequate legal base.
- **Article 2:** The definitions chosen are not considered to be advantageous for EU-industry, but given the strong request to include the specifications from the CN-codes directly into the FQD there seems to be no justification to explore the benefits of adoption of definitions used in other regions.
- **Articles 3 and 4** are considered to add value at the EU level. Most Member States consider that EU action was necessary in order to ensure the removal of lead and sulphur petrol in the EU. Although the fact that certain Member States have transposed the Directive differently may reduce its added value, the FQD was necessary to establish minimum environmental specifications on fuel at EU level and ensure that all the fuel supplied in the EU complied with certain quality criteria, which in turn is necessary for vehicles to comply with vehicle standards.
- **Article 6** has not been used to date, and Member States consider that other, more easily applicable policy measures are available to fulfil its intended function (protecting the health of a population or of an environment in a specific location). Therefore it is not considered to add value at the EU level.
- **Article 7** similarly is considered to add value at the EU level, as a safeguard in case of future disruption to the fuel supply.
- **Article 8** is assessed in a very mixed manner by stakeholders, with many considering that the value it delivers is not proportional to the administrative burden of reporting.
- The EU-added value of **Article 8a** seems to consist of ensuring the implementation of national bans by all Member States and to strengthen the negative attitude of the fuel industry and vehicle industry. It is not clear whether the EU-added value of the Article would be enhanced if it imposed a complete ban rather than the present 2mg limit.
- **Article 9** is considered to add value at the EU level, although some suggestions for improvements to the review process were put forward by stakeholders.
- **Article 9a** on penalties is considered to have limited added value, since Member States consider they can implement penalties at a national level. EU-added value of Article 9a might have been higher in case Article 9a also prescribed a certain level of harmonisation among Member States.

EQ 5.1 What is the overall perception of the Directive among stakeholders? (General)

There is not one single unanimous view on the added value of the Directive, as views vary among stakeholders according to the drivers for each sub-group, as is expected across a very diverse group.

In relation to the delivery of a single market, Member States believe that a single market could not be delivered in the absence of the FQD, therefore they value it in that regard. Conversely certain stakeholder sub-groups (e.g. fossil fuel manufacturers and suppliers) majoritarily do not believe that the Directive delivers a strong single market.

Overall perception of the Directive is more positive among Member States than among stakeholders.

Even among Member States, who view the Directive more favourably, certain issues are highlighted which negatively impact the overall perception of the Directive. These include perceived high costs of reporting and monitoring by some Member States (EQ 2.11), and the necessity for a specific article in relation to penalties (EQ 4.16, 5.15).

Individual Article evaluation

EQ 5.2 Could a single market be ensured by repeal of the FQD? (in the absence of the FQD)? (Article 1)

No evidence is found from either questionnaire responses or literature search indicating that the single fuel market could be ensured by repeal of the FQD.

11 out of 15 Member State respondents state that a single market could **not** be maintained in the absence of the FQD (the other 4 responded 'do not know'). The comments do not give additional details, other than supporting the response.

27 out of 37 respondents from both fossil fuel and biofuel industries and NGOs state that a single market could not be maintained in the absence of the FQD. 4 stakeholders from the oil industry stated 'yes', but with the requirement that CEN-standards (e.g. EN259 and EN 580) are made mandatory. The remaining respondents state they do not know.

Similarly, both Member States and stakeholders almost unanimously believe that the voluntary application of CEN standards EN 590 and EN 228 would not have the same results as the EU-level intervention delivered by the FQD. Only 2 out of 14 Member States (the Czech Republic and Slovakia) and only 1 out of 37 stakeholders (Forecourt Equipment Federation) believe voluntary application of CEN standards would have the same effect, but give no further details.

However as identified in EQ 1.3 above, the delivery of a consistent minimum level of fuel quality which is achieved by the Directive is not the same as the delivery of a single market. A strong single market is not being delivered due to the variety of biofuel blends available throughout the EU.

Given the clear and almost unanimous positions, the what-if question "what would happen to the single fuel market if the FQD was repealed" is not investigated. The FQD is considered to add value by ensuring a minimum level of fuel quality across the EU. Also, although the FQD has not delivered a strong single market, there is no evidence to suggest that a strong single market would be possible in its absence.

EQ 5.3 Does the scope as defined justify EU intervention? Would voluntary application of CEN standards not deliver the same result? (Article 1)

8 Member States give a clear 'yes', stating that voluntary application of CEN standards would not deliver the same result, with additional comments that support the statement. The Czech Republic and Slovakia respond 'no', but give no further details; from previous answers provided and assessed earlier in this report misinterpretation of the question cannot be ruled out.

In paragraph 4.3, under EQ 2.2 it was highlighted that stakeholders are convinced that a single market could not be maintained in the absence of the FQD. 4 stakeholders from the oil industry stated 'yes', but with the requirement that CEN-standards (e.g. EN259 and EN 580) are mandatory. In line with that result the stakeholders do not overall believe that the objectives of the FQD could be achieved by means of voluntary application of CEN specifications. Only Forecourt equipment has replied in the negative, but has not given any further details. In addition, evidence indicates that only a limited number of derogations have been requested and applied. Therefore overall the scope as defined would seem to justify EU intervention.

EQ 5.4 Does the FQD give the fuel and car industry a strong home-market? Does this bring competitive advantages over non-EU industries? (Article 1)

Less than half of stakeholders respondents believed that the FQD gives the fuel and car industry a strong home market (14 out of 38 believe it does, 21 believe it does not, 3 do not know). A strong divergence in opinions of oil industry and biofuel industry can be observed. In addition over three-quarters of stakeholders do not believe that the creation of a home market confers competitive advantages over non-EU industries (29 out of 38).

Most oil companies acknowledged that the FQD brings a level playing field within the EU by establishing harmonised fuel specifications across Member States, which enables fuel suppliers to operate across the EU. However the FQD doesn't create a strong home-market as these specifications and requirements can be met by refineries outside the EU.

It was highlighted that by introducing harmonised fuel specifications the FQD has reduced the barriers to entry for non-EU fuel suppliers, who can dedicate (part of) their plants to the refining of EU-specification compliant fuel, rather than having to comply with multiple specifications across different Member States. Meanwhile, EU refineries have converted their full production capacity to comply with the FQD, which then makes it more difficult for them to trade competitively with non-EU producers in regions with less stringent fuel specifications.

Only LUKOIL and the Bulgarian Petroleum and Gas Association consider the FQD to bring a strong home-market, but gave no further details.

Most respondents from the biofuel industry answered in the affirmative to this question, stating that harmonized fuel specifications are beneficial to consumers, fuel industry and car manufacturers. They call on the EU to keep its position as a frontrunner. The negative answer of one ethanol supplier is related to the maximum ethanol content compared to petrol in other regions. The biofuel industry is not convinced the FQD brings competitive advantage over non-EU industries.

In questionnaire response and follow-up interview the NGO Transport and Environment proposed to change the FQD into a regulation, to improve harmonized implementation and enhance a strong home-market.

The car industry gave no opinion on the 'strong home-market' question and doesn't see any competitive advantage over non-EU car manufacturers.

The position of the industry is striking as the FQD is, among others, established under Article 95 of the Treaty with its objective to strengthen the competitiveness of the EU market via the creation of single markets and level playing fields. The respondents are clear in their message that no single fuel market could be delivered without the FQD (see EQ 2.2). On the other hand most industrial stakeholders are convinced that a single fuel market delivered via the FQD isn't advantageous for EU industry (over non-EU industries) for the reasons set out above. The position of the fossil fuel industry

might be linked to the additional costs required to meet the FQD specifications, in particular the requirements for "deep desulphurisation", reduction in aromatics (in petrol), and PAH (in diesel) . This raises the issue of whether Article 95 is still relevant as (one of the) legal basis of the FQD.

EQ 5.5 Are the definitions chosen advantageous to the EU industry? (Article 2)

Based on evidence from the stakeholder engagement questionnaire, there is limited knowledge among stakeholders regarding the potential for the use of other definitions in the EU. Both among Member States and among industry stakeholders, approximately three-quarters of stakeholders stated they did not know if the EU would benefit from the adoption of definitions used in other regions.

Only 4 industrial respondents are in favour of adoption of specifications from other regions. LUKOIL commented that unification between regions would bring economic opportunities and EFOA and one of its members advocate that adoption of the Japanese approach (which relies strongly on petrol blends containing ETBE and MTBE) would be beneficial for the introduction of biofuels. The justification given suggests these industrial respondents are in favour of harmonised fuel standards and approaches between regions rather than just harmonization of the definitions in Article 2 with those from other regions. 3 respondents prefer no adoption of fuel specifications of other regions, of which ACEA commented that those specification are in general of overall less quality.

Given the position of stakeholders on this question and the strong request to include the specifications from the CN-codes directly into the FQD there seems to be no justification to explore the benefits of adoption of definitions used in other regions.

EQ 5.6 How has this Article been perceived by stakeholders? (Article 3 and 4)

Stakeholders have a positive view of the Articles and, in general, believe that the provisions therein (such as the removal of leaded petrol and the minimisation of the sulphur content of fuel) would not have been possible at EU level without the Directive.

Most of the Member States authorities (14 of 17, 82%) have stated that EU action was necessary for the removal of leaded petrol in the EU. These were Germany, Malta, Latvia, Romania, United Kingdom, Austria, Czech Republic, Croatia, Luxemburg, Netherlands, France, Slovakia, Slovenia and Finland. Some of them like Germany and Slovakia have added that the use of unleaded petrol was in place before the Directive, but recognising that Article 3 was necessary for an EU-wide removal. Only Sweden stated that it was not necessary, as unleaded petrol has been in the market since 1986, along with a tax incentive that promoted unleaded vs. leaded petrol[115]. However, the fact that some Member States introduced unleaded petrol earlier does not imply the same trend in other Member States (e.g. Greece, France, and Portugal, where unleaded petrol represented just under than 30% of the market in 1995[116]).

Industrial stakeholders' opinion was almost evenly divided among industry stakeholders as to whether EU action was necessary in order to ensure the removal of leaded petrol from the market. Those who state that EU action was not required are

[115] UNDP (1998) Human Development Report. United Nations Development Programme. Oxford University Press, New York, USA.

[116] EEA (2013) Late lessons from early warnings: science, precaution, innovation. Report 1/2013. European Environment Agency. Available from: http://www.eea.europa.eu/publications/late-lessons-2

principally fossil fuel manufacturers and suppliers. 8 of these are based in Sweden, Denmark, Germany, Spain or Austria, all countries which had banned lead in petrol prior to the introduction of the Directive. The fact that these Member States had imposed these controls does not imply the same trend in other Member States. Therefore, not having the FQD could have led to a more heterogeneous fuel market across the Europe.

Stakeholders who believe that EU intervention was required include biofuel stakeholders and a number of fossil fuel stakeholders based in other countries (Bulgaria, France, Hungary, Slovakia and Finland), along with ACEA, one NGO and two fuel additives manufacturers.

As for Article 4, the vast majority of the Member States authority responses (13 of 17) state that EU action was necessary for the introduction of sulphur-free diesel in the EU. These were Estonia, Germany, Malta, Latvia, Romania, United Kingdom, Austria, Czech Republic, Luxemburg, Netherlands, France, Slovakia and Finland. Moreover, Germany has commented that individual initiatives would have not implied an EU-wide introduction of this fuel.

EN Standards have a close relationship with the FQD and EN 228 and EN 590 includes technical specifications for petrol and diesel, respectively include requirements of the FQD but also other specifications related to are more extensive. Also, current EN standards are voluntary in principle. Although these have been prepared by technical experts, they have not been accepted by authorities and they have not followed a legislative process. As a result, they have not been prepared following the interest of the majority of the population and do not take into account political and socioeconomic criteria, as well as coherence with the Commission's strategy on fuel and environmental quality. Therefore, although they are a useful ancillary instrument for the success of the FQD, standards do not have the same guarantees and do not consider the same wider political and socioeconomic issues as the FQD.

Overall this article is perceived positively by stakeholders and it is believed that the benefits in terms of environmental and health protection and increased fuel quality would not have been achieved at EU level without the FQD. Some industrial stakeholders have stated that the FQD was not necessary as the national legislation of several countries already covered part of what was included in the FQD prior to the introduction of the Directive. However, other Member States had not introduced such legislation and EU action has been key in the harmonisation of fuel technical and environmental standards in these Member States.

Also, fuel harmonisation is key in the performance of engines, and has to be consistent with the technical specifications of vehicle standards. As seen in E.Q. 3.6 and 3.9, fuel quality specifications need to be in line with vehicle standards because some of the systems required to meet the emission limits set out in them may not work properly if the fuel does not meet certain criteria (e.g. with regard to the sulphur content of fuel).

EQ 5.7 Has the fact that some Member States have stricter limits reduced the added value of the Directive? (Article 3 and 4)

Evidence from the stakeholder engagement indicates contrasting opinions between Member States and industry stakeholders. Three-quarters of Member States do not believe that the introduction of differing limits by certain Member States has reduced the added value of the Directive.

Spain concludes that whereas the added value of the Directive has not been reduced, it would be challenging to have 28 different approaches, should each Member State decide to apply stricter limits. France, which has a higher FAME limit (8%) in diesel

than other Member States has stated that this additional 1% has little impact on vehicle performance and that there have not been issues in the country, despite the fact that it is only available in very specific areas. France has not studied possible impacts on neighbouring countries but states that trends should be similar.

Among industry stakeholders, opinion is divided clearly: fossil fuel manufacturers and suppliers state that the added value of the Directive **has** been reduced by the introduction of different limits by certain Member States, while the majority of biofuel stakeholders believe it has **not**.

A conclusion cannot be reached on this subject. Although Member States agree that the EU-added value of the Directive has not decreased, stakeholders understandably have conflicting views on this issue, given that harmonisation of limits is beneficial for fossil fuel suppliers, while introduction of different limits if likely to enable higher use of biofuels, being beneficial to biofuels producers.

EQ 5.8 How has this article been perceived by stakeholders? (Article 6)

The perception of stakeholders with respect to the efficiency and relevance are discussed under EQ 2.10 and EQ.4.11 respectively.

Given the fact that Article 6 is not perceived to be efficient the EU-added value of this Article is low: the article has not been applied and based on the stakeholder perceptions discussed under EQ 2.10 and EQ 4.11 Article 6 is not likely to be applied in the (near) future and will only serve as a last resource in case more efficient and easier policy options are no longer sufficient. Vehicle emission regulations add far more value by enabling local authorities to ban polluting vehicles from certain areas based on for example the Euro-classes.

EQ 5.9 How has this article been perceived by stakeholders? (Article 7)

This article has not been implemented to date, however the UK considered applying it in response to a threatened fuel tanker strike in 2012. In the event the strike did not go ahead and so the application of the article was not necessary.

As described in EQ 1.11 and EQ 4.12, overall perception of this article by Member States is positive, with Member States considering that although the article has not been required to date, it should be retained as a safeguard, since it is possible that it may be needed in future.

France additionally commented on the potential difficulty of applying this article within one Member State in isolation, since the current fuel market is sufficiently interconnected that application of the article in one Member State would be likely to impact on neighbouring Member States. The UK also perceived some potential for further clarity in the wording of the Article, as set out in EQ 1.11.

In summary the Article is perceived to be useful and relevant, with some suggestions for additional clarification and improvement being made by Member States.

EQ 5.10 Is action at EU level still prescribed? (Article 7)

Member States consulted during follow-up interviews mostly believe that Article 7 has a role to play and should be maintained, with France, Spain, Poland and the UK supporting the maintenance of the Article. Sweden did not believe the Article was necessary in the case of Sweden.

On the basis of the information obtained through the consultation exercise, as set out in more detail in EQ 4.12 and EQ 5.9 above, action at EU level is still prescribed and this article should be kept.

EQ 5.11 How has this article been perceived by stakeholders? (Article 8)

In order to assess the perception of Article 8, both Member States and stakeholders were asked whether the CEN (European Centre for Standardisation) and existing national standards were sufficient, or whether the FQD is assisting with harmonisation and therefore adding value.

Responses from Member States were evenly divided, with 7 respondents considering that the Directive is adding value (Finland, Malta, Croatia, Germany, the Netherlands, Denmark, Sweden), whereas 7 considered current standards are sufficient and the FQD is not adding value (Estonia, Romania, the United Kingdom, the Czech Republic, Luxemburg, France and Slovakia). Germany responded to the question by highlighting that the FQD at ensures a minimum level of fuel quality across all Member States, which otherwise although some such as France and Germany, consider stricter limits (more parameters) to be necessary. Therefore overall they consider that the FQD is adding value. Two Member States responded they did not know (Latvia and Slovenia).

In evaluating the responses from Member States, it could reasonably be expected that the Member States which historically implemented higher levels of fuel quality prior to the introduction of the FQD, and which continue to champion more stringent requirements, would consider that the FQD is not adding value. However, this is not always the case in the responses from e.g. Sweden, which historically introduced more advanced regulation regarding fuel quality, considers that the FQD is adding value. It seems therefore that in their response Member States are fully aware of the advantages of the FQD in ensuring, as Germany put it, a minimum level of fuel quality across all Member States which could not otherwise be taken for granted.

Stakeholders were less positive in their evaluation, with 21[117] out of 38 believing the Directive does not add value over and above CEN and the existing national standards. Only 16[118] out of 38 believed the Directive does add value because existing standards are not sufficient. One biofuel stakeholder stated they did not know (APPA Biocarburantes), and 12 stakeholders did not reply to this question[119].

On the basis of responses to this specific question in the questionnaire, the feedback from Member States and stakeholder on the Directive is not very positive. However, put into context with the feedback on a number of other areas of the Directive which have been discussed previously in this report, including:

- The acknowledgement that Article 8 contributes to ensuring compliance with the FQD,
- The evaluation of the costs and benefits of Article 8, which indicated benefits were significantly greater.

Taking the above into account, Article 8 is considered to add value at an EU-level.

[117] 17 fossil fuel manufacturers, two fossil and biofuel manufacturers (Nesté, the Swedish Petroleum and Biofuels Association), the forecourt equipment manufacturers, and one fuel additive manufacturer (Afton).
[118] 10 biofuels industry members, 5 fossil fuel manufacturers and suppliers (UPEI, Ineos, and the Polish, Slovak and Hungarian national petroleum associations), and a fuel additive manufacturer (EFOA).
[119] The 12 which did not respond were one fossil fuel stakeholder, ePURE, ASFE, Inland Navigation Europe, all 4 respondent NGOs, and 3 engine manufacturers.

EQ 5.12 Would MS monitor and centrally report this information without EU intervention? (Article 8)

In the absence of a requirement to monitor and report, Member States would be unlikely to report centrally on their compliance with the FQD, and certainly reporting at the current level of detail and coherence across Member States could not be guaranteed. The following factors should be taken into account:

- The high relative costs of monitoring and reporting (as indicated by some Member States in their responses to the consultation exercise) would be a strong deterrent. If monitoring and reporting were not required, Member States might find it difficult to justify this level of expenditure, particularly during less favourable financial time periods (e.g. following the 2009 recession);
- Since some Member States (Malta, Sweden) have expressed dissatisfaction with the high number of fuel samples they are currently required to monitor, it is likely that if monitoring were carried out at a Member State level in the absence of Article 8, a lower number of samples would be analysed.
- In the absence of a centrally convened Fuel Quality Monitoring template (the current Excel template used by Member States for annual reporting), Member States who did collect data would do so in a non-uniform way.

Conversely, the fact that some Member States had in place legislation banning lead and controlling other pollutants prior to the introduction of the FQD (e.g. Sweden removed lead from fuel since 1986) indicates that in the absence of the FQD some Member States would continue to restrict the presence of some pollutants in fuel, and would be likely to put in place their own monitoring and reporting mechanisms. However these would not be uniform across all Member States.

In conclusion, based on the feedback from Member States through the stakeholder engagement (highlighting costs of monitoring and reporting but for some MS also acknowledging the benefits of the monitoring and reporting requirements), it is considered that in the absence of Article 8, Member States would not be guaranteed to centrally collect and report data on compliance with the FQD, and even if they did, data collection and reporting would be carried out in a non-uniform manner, making comparisons across Member States difficult or impossible.

Therefore Article 8 is considered to add value.

EQ 5.13 How has this article been perceived by stakeholders? (Article 8a)

There is no unanimous agreement among all parties in regards to the EU-added value of Article 8a. Members States mainly perceive that MMT has been eliminated through the application of national legislation, therefore it is considered that Article 8a does not add value at present. According to Afton, producer of MMT, MMT 'is a cost effective and scientifically proven safe option to raise octane. Therefore there is no justification to ban or severely restrict the use of this product'. Therefore according to Afton Article 8a is not justified.

In addition, the stakeholder Transport & Environment stated that protecting people from negative health impacts should be a strong principle in the EU approach and should not be left to the individual legislation of Member States, therefore an article like Article 8a should exist at the EU level.

Overall, the EU-added value of Article 8a is to serve as a safeguard (in addition to bans implemented at the national level), given that MMT is still used in other parts of the world.

A more detailed description of the stakeholders' responses on Article 8a related questions in the questionnaire could be found under EQ 1.15.

EQ 5.14 How has this Article been perceived by stakeholders? (Article 9)

Overall Article 9 is perceived to add value at the EU level, although a report has not yet been published.

Limited commentary has been provided by Member States in the questionnaire when asked for their opinion regarding the FQD review process. Croatia, the Netherlands, Sweden and Slovakia all see the existence of an obligation to review as being positive. Croatia states it is good that there is an obligation to review, but believes this could be improved or simplified. Sweden states that while it is good that the review process exists now, it should have existed earlier.

Stakeholders have also been asked to give their opinion on the FQD review process. Overall there are no objections to the existence of a review process for the FQD, however there are a number of suggested improvements for the review process. 13 of the fossil fuel manufacturers state that in their opinion a three-year period is too brief and should be replaced by a five-year period for the review (the high number of identical responses indicates coordination of responses through an industry association). Note that this implies that stakeholders do not seem to have a problem with the fact that the European Commission is only currently reviewing the Directive.

10 of these 13 fossil fuel manufacturers also state that the FQD review process can ensure better compliance with fuel specifications. The Bulgarian Petroleum and Gas Association state that a review process is always necessary after some period of application of an act, and that they hope this process will not be used to adopt new rules which would add administrative burden, higher costs and limited trade freedom. Euromot stated that the organisation would appreciate a more transparent process on the decision making, such as on the "gas oil" vs. "diesel" issue. In addition LUKOIL Neftohim Burgas states that the FQD review process is a positive step towards implementation of the Better Regulation Package of the European Commission.

Six of the eleven biofuel stakeholders state that Article 7a should be included in the review process. Since Article 7a is not excluded from the FQD review process, it appears that these biofuel stakeholders are taking the opportunity to state their views on Article 7a.

EQ 5.15 How has this article been perceived by stakeholders? (Article 9a)

The added value of this article is considered to be limited, as stakeholders declare that penalties could be arranged at the national level without the need for this article (see EQ 4.15 for a more detailed description). The EU-added value might have been higher in case Article 9a was formulated in such a way that it was also targeted at a level of harmonisation among Member States. However, the current text leaves the assessment of effectiveness, proportionality and dissuasiveness up to the Member States and therefore leaves room for differences between Member States: *'Member States shall determine the penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties determined must be effective, proportionate and dissuasive.'*

5. Next Steps

Stakeholder workshop

A workshop will be held in Brussels by the Commission, in March 2017. The aim of this workshop is for the findings of this report to be presented to and discussed with stakeholders.

6. Conclusions and Recommendations

6.1 Evaluation conclusions

The two current main aims of the FQD are to ensure a single market for fuel in the EU, and to ensure minimum levels of environmental and health protection in relation to fuel use. The evaluation of these against the five themes of the evaluation is summarised below.

For further analysis of each of the summarised issues the reader is referred to the sections of this report as cross referenced with the relevant evaluation question (EQ) number.

Effectiveness

Effective elements of the FQD

Health and environmental protection

- The FQD has been effective in reducing emissions from transport. Historic data series available from the EEA show a reduction in emissions of SO_X, lead, NO_X, PM and PAH (EQ 1.2). These reductions can be linked to the FQD, either directly in the case of SO_X or indirectly for NO_X and PM. In the case of SO_X emissions the observed reductions correlate directly to the progressive lower sulphur limits permitted in fuels. For NO_X and PM emissions the historic observed reduction in emissions of NO_X and PM is not directly attributable to the FQD, however it could not have occurred in the absence of the FQD, since sulphur content in fuel inhibits the performance of catalytic converters which remove NO_X from tailpipe emissions, and also damage Particulate Diesel Filters which reduce PM. Therefore, both the FQD and vehicle emissions standard together have been responsible for this reduction. The introduction of Euro-6 and Euro-VI vehicles was only possible after the coming into force of petrol and diesel specifications of Directive 2009/30/EC.
- The improvements in health and environmental impacts arising from the FQD are due to the specifications for petrol and diesel fuel set out in Annex I and II. The high rate of compliance with the FQD specifications (in regards to minimum fuel quality standards) (EQ 1.6, 1.8) are supported by the monitoring and reporting requirements for Member States specified in Article 8 (EQ 1.14) and by the penalties regime stipulated in Article 9a (EQ 1.17).

Level of compliance

- As described above, compliance with the technical fuel specifications of the FQD is high, with the majority of Member State respondents noting that over 95% of fuels sold on the EU market are in compliance with the FQD (EQ 1.6, 1.8). This is supported by the non-compliance rates published in the annual FQD monitoring reports (EQ 1.6: around 2% for petrol; EQ 1.8: 3-5% for diesel in the 2009-2013 period, dropping to 1.3% in 2014, Ricardo-AEA 2014b, EEA 2015) and the limited number of penalties imposed (EQ 1.17). Non-compliance events can be classified as "exceptions" and/ or linked to introductions of new standards and/ or switches from grades (like winter to summer).
- In relation to monitoring and reporting (which contributes to the levels of compliance) there is potential for improvement among the Member State in terms of compliance with the minimum required number of fuel samples taken, in particular as many Member States are at the minimum level prescribed by the

FQD, however monitoring and reporting costs are considered to be high by four of the 17 responding Member States (Croatia, Estonia, Luxemburg, Sweden) (EQ 2.11). Penalties are considered to be necessary for meeting the objectives of the FQD by 14 of the 17 responding MS (EQ 4.15, 4.16).

Ensuring a single market

- Minimum fuel requirement obligations are an important driver towards the delivery of a single market (EQ 1.1). In this regard the Directive is succeeding, given that currently the majority of the fuel placed on the EU market is compliant with the FQD specifications as evidenced in the summary FQD annual reports and Member States Fuel Quality Monitoring annual reports (comprehensively described under EQ 1.6 and 1.8). Member States view the FQD positively in this regard.

Ineffective elements of the FQD

Ensuring a single market

- As Annex I and II of the FDQ only have an upper limit this creates the legal possibility that fuels with different levels of bio content are compliant with the FQD. According to the fossil fuel and biofuel producers and suppliers, this range of permissible bio content may have led to a fragmentation of biofuel blends that are supplied across Member States.
- Biofuel blends are supplied unevenly across the EU, principally due to bioethanol blends levels (E0, E5, and E10)[120] (see EQ 1.3). This range of biofuel blends is in line with the specifications for biofuel components according to Annex I, which specifies an upper limit of 10% bioethanol. This also reflects the different policies put in place by Member States with regards to biofuels. Fuel suppliers have indicated that there are possible additional costs associated with the provision of multiple fuel blends, however they have been unable to supply an estimation of these costs.
- For FAME, while Annex II sets an upper limit of 7% in diesel fuel, Article 4 also indicates that FAME levels greater than 7% may be permitted. This flexibility provided by the FQD was only utilised to date by two Member States (France and the Netherlands) establishing a legal framework permitting the placing on the market of diesel with >7% FAME levels.
- Certain Member States' national legislation transposing the FQD aligns with the minimal requirements set out by the Directive, whereas other Member States additionally include mandatory application of CEN standards EN228 and EN590.
- It was suggested by some Member States that the possible transposition of the full requirements of both CEN standards EN 228 and EN 590 into the FQD would be a positive step towards greater harmonisation of the single market for fuel. However, under the current scope of the Directive it would be difficult to justify such a change as this would not lead to clear, additional health and environmental benefits because the further specifications within the CEN standards relate to aspects not associated with pollutant emissions. Also, the economic impact of the unequal application of the CEN standards has not yet been fully demonstrated.
- There is a possible issue in relation to other fuel quality parameters where multiple blends are permissible, for example RON. This could in theory lead to

[120] Where 'E' denotes bioethanol and the number denotes the maximum percentage content in a petrol blend.

inconsistencies in relation to the single market, however this has not been observed or reported to date.

Efficiency

Overall the Directive is efficiently delivering health and environmental protection.

Efficient elements of the FQD

Environmental and health benefits delivered under Articles 3 and 4

- This is assessed on the basis of a comparison between the costs and benefits of this element of the Directive.
- The main costs for Member States in relation to implementing the FQD arise from the monitoring and reporting requirements, including requirements for fuel sampling. Costs vary significantly across Member States, with reported costs for overall fuel sampling and monitoring costs ranging from €173,000-€650,000 annually per Member State (EQ 2.11).
- The main costs arising from compliance with the FQD for fuel manufacturers are in relation to desulphurisation of fuel as required by the FQD and in meeting the vapour pressure limits (see EQ 2.3, EQ 2.4, and EQ 2.5). These costs were estimated to be in the region of €202 million cumulative costs per refinery for the time period 2001-2011. Of the €202 million cost, 51% corresponds to investment costs and 49% to operational costs[121]. Some additional costs to fossil fuel manufactures and suppliers arise from limits for ethanol blending (EQ 2.6) and the increased number of fuel grades to be supplied (EQ 2.3).
- All of these costs are outweighed by the significant benefits delivered through the FQD (detailed in EQ 2.3, 2.4, 2.5). The FQD has led to a decrease in fuel related emissions from transport and the associated health benefits of avoided health impacts are quantified using damage cost functions (detailed in EQ 2.3, 2.4, 2.5).
- The benefits arising from desulphurisation have been estimated as being €197 million[122] per average EU-28 refinery during the 2001-2011 period (EQ 2.4). Project calculations carried out using EEA data on historic emission trends estimated the benefits of avoided damage cost associated with reduced EU road transport and NRMM emissions, at **€ 695 million** for reduction in SO_X, and **€8,611** million for reduction in NO_X for the period 2009-2013 for the EU 28.
- The FQD does not operate in isolation and the above benefits arising from reduction in road transport and NRMM emissions are therefore not entirely attributable to the FQD. The observed historic reduction in SO_2 emissions is directly attributable to the FQD, whereas the reduction in emissions of NO_X and PM are indirect. Other factors include the influence of vehicle emissions standards and the economic recession in 2009, amongst others (EQ 1.2).
- In addition, the FQD has also delivered benefits in relation to engine and emissions abatement performance due to improved fuel specifications, which are compatible

[121] These are estimates from the EU Refineries Fitness Check (JRC, 2015) report.

[122] This value is a cumulative estimate for the period 2001-2011, not for a single year. These estimates are calculated using EEA damage cost values on the benefits of decreasing SO_2 intensities, and represent the difference between a baseline situation where the average sulphur content in gasoline and diesel would have remained at the level determined by the FQD in 2000 (150ppm for gasoline and 350ppm for diesel), against the actual reported sulphur levels in fuel (as illustrated in Figure 4.19 below) (source JRC, 2015).

with advanced engine standards. For example, the application of particulate filters in modern diesel engines was only possible after the introduction of low sulphur content fuels (EQ 1.2, 1.4, EQ 2.4).

- The derogations associated with Articles 3 and 4 (derogations available in relation to vapour pressure for Member States with low summer ambient temperatures, in relation to vapour pressure and the use of bioethanol, derogations for the Outermost Regions), are considered to be cost efficient, taking into consideration the cost to the Member States of applying for these derogations, and the benefits obtained. Based on estimations provided by Member States in their applications for derogations, a minimum of €637 million (investment) and operational costs savings of at least €247 million per year are saved in the EU (EQ 2.8).

Article 7 Provision for temporary relaxation of fuel specification in the case of disruption to the fuel supply chain

- Even though this Article has not been applied to date, it is considered to be efficient by the UK, which considered its application in the past. It is also considered to be efficient by stakeholders who value security of supply. Therefore overall it is assessed positively (EQ 2.10).

Inefficient elements of the FQD

- There is uncertainty regarding the additional costs incurred by fuel suppliers in relation to the costs of supplying multiple fuel blends. Since E5 and E10 (the two predominant petrol blends) require the same base petrol blend, additional costs in relation to the provision of these two blends are possibly not significant. Fuel suppliers stated that they incurred additional costs due to the provision of multiple fuel blends but were unable to provide data to support this (EQ 1.3)

Article 6 permitting the tightening of fuel specifications in particular situations

- Article 6 derogation is considered by Member States to not be an efficient choice for reducing emissions in a local area in comparison to other available measures. This is because it is considered that it would be difficult to apply, and other measures of easier application are available (EQ 2.9).

Coherence

Generally, the FQD is found to be coherent with the remainder of the environmental policy acquis. Certain issues have been raised with regards to biofuels, concerning provisions within the FQD itself and in relation to the Renewable Energy Directive (RED).

Coherent elements

- The use of derogations under Articles 3 and 4, is coherent with the overall approach of the FQD and of other environmental legislation to ensure that no Member State is unduly penalised due to exceptional circumstances beyond their control (e.g. Outermost Regions, countries with low summer ambient temperatures) (EQ 3.10).
- The FQD is coherent with Directive 94/63/EC on stage I controls for the VOC emissions arising from the storage and distribution of petrol. The objectives of the FQD and Directive 94/63/EC are complimentary and both Directives aim to reduce harmful pollutants being released into the air (EQ 3.5).

- **Article 7** which provides for a safeguard in case of a disruption to the supply of crude oils is coherent with other environmental legislation which also contains safeguards to take into account circumstances outside the normal and outside the control of Member States (e.g. the Industrial Emissions Directive contains a similar safeguard) (EQ3.12).
- The monitoring and reporting requirements under **Article 8** are considered to be broadly coherent with those of other Directives and contribute to the overall aims of the Directive by encouraging compliance (EQ 3.13).
- **Article 9a** setting out the penalties regime is also coherent with the overall aims of the Directive and does not differ in key ways from the penalty regime of other environmental legislation (EQ3.15).

Less coherent elements

- The RED sets a target of 10% for the share of energy from renewable sources in transport by 2020 for each Member State. The FQD sets upper limits for bioethanol (10%) and FAME (7%) (Articles 3 and 4, Annexes I and II). Some Member States claim that it is not possible to meet the 2020 RED target through the use of these biofuels alone and that they will need to implement additional measures (e.g. use of Hydrotreated Vegetable Oil (HVO) which is not included in the 7% limit for FAME, using advanced biofuels that can be double-counted, or the electrification of transport). There is however no evidence to suggest that the blend walls for bio components in fuel established by the FQD would hamper meeting the RED target. In particular, currently Member States are still far from reaching full implementation of the upper limits set in the FQD (ICF et al 2015, EQ 3.5).
- The use of CN codes in Article 2 defining a minimum of 70% mineral oil, together with Article 4 which permits placing on the market of diesel containing greater than 7% FAME, would theoretically allow a FAME content in diesel of between 0% and 30% to fall within the scope of the Directive (higher blends could be marketed as well but are outside of the scope of the Directive). Since Article 3 does not allow an equivalent flexibility for the bioethanol content of petrol to exceed 10%, this represents a theoretical incoherence, which, however, is not of any practical implication.
- In practice, the flexibility provided by Article 4 is implemented in a very limited way. Only two Member States (France and the Netherlands) have transposed the flexibility provided for in Article 4 into their national legislation. Biodiesel with a FAME content up to 8% is currently placed on the market only in one Member State (France). In consultation for this evaluation, France indicated that one of the reasons for transposing this flexibility was to allow such an option as a possible means to achieve the RED targets, and Spain indicated it may consider taking a similar approach.
- Additionally the specifications of gas oil for Non-Road Mobile Machinery (NRMM) and e.g. inland waterway vessels are currently not fully coherent with the diesel specifications in the Directive, and some engine manufacturers consider that aligning the two would be beneficial and improve the single market (EQ 3.9).
- **Article 5** should ensure the free circulation of fuels, but the coherence issues described above show that Article 5 has not been able to fully deliver a single market: although Member States do not intentionally restrict the free circulation of compliant fuels, the differences in national implementation resulting in various biofuel grades create market barriers for certain compliant fuels (EQ 3.11).
- There are potential discrepancies between the FQD and Directive 2009/126/EC on Stage II controls at service stations. However, both Directives are considered

coherent in practice, as the process for allowing higher volatility petrol under the FQD takes into account the application of Stage II controls, and includes provisions for ensuring that VOC emission increases do not prevent Member States from meeting national and international emissions and air quality obligations (Articles 3 and 4, EQ 3.5 and 3.8).

- Other aspects of the specifications in Annexes I and II in relation to RON could also potentially lead to market fragmentation but the available data confirms that this has not yet been the case (EQ 3.5, 3.8).

Relevance

The Directive overall is still considered to be relevant and no articles are considered not to be relevant. The limitations placed upon petrol and diesel fuels by the FQD are still relevant to ensuring the health and environmental benefits of the FQD as well as promoting a single market for fuels within scope.

Relevant elements

Relevance of derogations (Articles 3 and 4)

- The FQD contains a significant number of derogations. Part of this assessment was to evaluate whether these derogations are still relevant at present. These derogations range from derogations for the fuel quality for the Outermost Regions of the EU (EQ 4.6, EQ 4.8) to more lenient specifications in the event of disruptions of supply (EQ 4.12).
- The derogation for Outermost Regions has been applied by Mayotte to date. France states that the derogation is still relevant and is allowing fuel supply to Mayotte to continue without incurring significant additional costs which would hamper the local economy (EQ 4.6, 4.8, 4.12).
- The derogation for vapour pressure is considered to still be relevant on the basis of the high number of applications to apply this derogation in recent years, and the supporting data included in the derogations which outlines the avoided costs to Member States (EQ 4.6).
- No Member State nor any of the other stakeholders contacted during this study proposes to delete or repeal the derogations on grounds of administrative or legislative burden or single market considerations (EQ 4.4, 4.5, 4.7, 4.9, 4.10, 1.7).
- **Article 8a** on the use of metallic additives is considered to still be relevant. Although Member States indicate that MMT would not be used even in the absence of the Article, the Article remains relevant as a safeguard.
- In relation to **Article 9a** on the setting of penalties, some Member States query whether it is necessary to have an Article at the EU level, considering that penalties could be dealt with at a national level. However its removal could contribute to competitive distortion across Member States, since there would be no driver to ensure the level of penalty setting is equivalent among them (EQ 4.16

EU-added value

Member States consistently state that a single market could not be delivered in the absence of the Directive (EQ 5.2), therefore the directive maintains EU–added value.

Positively evaluated elements

- The introduction of harmonised fuel specifications creates a strong intra-EU market for fuel suppliers and vehicle manufacturers. The harmonisation of fuel specifications has reduced the barriers to entry for EU and non-EU fuel suppliers, who can dedicate (part of) their plants to the refining of EU-specification compliant fuel or manufacturing of compatible vehicles, rather than focusing on one country or needing to comply with multiple specifications across different Member States (this excludes the issue of different biofuel blends which is discussed above).
- **Articles 3 and 4** are considered by most stakeholders to add value at the EU level by ensuring environmental and health protections (EQ) and by ensuring correct functioning of vehicle engines and after treatment systems (EQ 5.6). Most Member States consider that EU action was necessary in order to ensure the removal of leaded petrol from the EU.
- **Article 7** on temporary relaxation of fuel specification in the case of disruption to fuel supply is considered to add value at the EU level, as a safeguard in case of future disruption to the fuel supply (EQ 5.10).
- **Article 8a** in relation to MMT adds value by acting as a safeguard to ensure a limitation upon the use of MMT, strengthening the position of national level bans within the EU in the face of ongoing international use of MMT. It is not clear whether the EU-added value of the Article would be enhanced if it imposed a complete ban rather than the present 2mg limit (EQ 5.13).

Negatively evaluated elements

- Some stakeholders have called for more harmonisation which they consider would increase the overall EU-added value of the legislation Directive in relation to delivery of a single market.
- **Article 6** in relation to marketing of fuels with more stringent environmental specifications has not been used to date. Member States consider that this Article still has a purpose, however they also consider that it is cumbersome to implement and that other more easily accessible measures can be applied in the case that it is necessary to try to restrict emissions from a particular location (EQ 5.7).
- **Article 8 on monitoring and reporting** is assessed in a very mixed manner by stakeholders, with many considering that the value it delivers is not proportional to the administrative burden of reporting (EQ 5.11, EQ 5.12).
- **Article 9a** on penalties is considered to have limited added value, as Member States consider they can implement penalties at a national level. However this could lead to different levels of penalties being applied in different countries (EQ 5.15).

6.2 Areas for further consideration

Some points have been identified in the literature and through the stakeholder consultation which deserve further consideration. These relate to the functioning of the internal market.

The FQD does not harmonise all aspects of the internal transport fuel market and it allows certain margin for national measures. In principle, options towards greater harmonisation would include the following measures:

- Including higher blends of biofuels into the scope of the FQD;
- Introducing a protection grade for biodiesel;

- Introducing relevant CEN standards into the FQD.

However, there is currently no compelling evidence that national flexibilities provided by the FQD have led to severe market disruptions. In particular, higher blends of biofuels are produced for niche markets and limited to a few Member States. Also, limited improvement is expected by a potential inclusion of CEN standards into the FQD.

Further monitoring of the development of the internal transport fuels market should therefore be considered.

Appendix A
List of stakeholders consulted

Country	Organisation name	Contact Name
Member State competent authorities		
AT	BMLFUW - Federal Ministry of Agriculture, Forestry, Environment and Water Management	BACH, Heinz
CZ	Ministry of Trade and Industry of the Czech Republic	LIPTAKOVA, Darina
DE	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany	WONG-ZEHNPFENNIG, Stefanie
DK	Danish Environmental Protection Agency	JENSEN, Anne
EE	Ministry of the Environment	HEITUR, Heiko
FI	Ministry of the Environment	LAHTINEN, Tarja
FR	French Ministry of Ecology, Sustainable Development and Energy	n/a
HR	Ministry of Environmental and Nature protection	DOSEN, Gordan
LU	Administration of the Environment	WILTGEN, Claude
LV	Ministry of Environmental Protection and Regional Development	PLAVINSKIS, Janis
MT	Regulator for Energy and Water Services	GENUIS, Graziella
NL	Dutch Ministry of Infrastructure and Environment	ZWERVER, Albert
SE	Swedish Transport Agency & Swedish Energy Agency	AGREN, Ulrika
SK	Ministry of the Environment, Air protection department	VERESOVA, Andrea
SI	Ministry of the Environment and Spatial Planning	FERJANCIC, Matjaz
RO	Ministry of Energy	n/a
UK	Department for Transport	DOUGLAS, Hannah
Industry stakeholders		
AT	OMV Refining & Marketing GmbH	Not Provided
AT	Austria Petroleum Industry Association (APIA)	CAPEK. Christoph
BE	Transport & Environment	BUFFET, Laura
BE	Alliance for Synthetic Fuels in Europe (ASFE)	LUCHMAN, Jenna
BE	Fuels Europe	LEUCKX, Daniel
BE, FR, DE, NL, UK	Anonymous	Anonymous
BG	LUKOIL Neftohim Burgas	Not Provided
BG	Bulgarian Petroleum and gas association	Not Provided
DE	Association of the German Biofuel Industry (VDB)	DAUM, Johannes
DE	TOTAL Deutschland GmbH	MAYER, Uwe
DE	OMV Deutschland GmbH	Not Provided
DE	Refinery Heide	NIEBLER, Sandra
DE	German oil industry association (Mineralölwirtschaftsverband e.V.)	WINKLER, Michael
DE	Verbio Vereinigte Bioenergie AG	SAUTER, Claus

Country	Organisation name	Contact Name
DK	Danish Oil Industry Association	MÜCKE JENSEN, Michael
EL	Agroinvest SA	FAVVATAS, Argirios
ES	APPA Biocarburantes	BUSTOS, Manuel
ES	Bio-Oils Energy S.A.	SCHMID. Christoph
ES	Asociación Española de Operadores de Productos Petrolíferos (AOP)	Not Provided
EU	Inland Navigation Europe (INE)	DE SCHEPPER, Karin
EU	UPEI : Union of European Petroleum Independents	Not Provided
EU	TOTAL S.A.	Not Provided
EU	European Biodiesel Board	GAROFALO, Raffaello
EU	ePURE	WRIGHT, Robert
EU	EFOA - European Fuel Oxygenates Association	SCHONBACH, Claire
EU	Ethanol Europe	ZUBAREV, Vadim
EU	BirdLife Europe	ERÄJÄÄ, Sini
EU	EEB	Not Provided
EU	Oxfam International	HERMAN, Marc-Olivier
EU	ACEA	GREENING, Paul
EU, Other	EUROMOT	SCHERM, Peter
FI	Nesté	Not Provided
FR	INEOS	DUFRENOY, Bertran
FR	French petroleum industry association, UFIP (Union française des industries pétrolières)	Not Provided
FR, Other	Centre Ouest Céréales	GIBIER, Lionel
HU	Hungarian Petroleum Association	GYÖRGY, Wilde
IT	Unione Petrolifera	Not Provided
IT	Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec	FILIPPINI, Fabrizio
LT	Statoil Fuel & Retail Lietuva, UAB	Not Provided
NL	Netherlands Petroleum Industry Association (VNPI)	SPIERINGS, Anton
PL	Polish Organisation of Oil Industry and Trade	Not Provided
PT	Portuguese oil industry association (APETRO- Associação Portuguesa de Empresas Petrolíferas)	ALBUQUERQUE, Guido
SE	The Swedish Petroleum & Biofuels Institute	Not Provided
SE	SCANIA engines	Not Provided
SK	Slovak Association for the production and use of biofuels (Združenie pre výrobu a využitie biopalív)	BREZINOVA, Zuzana
SK	Slovak Association of Petroleum Industry and Trade	ARVENSIS, Andrej
UK	Anonymous	Anonymous
UK	Afton Chemicals Limited	FENZI. Elisa
UK	Greenergy Fuels Ltd.	LYNCH, Patrick
UK	Forecourt Equipment Federation	DUNN-MEYNELL, Crispin

Classification of industry stakeholders

Industry stakeholders			
Country	**Sub-sector**	**Organisation**	**Members of**
BE	Fossil fuel manufacturers and suppliers	Fuels Europe	
EU	Fossil fuel manufacturers and suppliers	TOTAL S.A	Fuels Europe
AT	Fossil fuel manufacturers and suppliers	OMV Refining & Marketing GmbH	Fuels Europe
BG	Fossil fuel manufacturers and suppliers	LUKOIL Neftohim Burgas	Fuels Europe
DE	Fossil fuel manufacturers and suppliers	TOTAL Deutschland GmbH	Fuels Europe
DE	Fossil fuel manufacturers and suppliers	OMV Deutschland GmbH	Fuels Europe
DE	Fossil fuel manufacturers and suppliers	Refinery Heide	Fuels Europe
LT	Fossil fuel manufacturers and suppliers	Statoil Fuel & Retail Lietuva, UAB	Fuels Europe
AT	Fossil fuel manufacturers and suppliers	Austria Petroleum Industry Association (APIA)	Fuels Europe & CONCAWE (National Association)
BG	Fossil fuel manufacturers and suppliers	Bulgarian Petroleum and gas association	Fuels Europe & CONCAWE (National Association)
DE	Fossil fuel manufacturers and suppliers	Mineralölwirtschaftsverband e.V. - Petroleum industry ev	Fuels Europe & CONCAWE (National Association)
DK	Fossil fuel manufacturers and suppliers	Danish Oil Industry Association	Fuels Europe & CONCAWE (National Association)
ES	Fossil fuel manufacturers and suppliers	Asociación Española de Operadores de Productos Petrolíferos (AOP)	Fuels Europe & CONCAWE (National Association)
HU	Fossil fuel manufacturers and suppliers	Hungarian Petroleum Association	Fuels Europe & CONCAWE (National Association)
IT	Fossil fuel manufacturers and suppliers	Italian petroleum industry association - Unione Petrolifera	Fuels Europe & CONCAWE (National Association)
PL	Fossil fuel manufacturers and suppliers	Polish Organisation of Oil Industry and Trade	Fuels Europe & CONCAWE (National Association)
PT	Fossil fuel manufacturers and suppliers	APETRO- Associação Portuguesa de Empresas Petrolíferas	Fuels Europe & CONCAWE (National Association)
SK	Fossil fuel manufacturers and suppliers	Slovak Association of Petroleum Industry and Trade	Fuels Europe & CONCAWE (National Association)
FR	Fossil fuel manufacturers and suppliers	UFIP - Union Française des Industries pétrolières	Fuels Europe & CONCAWE (National Association)
NL	Fossil fuel manufacturers and suppliers	VNPI - Netherlands Petroleum Industry Association	Fuels Europe & CONCAWE (National Association)
UK	Fossil fuel manufacturers and suppliers	Anonymous	

Industry stakeholders			
Country	**Sub-sector**	**Organisation**	**Members of**
EU	Fossil fuel manufacturers and suppliers	UPEI : Union of European Petroleum Independents	
FR	Fossil fuel manufacturers and suppliers	INEOS	
FI	Fossil and biofuel manufacturers	Nesté	European Biodiesel Board, Fuels Europe
SE	Fossil and biofuel manufacturers	The Swedish Petroleum & Biofuels Institute	
UK	Fossil and biofuel manufacturers	Greenergy Fuels Ltd.	
FR, Other	Biofuel industry (manufacturers or industry association)	Centre Ouest Céréales	European Biodiesel Board
DE	Biofuel industry (manufacturers or industry association)	Verbio Vereinigte Bioenergie AG	European Biodiesel Board
EL	Biofuel industry (manufacturers or industry association)	AGROINVEST SA	European Biodiesel Board
ES	Biofuel industry (manufacturers or industry association)	APPA Biocarburantes	European Biodiesel Board
ES	Biofuel industry (manufacturers or industry association)	Bio-Oils Energy S.A.	European Biodiesel Board
EU	Biofuel industry (manufacturers or industry association)	European Biodiesel Board	European Biodiesel Board
EU	Biofuel industry (manufacturers or industry association)	ePURE	
EU	Biofuel industry (manufacturers or industry association)	Ethanol Europe	
IT	Biofuel industry (manufacturers or industry association)	Gruppo Fonti Rinnovabili (GFR) of Federchimica-Aispec	
SK	Biofuel industry (manufacturers or industry association)	Slovak Association for the production and use of biofuels (Združenie pre výrobu a využitie biopalív)	
DE	Biofuel industry (manufacturers or industry association)	Association of the German Biofuel Industry (VDB)	
BE, FR, DE, NL, UK	Biofuel industry (manufacturers or industry association)	Anonymous	
EU	Fuel additive manufacturers	EFOA - European Fuel Oxygenates Association	
EU	Fuel additive manufacturers	Afton Chemicals Limited	
EU, Other	Engine manufacturers	EUROMOT	
SE	Engine manufacturers	SCANIA ENGINES	
EU	Engine manufacturers	ACEA - European automobile manufacturers association	
UK	Forecourt equipment manufacturers	Forecourt Equipment Federation	
EU	NGO	BirdLife Europe	
EU	NGO	Oxfam International	
BE	NGO	Transport & Environment	
EU	NGO	EEB - European Environment Bureau	
BE	Other	Alliance for Synthetic Fuels in Europe (ASFE)	
EU	Other	Inland Navigation Europe (INE)	

Appendix B
List of contacts approached

The tables below list all the contacts who were invited, by email, to respond to the questionnaire in regards to the evaluation of the FQD.

One email was sent in late August 2015 and one further reminder sent in September 2015, inviting them to respond to the questionnaire online, including a link to the questionnaire and the introductory letter from the Commission in regards to the evaluation project.

Member States and stakeholders which replied either to the questionnaire or the follow-up interviews later are excluded.

Member State contacts

Country	Organisation name	Contact Name
Member State competent authorities		
BE	SPF Santé publique, Sécurité de la chaîne alimentaire et Environnement	Michel Degaillier
BE	Agence wallonne de l'Air et du Climat (AWAC)	Camille Vercruysse
BE	Flemish Environment, Nature and Energy Ministry	David KNIGHT
BG	Ministry of Environment and Water	Ms. Elena Yakimova
CY	Ministry of Labour and Social Insurance	George P. Georgiou
EL	Ministry for transport	Mr. Aristomenis Skillakos
EL	Ministry of environment	Secretariat contact
HU	Ministry of Agriculture	Viola PARÁSZKA
IE	Department of the Environment, Community and Local Government	Gary Mc Guinn
LT	Ministry of Energy	Vytautas Aršauskas
PT	Direção Geral de Energia e Geologia	Eng.º Carlos Oliveira
SK	Ministry of the Environment of the Slovak Republic	Andrea Veresova

Industry stakeholders

Country	Organisation name	Type of organisation	Contact name
Industry stakeholders			
European	Cefic - European Chemical Industry Council	EU Association	Claire Schonbach
European	European Confederation of Fuel Distributors (ECFD)	EU Association	Johan Mattart
European	AECC	EU Association	John May
European	Committee for European Construction equipment (CECE)	EU Association	Stephan Belaen
European	European Materials Handling Federation (FEM)	EU Association	Olivier Janin
European	All-terrain Vehicle Industry European Association (ATVEA)	EU Association	Secretariat
European	European Barge Union (EBU)	EU Association	Theresia K. Hacksteiner

Country	Organisation name	Type of organisation	Contact name
European	Committee of European Manufacturers of Petroleum Measuring and Distributing Equipment (CECOD)	EU Association	?
European	European Confederation of Fuel Distributors (ECFD)	EU Association	Johan Mattart
World	International Association of Oil and Gas Producers (IOGP)	World association	Alessandro Torello
World	International Association of Oil and Gas Producers (IOGP)	World association	Caterina De Matteis
DE	Verband Deutscher Verkehrsunternehmen	National association	Daniel Brand
FR	Federation Nationale d'Entraide aux Conducteurs (France)	Consumer and drivers association	
UK	RAC	Consumer and drivers association	Pete Williams
International	World Petroleum Council (WPC)	International platform	http://www.world-petroleum.org
BE	Union Pétrolière Belge ASBL	National oil association	Dhr. Joris Schoofs
CZ	Czech Association of Petroleum Industry and Trade (ČAPPO)	National oil association	Ing. Jan Mikulec, CSc. (Assistant: Ing. Milada Šmahová)
CZ	"Unie Nezávislých Petrolejářů ČR, z.s. (Union of the Czech Petroleum Independents)	National oil association	info
DE	UNITI federal association of medium-sized oil companies	National oil association	Andreea-Corina Chivaran
EE	Estonian Oil Association (EE)	National oil association	
EL	Hellenic Petroleum Marketing Companies Association (GR)	National oil association	
EL	Helenic petroleum	Oil company	George Alexopoulos
ES	Abengoa	Company	Tom Gameson
ES	CEPSA	Oil company	Encina Benavente
FI	Finnish Petroleum and Biofuels Association	National oil association	Mr. Pekka Huttula
FI	Finnish Petroleum and Biofuels Association	National oil association	Tina Sammi
HR	Croatian Chamber of Economy, Industry and Technology Department	industrija@hgk.hr	industrija@hgk.hr
IE	IPIA (Irish Petroleum Industry Association)	National oil association	Michael Forde
LU	Groupement Pétrolier Luxembourgeois	National oil association	
LV	Latvian Fuel Traders Association (LV)	National oil association	
NL	Shell Nederland BV	Oil company	Henk Vasmel
NL	ARGOS	Oil company	René Kleijntjens
NL	Shell Nederland BV	Oil company	Emile Dalebout
RO	ARP - Asociatia Romana a Petrolului	National oil association	CRISTINA NECULAI

Country	Organisation name	Type of organisation	Contact name
SK	SAPPO - Slovak Association of Petroleum Industry and Trade	National oil association	Ing. Bc. Andrej Arvensis
UK	Energy Insitute	National oil association	Marta Kozlowska
UK	UK Petroleum Industry Association (UKPIA) (UK)	National oil association	Ron Murray / Chris Hunt
UK	Petrol Retailers Association (UK)	National oil association	Phil Monger
UK	Valero	Oil company	Neil White
UK	BP	Oil company	Phil Lambeth
UK	Essar UK Oil Limited	Oil Company	Alan Graves
UK	Exonnmobile	Oil company	Ian Althorp
UK	Phillips 66	Oil company	Alison Walker
UK	Caterpillar/finning	NRMM	Dave Gargett
UK	PetroIneos	Oil Company	Jacqueline Lobban
UK	PetroIneos	Oil Company	Christopher Gould
DE	BOSCH global / Bosch automotive*		Bernhard Schwager

*BOSCH were not contacted at the questionnaire stage, rather they were contacted later, at the follow-up interview stage in December 2015.

Other stakeholders

Country	Organisation name	Contact name
UK	RAC	Pete Williams
European	Friends of the Earth - Europe	info@foeeurope.org
European	European Committee for Standardisation (CEN)	Mrs Andrea Nam
European	European Committee for Standardisation (CEN)	Mr Thierry Legrand
World	ISO standards	central@iso.org
European	European Commission – Joint Research Centre	Panagiota Dilara
European	European Environment Agency	Alberto GONZÁLEZ ORTIZ
European	European Environment Agency	Diana VEDLUGAITE
European	European Environment Agency	Valentin Leonard FOLTESCU
European	Baltic Environmental Forum	Dania Indriksone
European	FIA foundation (European association of national driver associations)	Sheila Watson
International	International Energy Agency (working with OECD)	info@iea.org
International and European	The International Council on Clean Transportation	Chris Malins
DE	TÜV-Süd	info@tuev.sued.de
SE	Air Pollution & Climate Secretariat	Christer Ågren

Appendix C
Bibliography

C.1 EU Legislation/ Communications

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for petrol pursuant to Article 3(4) and (5) of Directive 98/70/EC relating to the quality of petrol and diesel fuels as amended by Directive 2009/30/EC

C.2 Literature

C.2.1 Commission studies on the Directives

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Appendix D
Glossary of terms

ACEA	European Automobile Manufacturers' Association.
AECC	Association for Emissions Control by Catalyst.
AQIRP	Air Quality Improvement Research Plan.
BAU	Business as usual. Relates to projected activity, emissions, etc. with currently implemented policies and measures in place.
Bioethanol	Ethanol produced from plants, used as an alternative to petrol.
Biofuel	Liquid or gaseous fuel for transport produced from biomass.
Biofuels Directive	Directive 2003/30/EC on Biofuels, replaced by 2009/28/EC.
CEN	European Committee for Standardisation.
CLEPA	European Association of Automotive Supplier.
CN Code	Combined Nomenclature Code. Used to demonstrate customs compliance.
CONCAWE	European Oil Company Organisation for Environment, Health and Safety.
Derogation	A relaxation of EU legislation under permissible circumstances.
E5 and E10	Blends of fuel containing 5% or 10% ethanol respectively.
EN	European Standard, mandated by CEN.
EN 590 and 228	European standards on unleaded petrol and diesel fuel.
EU	European Union. EU28 includes the 28 current Member States.
Euro 5 and Euro 6	Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles and on access to vehicle repair and maintenance information.
EUROMOT	The European Association of Internal Combustion Engine Manufacturers.
ETBE	Ethyl tertiary butyl ether
FAME	Fatty Acid Methyl Esters.
FQD	Directive 98/70/EC on fuel quality as amended.
GHG	Greenhouse Gas.
IED	Directive 2010/75/EU on industrial emissions.
Kg	Kilogram.
kPa	KiloPascals (Pascals x 10^3).
n/a	Not applicable.
NO_X	Oxides of Nitrogen.
Mg	Milligram.

MMT	Methyl Cyclopenta Dienyl Manganese Tricarbonyl. A metallic fuel additive that increases octane rating.
MS	Member State of the EU.
MTBE	Methyl tertiary butyl ether
NGO	Non-governmental Organisation.
NRMM	Non-road mobile machinery.
OICA	International Organisation of Motor Vehicle Manufacturers.
PAHs	Polycyclic aromatic hydrocarbons.
PPM	Parts per million.
RED	Renewable Energy Directive 2009/28/EC.
RON	Research Octane Number
Stage I	Recovery of petrol vapours during petrol storage and loading at terminals/refineries (Stage IA) and during filling of storage tanks at service Stations (Stage IB).
Stage II	Recovery of petrol vapours during refuelling of vehicles at service stations.
Stage IIIB Standards	Emissions standards for non-road diesel engines.
UFIP	French petroleum industry association
UPEI	European independent fuel suppliers association
Vapour	Taken to mean any gaseous compound which evaporates from petrol.
VOC	Volatile organic compound. Defined as any organic compound as well as the fraction of creosote, having at 293,15K a vapour pressure of 0,01kPa or more, or having a corresponding volatility under the particular conditions of use (definition from Directive 2010/75/EU).
V/V	Percentage volume per volume.
Worldwide Fuel Charter	Publication by ACEA on global fuel quality.

Appendix E
Summary of Articles

A summary of the Articles evaluated by this project and the aims of each:

- **Article 1** of the FQD confirms the Directive's objectives and clearly indicates that the scope of the FQD is not limited to road vehicles, but also includes non-road mobile machines, inland waterway vessels (when not at sea), recreational crafts and tractors. Fuels used by sea going ships (regulated under Directive 1999/32/EC and its amendments) and aviation are not covered by the FQD.
- The definitions in **Article 2** support establishing a harmonized single fuel market.
- **Article 3** ensures that petrol in the EU is generally lead free and sulphur free (<10 ppm). Fuel may contain up to 10% v/v ethanol and up to 3.7 % m/m oxygen content and fulfils octane, vapour pressure, distillation and specific hydrocarbon requirements. Special derogations were introduced to facilitate the introduction of this petrol standard: for outermost regions, for Member States with low ambient summer temperatures, for very limited quantities of leaded fuel and an ethanol vapour pressure waiver. Most derogations are accompanied by additional conditions and notification obligations.
- As some older vehicles are not capable of handling petrol with up to 10% ethanol (E10), the continued supply of petrol with up to 5% ethanol (E5) was ensured for a transitional period with an appropriate geographical coverage. The transitional period was originally foreseen to end in 2013, with the possibility of extension. E5 and E10 are to be marked adequately.
- Article 4 ensures that diesel for road vehicles in the EU is generally sulphur free (<10 ppm), may contain up to 7% v/v FAME and up to 8% m/m polycyclic aromatic hydrocarbons and fulfils cetane, distillation and density requirements. For the outermost regions and Member States with severe winter conditions special derogations apply. As of the end of 2011 all transitional periods have expired and gas oil for use in non-road mobile machinery, inland waterway vessels, tractors and recreational crafts should be sulphur free. The CN code and the sulphur content are the only requirements for gas oil in the FQD.
- **Article 5** ensures the free circulation of fuels which comply with the FQD specifications.
- **Article 6** enables the marketing of fuels that comply with more stringent environmental specifications, but only with a view to protecting the health of the population in a specific agglomeration or the environment in a sensitive area.
- **Article 7** is a general safeguard to prevent any disruptions of fuel supply to the transportation sector in case refineries cannot comply with the fuel specification due to an exceptional event.
- **Article 8** is on the monitoring and reporting requirements of both Member States and Commission. The annual reports are a valuable source of information on the implementation and achievements of the FQD.
- **Article 8a** limits the use of metallic additive MMT and requires labelling in case MMT or any other metallic additive is applied.
- **Article 9** contains the Commission's obligation to submit every three years a report to Parliament and Council on the functioning of the FQD. Continuing technical progress in the fields of automotive and fuel technology coupled with the continuing desire to ensure that the level of environmental and health protection is optimised necessitate periodic review of the fuel specifications based upon further

studies and analyses of the impact of additives and biofuel components on pollutant emissions.

- **Article 9a** requires Member States to set penalties for the breach of the provisions of the FQD.

Appendix F
Analytical framework

The objectives of the Fuel Quality Directive are to:

- Ensure a single market for diesel and petrol fuels across the EU;
- Ensure minimum levels of environmental and health protection (this includes petrol and diesel fuels being generally lead and sulphur free, meeting cetane etc levels as specified in Articles 3 and 4).

The table below summarises the Evaluation Questions formulated for each Article, following the five evaluation themes.

	Effectiveness	Efficiency	Relevance	Coherence	EU-added value
Article 1	✓	✓	✓	✓	✓
Article 2	✓	✓	✓	✓	✓
Article 3	✓	✓	✓	✓	✓
Article 4	✓	✓	✓	✓	✓
Article 5	✓		✓	✓	
Article 6	✓	✓	✓		✓
Article 7	✓	✓	✓	✓	✓
Article 8	✓	✓		✓	✓
Article 8a	✓		✓		✓
Article 9	✓		✓	✓	✓
Article 9a	✓	✓	✓	✓	✓

E.1 EFFECTIVENESS

The evaluation of the effectiveness of the Regulation will be carried out based on a set of evaluation criteria, indicators and questions as described above. The objectives of the Fuel Quality Directive are to:

- Ensure a single market for diesel and petrol fuels across the EU;
- Ensure minimum levels of environmental and health protection (this includes petrol and diesel fuels being generally lead and sulphur free, meeting cetane etc. levels as specified in Articles 3 and 4).

The Fuel Quality Directive does not operate in a vacuum, rather within the context of other existing Directives. Therefore it is important that the assessment of effectiveness takes this into account.

Overarching question	
EQ 1	How well does progress towards the objectives of the Fuel Quality Directive match the initial expectations for this directive?
Article 1	
EQ 1.1	**Are the objectives of the Directive sufficiently reflected in the scope of the FQD?**
Judgement Criteria	Assessment of whether the objectives are fully reflected in the scope
Indicators	Comments from stakeholders indicating that this is not the case. Public statements from industrial associations pointing out that this is not the case.
Method	Qualitative and quantitative assessment of the consultation responses from relevant stakeholders.
Sources	Consultation with relevant stakeholders, including Competent Authorities, industry stakeholders and others such as NGOs
Comments	The single market is not mentioned in the scope
EQ 1.2	**Has the FQD been effective in reducing transport emissions?**
EQ 1.3	**Does the FQD ensure a single market? Are there potential improvements if the scope was changed?**
EQ 1.4	**Does the FQD ensure the proper functioning of engines and emissions after treatment systems?**
Judgement Criteria	That there are clear indicators of progress on the objectives and that there is understanding of the contribution that the Fuel Quality Directive has made to each and of other factors.
Indicators	Quantitative and qualitative indicators for the objectives such as whether the proportion of petrol and diesel fuel which meets the specification of Articles 3 and 4 has increased (since baseline 2009). Commentary on the role of the Fuel Quality Directive in achieving this. Commentary on the impact of the Fuel Quality Directive on the functioning of engines and emission after treatment systems
Method	Quantitative and qualitative analysis. Analysis of the literature and data for the objectives, for example analysis of trends in time in the proportion of fuels supplied which meet the environmental criteria. Analysis of stakeholder consultation responses in regards to the effectiveness of the FQD. In relation to the success of a single market, stakeholder consultation qualitative responses will be key. Stakeholder responses on the impact of the Fuel Quality Directive on the functioning of engines will the analysed.
Sources	Member State annual reports on FQD, together with Commission reports. Review of relevant literature sources Consultation with Competent Authorities and industry stakeholders.
Comments	Identifying change in the two objectives will vary. Declines in pollutant emissions are measurable and quantifiable, but the assessment of whether a single market has been achieved will require a qualitative assessment.
Article 2	
EQ 1.5	**Does the use of CN-codes contribute to establishing a single fuel market? Should additional definitions or codes be used?**
Judgement Criteria	Assessment of whether the use of CN-codes is appropriate, or whether the use of different codes would strengthen the single market.

Indicators	Qualitative indicators regarding the use of CN indicators
Method	Qualitative assessment
Sources	Consultation with relevant stakeholders, including MS Authorities and industry stakeholders
Article 3	
EQ 1.6	Is the petrol fuel placed on the market in compliance with the specifications of Annex I of the Directive?
Judgement Criteria	Evidence showing what proportion of petrol sold meets the specifications of the Directive
Indicators	Petrol fuel specifications and related sales information
Method	Quantitative analysis of consultation responses from relevant stakeholders, including Competent Authorities, fuel manufacturers and suppliers. Quantitative analysis of data from Member State annual FQD reports
Sources	Consultation with relevant stakeholders, including Competent Authorities and industry stakeholders Member State annual reports and annual summary reports published by Commission
Comments	-
EQ1.7	Have the derogations in Article 3 been effective?
Judgement Criteria	Evidence of the derogations being used in the relevant time period, stakeholder support for the derogations being kept
Indicators	Examples of the derogations being used. Stakeholders view on whether derogations are useful, are necessary
Method	Qualitative analysis of stakeholder consultation responses
Sources	Consultation of relevant stakeholders including industry
Comments	
Article 4	
EQ1.8	Is the diesel fuel placed on the market in compliance with the specifications of Annex II of the Directive?
Judgement Criteria	Evidence showing what proportion of diesel sold meets the specifications of the Directive
Indicators	Diesel fuel specifications and related sales information
Method	Quantitative analysis of consultation responses from relevant stakeholders, including Competent Authorities, fuel manufacturers and suppliers. Quantitative analysis of data from Member State annual FQD reports
Sources	Consultation with relevant stakeholders, including Competent Authorities and industry stakeholders Member State annual reports and annual summary reports published by Commission
Comments	

Article 5		
EQ 1.9	Where there any cases of MS States prohibiting, restricting or preventing marketing of fuels complying with the Directive?	
Judgement Criteria	Evaluation of frequency of occurrence of any of the exceptions listed in the question (prohibition, restriction of preventing markets of fuels complying with the Directive)	
Indicators	List of derogations requested by Member States	
Method	Qualitative analysis of information obtained from stakeholders and the Commission	
Sources	Stakeholder consultation, Commission data sources	
Comments		
Article 6		
EQ 1.10	What environmental gains have been achieved by this Article (which allows MS to require some fuels to meet more stringent environmental specifications)	
Judgement Criteria	Evidence showing a reduction in pollutant emissions in countries which have availed themselves of this Article	
Indicators	Indications of the reduction in pollutant emissions due to the Article	
Method	Quantitative analysis Indicative calculations using data from recent academic and technical work on engine and fuel technology in the EU, data gathered under 'Relevance' and data on fuel sales	
Sources	Consultation of stakeholders including Competent Authorities and fuel manufacturers/suppliers Review of MS annual reports	
Comments		
Article 7		
EQ 1.11	Has the application of Article 7 ensured a supply of fuel following exceptional events which would otherwise have led to the loss of supply?	
EQ 1.12	Have Member States resumed compliance with lower limits after the 6 month derogation periods?	
Judgement Criteria	Evidence indicating that the application of Article 7 was necessary to ensure security of supply	Data on fuel quality and specifications in the period following application of Article 7
Indicators	Evidence of continuous fuel supply in the country / absence of interruption to fuel supply	Data on fuel quality in petrol and diesel after the 6 month interval (regarding Annex II and III respectively)
Method	Qualitative and quantitative analysis.	
Sources	Information in MS press Data from industry publications Consultation of relevant stakeholders Review of Member States annual reports	Consultation of relevant stakeholders Extraction of costs data from databases (Eurostat) Extraction of emission data from databases (LRTAP
Comments		
EQ 1.13	What are the impact on health and the environment of this Article?	
Judgement Criteria	Data indicating changes in pollutant emissions in countries which have applied for a derogation under this Article, together with evidence of the link between the derogation and the change if available	

Indicators	Number of times Article 7 has been used, or number of authorisations granted under this Article Diesel and petrol fuel specifications and related sales information
Method	Qualitative and quantitative analysis. Quantitative analysis of fuel specification and related sales information in countries which have applied for an authorisation under Article 7, compared to a baseline of countries which have not.
Sources	Consultation with relevant stakeholders, including Competent Authorities, fuel manufacturers Review of Member State annual reports
Article 8	
EQ 1.14	Has the reporting of MS been useful to reduce health and environmental impacts from fuels used in transport?
Judgement Criteria	Evidence to indicate that the reporting requirement has reduced impacts from fuels used in transport
Indicators	Number of MS reporting Emissions of sulphur, NO_X and PM from transport Evolution of catalyst equipment Commentary from stakeholders
Method	Quantitative and qualitative analysis
Sources	LRTAP Review of Commission annual reports on FQD
Article 8a	
EQ 1.15	Would the use of MMT be any different without this Article, and what would be the impacts of this?
Judgement Criteria	Evidence to indicate that the use of MTT would be different if the Directive was not in place Assessment of impact of the Article in relation to the use of MMT
Indicators	Examples of MMT being used, or not being used due to the Directive
Method	Qualitative analysis of data obtained from stakeholder consultation
Sources	Engagement with relevant stakeholders, including Competent Authorities and industry organisations regarding the frequency of use of MTT
Comments	
Article 9	
EQ1.16	Has the reporting and proposal as required by this Article resulted in a better understanding of the impacts of the Directive and how it could be further developed?
Judgement Criteria	Evidence indicating that the reporting requirements translate into a better understanding of the Directive Assessment of stakeholder responses/opinion regard the role or Article 9 within the Directive overall
Indicators	Commentary and examples regarding the impact of the reporting
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities, car manufacturers and fuel manufacturers/suppliers
Comments	

Article 9a	
EQ 1.17	Have penalties for not meeting the Directive have been imposed by Member States?
Judgement Criteria	Data on the number of penalties issues in relation to non-compliance with the Directive
Indicators	Overview of penalties imposed
Method	Quantitative assessment (on number of penalties imposed), together with qualitative assessment (on responses of stakeholders in relation to the usefulness of the penalty system)
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member State annual reports
Comments	

E.2 EFFICIENCY

EQ 2.1	Has the Directive delivered its objectives in an efficient manner?
Judgement Criteria	Identifying evidence to show that single market would exist in the absence of the Directive
Indicators	Responses from stakeholders indicating that Member States go beyond the FQD. Fuel supplied under CEN specifications rather than FQD. Member States use derogations
Method	Assessment of amount of fuel delivered in non-mandatory MS under CEN specifications. Assessment of the use of derogations, in comparison to the EU total.
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
Comments	
Article 2	
EQ 2.2	**Have the definitions contributed to the clear implementation of the FQD?**
Judgement Criteria	Evidence or examples to indicate the definitions have helped to implement the Directive
Indicators	Qualitative indicators regarding the use of CN indicators
Method	Qualitative assessment
Sources	Consultation with relevant stakeholders, including MS Authorities and industry stakeholders
Article 3 and 4 (the same questions will be assessed separately for each Article if appropriate)	
EQ 2.3	What the costs arising from the restrictions on petrol and diesel fuel that can be placed on the market ?
EQ 2.4	What are the benefits arising from the restrictions on petrol and diesel fuel that can be placed on the market?
EQ 2.5	Are the costs arising from the restrictions of petrol and diesel fuel that can be placed on the market justified in light of the benefits?
Judgement Criteria	Analysis or data indicating that the costs arising from the implementation of the Directive are proportional to the benefits accrued from it
Indicators	Costs for fuel producers and manufacturers to adapt to specifications Costs for automobile manufacturers to adapt vehicles to petrol fuel specifications Benefits for environment (emissions of sulphur from transport) Benefits for vehicle longevity (catalyst equipment life time)
Method	Quantitative and qualitative assessment of costs versus benefits
Sources	Consultation with relevant stakeholders Extraction of costs data from databases (Eurostat) Extraction of emission data from databases (LRTAP emission database hosted by EEA) Review of Member States annual reports
Comments	Consider also the potential costs of loosening such limits in terms of loss of standardisation across the sector and consequent deterioration in the types of products, including cars placed on the market. It is important to acknowledge that the limits that exist in the EU limit the import of more polluting vehicles and engines from countries with lower standards. EU manufacturers of engines that are designed to use EU fuels are at an advantage in comparison to others.
EQ 2.6	What are the costs arising from the application of the derogations?
EQ 2.7	What are the benefits arising from the application of derogations?
EQ 2.8	Have the costs outweighed the benefits in the application of derogations?

	In particular with regards to the derogation for the Outermost Regions?
Judgement Criteria	Data on the costs arising from the application of derogations, and data on the benefits arising from these. Data indicating that the costs of the derogations have been smaller than the benefits. If sufficient quantitative data is not available to allow an evaluation, opinions from stakeholder responses will be relied upon
Indicators	Costs of the administrative burden, cost to society of the additional amount of emissions. Economic benefit of the application of the derogation
Method	Analysis of emissions data and cost data on administrative burden
Sources	Emissions data from the countries that have applied the derogation, estimation of the damage costs of the additional emissions, review of MS annual reports. Possibly review of MS applications for derogations (if available)
Article 6	
EQ 2.9	Could the environmental gains achieved by this Article have been met against lower costs?
Judgement Criteria	Evidence showing a reduction in pollutant emissions in countries which have availed themselves of this Article
Indicators	Additional fuel costs Benefits in terms of emission reductions Other costs and benefits
Method	Quantitative (if possible) and qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports Consultation of relevant Member States
Comments	
Article 7	
EQ 2.10	Has the authorisation to use higher limits in case of change in supply of crude oils been justified in terms of costs?
Judgement Criteria	Judgement on whether the costs incurred in case of application of Article 7 are commensurate with the benefits (through not losing security of supply). This assumes that without Article 7 security of supply would be lost
Indicators	Benefits to the environment (emissions of sulphur from transport) Cost data for fuel producers and fuel manufacturers rising as a result of the application of Article 7
Method	Qualitative and quantitative analysis
Sources	Consultation of relevant stakeholders Extraction of costs data from databases (Eurostat) Extraction of emission data from databases (LRTAP)
Comments	

Article 8	
EQ 2.11	Are the monitoring and reporting obligations included in the FQD cost efficient?
Judgement Criteria	Data indicating that the monitoring and reporting obligations of the Directive are proportional to the benefits accrued from the Directive, and not disproportionately more onerous than those of other Directives
Indicators	Costs of MS collecting data on fuel quality Benefits for environment of the FQD (emissions of sulphur from transport) Benefits for vehicle longevity of the FQD (catalyst equipment life time)
Method	Qualitative and quantitative (if possible) analysis
Sources	Consultation of relevant stakeholders Extraction of costs data from databases (Eurostat) Extraction of emission data from databases (LRTAP emission database hosted by EEA) Review of Member States annual reports
Comments	Where possible contrast with the costs of Member State reporting under other EU legislation.
Article 9a	
EQ 2.12	Could the Directive be effectively enforced against lower costs?
Judgement Criteria	Opinions from industry strongly suggest Directive could be enforced against lower costs
Indicators	Little evidence of penalties being used – indicating penalties themselves potentially not necessary Commentary / opinion from industry suggesting lower penalties could be sufficient
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers

E.3 COHERENCE

EQ 3.1	**Is the Directive coherent with other Directives and EU policies? (see below)**
Article 1	
EQ 3.2	Is the scope of the Directive clear? Is it coherent with other Directives in terms of fuels covered in each of them?
Judgement Criteria	Opinions from industry and authorities stating that what the Directive covers is clear. Opinions from authorities and industry claiming that certain types of fuels are redundant or not covered by the different legal instruments that exist
Indicators	Positive and negative responses. Commentary from stakeholders providing evidence that there are redundant or contradictory requirements on the same fuel in another Regulation that they have to comply with. Also, evidence that a fuel that they consider relevant is not covered by the FQD or any other legislation
Method	Qualitative analysis of the responses obtained. As part of the review of the Member States annual reports, attention will be paid to identify whether any issues have been reported with regard to this
Sources	Consultation with stakeholders, Member State annual reports on FQD Review of relevant literature sources Consultation with Competent Authorities and industry stakeholders.
EQ 3.3	Is the limitation to health and environment in the scope of the FQD coherent with long term ambition on climate policy and air quality?

Judgement Criteria	Assessment of whether the FQD is consistent with current air quality and climate policy
Indicators	Comments from stakeholders indicating whether the latest developments in air and climate policy either diverge, or agree with, what is set in the scope of the FQD Public statements from industrial associations pointing out that the FQD is no longer in line with the latest policy developments
Method	Qualitative assessment of the consultation responses from relevant stakeholders.
Sources	Consultation with relevant stakeholders, including Competent Authorities, industry stakeholders and others such as NGOs
Comments	Climate and energy policy objectives change over time, all affecting the fuel market.
Article 2	
EQ 3.4	Are the definitions in line with those included in other legislation?
Judgement Criteria	Assessment on whether there are any definitions which are unclear, or not in agreement with those in other Directives. Special focus will be paid to the Renewable Energy Directive (RED) and Directive 1999/32/EC
Indicators	Stakeholders' views on these definitions Questions raised to the Commission requesting clarifications on the subject.
Method	Qualitative assessment of responses.
Sources	Consultation with relevant stakeholders, including MS Authorities and industry stakeholders
Article 3	
EQ 3.5	Are the specifications in Annex I coherent with the rest of the Directive and with other legislation or standards in the EU and beyond?
Judgement Criteria	Evidence of Article 3 being contradictory with another Article of the Directive (e.g. Article 8) or with those in other legislation. Examples in countries outside the EU with different requirements
Indicators	Petrol fuel specifications in other legislation and in international standards
Method	Review of Directives that could potentially have conflicting requirements Quantitative and qualitative analysis of stakeholder consultation responses
Sources	Member State annual reports, relevant Directives, responses to the stakeholder consultation
EQ 3.6	Are there interactions between Annex I requirements and vehicle standards?
Judgement Criteria	Evidence showing whether vehicle standard specifications and fuel quality standards are in line with each other. Assessment of whether modifications/improvement to both fuels and vehicle standards are introduced in a timely manner
Indicators	Vehicle standards in the EU and their historic evolution. Fuel quality standards in the EU and their historic evolution.
Method	Qualitative analysis of stakeholder consultation responses. Review of EU annual report on the implementation of the FQD Literature review
Sources	Consultation of relevant stakeholders including industry, annual reports of the implementation of the FQD, reports from industrial associations such as ACEA or EUROPIA
EQ 3.7	Is the derogation for the Outermost regions coherent with the approach taken by other Directives?
Judgement Criteria	Assessment of whether the provisions are in line with a common strategy (i.e. other derogations granted to the Outermost Regions)
Indicators	Derogations for the Outermost Regions included in other Directives

Method	Qualitative analysis of the derogations included in other relevant legislation, especially the RED (if any). Assessment of responses of the stakeholder consultation.
Sources	Consultation of relevant stakeholders. Information regarding derogations from other relevant Directives such as the RED
Article 4	
EQ 3.8	Are the specifications in Annex II coherent with the rest of the Directive and with other legislation or standards in the EU and beyond?
Judgement Criteria	Evidence of Article 4 being contradictory with another Article of the Directive (e.g. Article 8) or with those in other legislation. Examples in countries outside the EU with different requirements
Indicators	Petrol fuel specifications in other legislation and in international standards
Method	Review of Directives that could potentially have conflicting requirements Quantitative and qualitative analysis of stakeholder consultation responses
Sources	Member State annual reports, relevant Directives, responses to the stakeholder consultation
EQ 3.9	Are there interactions between Annex II requirements and vehicle standards?
Judgement Criteria	Evidence showing whether vehicle standard specifications and fuel quality standards are in line with each other. Assessment of whether modifications/improvement to both fuels and vehicle standards are introduced in a timely manner
Indicators	Vehicle standards in the EU and their historic evolution. Fuel quality standards in the EU and their historic evolution.
Method	Qualitative analysis of stakeholder consultation responses. Review of EU annual report on the implementation of the FQD Literature review
Sources	Consultation of relevant stakeholders including industry, annual reports of the implementation of the FQD, reports from industrial associations such as ACEA or EUROPIA
EQ 3.10	Is the derogation for the Outermost regions coherent with the approach taken by other Directives?
Judgement Criteria	Assessment of whether the provisions are in line with a common strategy (i.e. other derogations granted to the Outermost Regions)
Indicators	Derogations for the Outermost Regions included in other Directives
Method	Qualitative analysis of the derogations included in other relevant legislation, especially the RED (if any). Assessment of responses of the stakeholder consultation.
Sources	Consultation of relevant stakeholders. Information regarding derogations from relevant Directives such as the RED
Article 5	
EQ 3.11	Is the free circulation of fuel compliant with the requirements of the FQD coherent with other EU legislation?
Judgement Criteria	Assessment of whether the free circulation of fuel in the FQD is coherent with other EU legislation
Indicators	Commentary from stakeholders
Method	Qualitative analysis of stakeholder consultation
Sources	Consultation of relevant stakeholders

Article 7	
EQ 3.12	Is the provision of the Article coherent with the rest of the Directive?
Judgement Criteria	Assessment of whether such a derogation is likely to hinder the overall objectives of the Directive
Indicators	Number of times the Article has been used.
Method	Qualitative analysis of information obtained from stakeholders and the Commission
Sources	Stakeholder consultation, Commission data sources
Article 8	
EQ 3.13	Are the monitoring and reporting obligations aligned with other related monitoring and reporting obligations?
Judgement Criteria	Assessment of whether the administrative burden to authorities and the industry is increased by a deviation from or contradiction of other reporting requirements that the same stakeholders have to comply with
Indicators	Requirements for reporting in other Directives
Method	Quantitative and qualitative analysis of the stakeholder responses. If/when these highlight specific CEN standards or Directives (e.g. 1999/32/EC) that could be in conflict with Article 8, then these will be reviewed
Sources	Consultation of stakeholders including Competent Authorities and fuel manufacturers/suppliers Review of MS annual reports
Article 9	
EQ 3.14	Do the requirements related to the review process contradict other legislation?
Judgement Criteria	Evidence clarifying whether the review process is not similar to that established by other legislation or that it hinders the ability to comply with the review process of other legislation
Indicators	Commentary and examples of how the requirements of this Article may be or not be in line with other legislation
Method	Qualitative and quantitative analysis of stakeholder responses
Sources	Consultation with relevant stakeholders, including Competent Authorities
Article 9a	
EQ 3.15	Do the penalties established by the Article contradict or contribute to the objectives set by other legislation?
Judgement Criteria	Evidence indicating that complying with other related legislation could lead to a penalty according to Article 9a
Indicators	Commentary from consultees
Method	Quantitative and qualitative analysis of stakeholder responses
Sources	Consultation with relevant stakeholders, including Competent Authorities

E.4 RELEVANCE

EQ4.1	**Is the FQD still relevant ?**
Article 1	
EQ 4.2	Does the scope bring unwanted restrictions? If so, what should be changed?
Judgement Criteria	Evidence that the scope excludes fuels or other elements that are relevant
Indicators	Positive and negative responses. Commentary from stakeholders providing evidence that there are elements that should be in the scope and reasoning of why these should be included.
Method	Qualitative analysis of the responses obtained. As part of the review of the Member States annual reports, attention will be paid to identify whether any issues have been reported with regard to this.
Sources	Consultation with stakeholders, Member State annual reports on FQD Consultation with Competent Authorities and industry stakeholders.
Article 2	
EQ 4.3	Are the definitions still adequate?
Judgement Criteria	Assessment on whether there is any definition that is not up to date or that is not necessary
Indicators	Stakeholders' views on these definitions Questions raised to the Commission requesting clarifications on the subject.
Method	Qualitative assessment of responses. Quantitative analysis of responses
Sources	Consultation with relevant stakeholders, including MS Authorities and industry stakeholders
Article 3	
EQ 4.4	Is the limitation of petrol fuel placed on the market still necessary?
Judgement Criteria	Assessment of whether improvements in engine management systems makes it unnecessary to maintain this limitation
Indicators	Review of impacts of petrol fuels on air quality and the wider environment
Method	Review of recent publications on petrol fuel Opinions or reports from industrial associations
Sources	Recent publications on petrol fuel Reports from industrial associations (e.g. ACEA)
Comments	It has to be considered whether engines may or may not work properly with fuels that do not comply with these limitations. If that was the case, these limits would be necessary without the legislative provision
EQ 4.5	Are the specifications in Annex I adapted to the latest technical and scientific progress?
Judgement Criteria	Evidence showing whether vehicle standard specifications and fuel quality standards are up to date.
Indicators	Comparison of the specifications of Annex I with the latest technical and scientific work
Method	Review of recent academic and technical work on petrol fuel specifications
Sources	Recent academic and technical work on petrol fuel specifications
EQ 4.6	Are the derogations still relevant?
Judgement	Assessment of whether the provisions have been used

Criteria	
Indicators	Review of impacts in the Member States that have applied these derogations Commentary from stakeholders on these derogations
Method	Qualitative analysis of the responses obtained in the consultation. Review of reported emissions Review of the applied derogations
Sources	Consultation of relevant stakeholders. Data on derogations from the Commission and the FQD implementation reports Review of emissions inventories
Article 4	
EQ 4.7	Is the limitation of diesel placed on the market still necessary?
Judgement Criteria	Assessment of whether improvements in engine management systems makes it unnecessary to maintain this limitation
Indicators	Review of impacts of diesel on air quality and the wider environment
Method	Review of recent publications on diesel fuel Opinions or reports from industrial associations
Sources	Recent publications on diesel Reports from industrial associations (e.g. ACEA)
EQ 4.8	Are the derogations still relevant?
Judgement Criteria	Assessment of whether the provisions have been used
Indicators	Review of impacts in the Member States that have applied these derogations Commentary from stakeholders on these derogations
Method	Qualitative analysis of the responses obtained in the consultation. Review of reported emissions Review of the applied derogations
Sources	Consultation of relevant stakeholders. Data on derogations from the Commission and the FQD implementation reports Review of emissions inventories
Article 5	
EQ 4.9	In the absence of this Article, would any Member State prohibit, restrict or prevent marketing of fuels complying with the Directive?
Judgement Criteria	Evaluation of frequency of occurrence of any of the exceptions listed in the question (prohibition, restriction of preventing markets of fuels complying with the Directive)
Indicators	List of derogations requested by Member States, as published in annual reports on FQD Commentary from Member States regarding their use of the Article and whether in its absence they would prohibit, restrict or prevent marketing of fuels
Method	Qualitative analysis of information obtained from stakeholders and the Commission
Sources	Stakeholder consultation, Commission data sources
Article 6	
EQ 4.10	Have any Member States used this Article since 2009?
EQ 4.11	Are more stringent environmental fuel specifications still relevant in some cases?

Judgement Criteria	Evidence of MS using this Article since 2009	Analysis of examples in which more stringent environmental specifications can still be relevant
Indicators	Derogations requested by Member States	Overview of the type of cases in which more stringent environmental specifications can still be relevant
Method	Quantitative and qualitative analysis	Quantitative and qualitative analysis
Sources	Consultation of relevant Commission services	Literature review
Article 7		
EQ 4.12	Is the safeguard to prevent disruptions to fuel supply still necessary? How often were MS authorised to use this Article?	
Judgement Criteria	Assessment of the frequency with which permission has been giving to use Article 7	
Indicators	Data on number of times Article 7 has been used Diesel and petrol fuel specifications and related sales information Commentary from stakeholders on the usefulness of Article 7	
Method	Qualitative analysis	
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports	
Article 8a		
EQ 4.13	Is the use of metallic additives still regarded as relevant option?	
Judgement Criteria	Assessment of evidence regarding the current usefulness of, or need for, the use of metallic additives	
Indicators	Indication of the relevance of the use of metallic additives	
Method	Qualitative analysis	
Sources	Literature review, including EC proposal that was withdrawn relevant documents with argumentation why Recent academic and technical work	
Article 9		
EQ 4.14	Was this Article necessary for the reporting and preparation of a proposal by the EC?	
Judgement Criteria		
Indicators		
Method	Qualitative assessment	
Sources	Consultation of relevant stakeholders, including Competent Authorities, car manufacturers and fuel manufacturers/suppliers	
Article 9a		
EQ 4.15	Are penalties necessary for meeting the objectives of the Directive?	
EQ 4.16	Is this Article necessary for Member States to set penalties?	
Judgement Criteria	Assessment of evidence regarding the need for penalties in order to meet the objectives	Assessment of evidence regarding whether Member States would set penalties in the absence of this Article
Indicators	Responses from stakeholders indicating the need for penalties in order to meet the objectives of the Directive	Responses from stakeholders indicating the need for this Article in order to ensure Member States set penalties

Method	Qualitative analysis
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers

E.5 EU-ADDED VALUE

The principal assessment of EU-added value will be a comparison with what could reasonably be expected to be achieved by the MS themselves. There is evidence indicating that some Member States had banned sulphur in fuel prior to the introduction of the FQD (e.g. Sweden), however the overall picture taking into account the full specification included in Annexes II and III of the current FQD is more complex to assess.

EQ 5.1	**What is the overall perception of the Directive among stakeholders?**
Article 1	
EQ 5.2	Could a single market by ensured by repeal of the FQD? (in the absence of the FQD)
Judgement Criteria	Identifying evidence to show that single market would exist in the absence of the Directive
Indicators	Responses from stakeholders indicating that Member States go beyond the FQD. Fuel supplied under CEN specifications rather than FQD. Member States use derogations
Method	Assessment of amount of fuel delivered in non-mandatory MS under CEN specifications. Assessment of the use of derogations, in comparison to the EU total.
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
EQ 5.3	Does the scope as defined justify EU intervention?
Judgement Criteria	Assessment of whether the evidence suggests the scope defines EU intervention
Indicators	Member states go beyond FQD. Fuel supplied under CEN specifications rather than FQD. Member States use derogations
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
EQ 5.4	Does the FQD give the fuel and car industry a strong home-market? Does this bring competitive advantages over non-EU industries?
Judgement Criteria	Evidence form industry that the FQD gives the fuel and car industry a strong home market
Indicators	Commentary from industry indicating that FQD provides a strong home market
Method	Qualitative assessment
Sources	Literature review. Review of refinery report. Consultation of relevant stakeholders, including Competent Authorities, car manufacturers and fuel manufacturers and suppliers
Article 2	
EQ 5.5	Are the definitions chosen advantages to the EU industry?

	Would the EU benefit from adoption of definitions used in other regions?
Judgement Criteria	Evidence form industry that the definitions chose are advantageous to the industry
Indicators	Commentary from industry regarding the advantages of the definitions used in the FQD
Method	Qualitative analysis
Sources	Consultation of relevant stakeholders, including Competent Authorities, car manufacturers and fuel manufacturers and suppliers
Articles 3 and 4	
EQ 5.6	How has this Article been perceived by stakeholders?
Judgement Criteria	Evidence from stakeholders on their judgement of this Article and the specifications for petrol in Annex I, diesel in Annex II.
Indicators	Commentary from stakeholders
Method	Qualitative assessment
Sources	Review of Member State annual reports
EQ 5.7	Has the fact that some Member States have stricter limits reduced the added value of the Directive?
Judgement Criteria	Assessment of evidence suggesting that some Member States have stricter limited and this has reduced the added value of the Directive
Indicators	Commentary from Member States on the added value of Article 3
Method	Qualitative assessment
Sources	Consultation with relevant stakeholders
Article 6	
EQ 5.8	How has this Article been perceived by stakeholders?
Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Commentary from stakeholders
Method	Qualitative assessment
Sources	Questions received by Commission regarding this Article (if any) Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
Article 7	
EQ 5.9	How has this Article been perceived by stakeholders?
Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Feedback on Article 7 Commentary from stakeholders regarding Article 7
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
EQ 5.10	Is action at EU level still prescribed?
Judgement	Evidence indicating that without this Article the aims of the FQD would not be fulfilled at a Member State level

Criteria	
Indicators	National transposition information National derivation to Directive
Method	Qualitative assessment
Sources	Literature review
Article 8	
EQ 5.11	How has this Article been perceived by stakeholders?
Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Consideration of the use made of Member State reports as one measure of value.
Method	Qualitative assessment
Sources	Consultation with stakeholders including Competent Authorities
EQ 5.12	Would MS monitor and centrally report this information without EU intervention?
Judgement Criteria	Evidence indicating Member States would monitor and report on information in the absence of this Article
Indicators	National transposition information National derivation to Directive
Method	Qualitative assessment
Sources	Literature review Consultation of stakeholders and Competent Authorities Review of Member States annual reports
Article 8a	
EQ 5.13	How has this Article been perceived by stakeholders?
Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Views on this Article and its role (from stakeholders)
Method	Qualitative assessment
Sources	Questions received by EC. Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers Review of Member States annual reports
Article 9	
EQ 5.14	How has this Article been perceived by stakeholders?
Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Views on this Article and its role (from stakeholders)
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities, car manufacturers and fuel manufacturers/suppliers
Article 9a	
EQ 5.15	How has this Article been perceived by stakeholders?

Judgement Criteria	Assessment of the regard in which stakeholders hold this Article
Indicators	Views on this Article and its role (from stakeholders)
Method	Qualitative assessment
Sources	Consultation of relevant stakeholders, including Competent Authorities and fuel manufacturers/suppliers

Appendix G Questionnaire for Member States

Appendix H Questionnaire for industry and other stakeholders

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