European Commission

Support Study on the Evaluation of Article 7A of the Fuel Quality Directive and Assessment of Approaches to Reduce Greenhouse Gas Emissions from Transport Fuels

Final report

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SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS FROM TRANSPORT FUELS

Final Report

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ABSTRACT

This study for the European Commission focuses on the evaluation of Article 7A of Directive 98/70/EC relating to the quality of petrol and diesel fuels, so-called Fuel Quality Directive (FQD Art.7A) and on the assessment of policy options under various fuel mix scenarios to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050.

It was conducted by Technopolis Group (lead), COWI and Exergia.

Through desk research, interviews, surveys, and stakeholder workshops (Task 4) it assesses the effectiveness, efficiency, relevance, coherence, and EU-added value of FQD Art.7A, identifying enabling and hampering factors for its environmental, economic, and social impacts, and drawing lessons for future efforts to reduce GHG emissions from transport (Task 1).

Based on the projected fuel-mix under the scenarios underpinning the 2030 Climate Target Plan (CTP), the study calculates the GHG emission intensity of the overall fuels used in transport based on the life-cycle approach of the FQD, and its reduction from the FQD 2010 baseline. (Task 2).

The evidence collected was used to detail and assess policy options (Task 3) to reduce the GHG intensity of transport fuels to deliver on the targets set forth in the 2030 CTP and the 2050 climate neutrality objective.

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Abbreviations

Acronyms	Meaning
BImSchG	Federal Immission Control Act (*Bundes-Immissionsschutzgesetz*)
CDM	Clean Development Mechanism
CEN	European Committee for Standardization
CFS	Carbon Fuel Standards
CNG	Compressed natural gas
CTP	Climate Target Plan
EEA	European Environment Agency
EN	European Norm
ETS	Emissions Trading Scheme
EV	Electric vehicle
FAME	Fatty acid methyl ester
FQD	Fuel Quality Directive
GHG RR	Greenhouse Gas Emissions Reporting Regulations
GoO	Guarantees of Origin
HVO	Hydrotreated vegetable oil
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
ILUC	Indirect Land Use Change
IRENA	International Renewable Energy Agency
LCFS	Low Carbon Fuel Standards
LNG	Liquified natural gas
LPG	Liquified petroleum gas
MJ	Megajoule
NECP	National Energy and Climate Plans
NGO	Non-Governmental Organisation
POME	Palm Oil Mill Effluent
RED	Renewable Energy Directive

Acronyms	Meaning
REV	Energy for Transport Registry (*Register Energie voor Vervoer*)
RFNBO	Renewable Liquid and Gaseous Transport Fuels of Non-Biological Origin
RFTO	Renewable Transport Fuel Obligation
ToR	Terms of Reference
UER	Upstream Emission Reduction
UNFCCC	United Nations Framework Convention on Climate Change
WtW	Well-to-Wheels

EXECUTIVE SUMMARY

The focus of the analysis carried out by Technopolis Group, in cooperation with COWI and Exergia for DG CLIMA, includes two parts, which had been identified by DG CLIMA as relevant for their work and were completed by Technopolis Group, accordingly. The two parts (results presented in Sections 3 and 4 of this report) were defined as follows:

A. Evaluation of Art.7A of Directive 98/70/EC relating to the quality of petrol and diesel fuels, so-called Fuel Quality Directive (FQD Art.7A)

B. Calculation of the GHG emission intensity of fuels under various fuel mix scenarios and assessment of policy options to steer the progressive reduction of transport fuels' GHG intensity reduction towards 2030 and 2050.

In compliance with the Better Regulation Guidelines, the analysis assesses the effectiveness, efficiency, relevance, coherence, and EU added value of FQD Art.7A. The evaluation of the **relevance** of FQD Art.7A highlights the (ongoing) alignment of its objectives with the needs it addresses. The criterion of **effectiveness** addresses the extent to which the objectives of FQD Art.7A were reached, and the related facilitators and/or barriers. The assessment of **efficiency** focuses on the effects of FQD Art.7A in relation to the costs of the inputs provided as well as all other costs induced by its implementation. As regards the criterion of **coherence**, this entailed evaluating the positioning and relationship of FQD Art.7A with other provisions in the FQD, and other EU and/or international/national/local initiatives that have similar objectives. Last, but not least, the study includes an analysis of the **added value** resulting from the intervention at the EU level, compared to what could have been achieved at the national or local levels.

The findings of the analysis are summarised below:

A. Evaluation of FQD Art.7A

Relevance of FQD Art.7A and of its objectives

The stakeholders consulted via surveys, interviews, and workshops consider that FQD Art.7A and its quantitative goals in terms of reduction of Greenhouse Gas (GHG) emissions intensity of transport fuels are overall providing a relevant contribution to EU climate policy and ambitions.

Consulted stakeholders view increased competitiveness of fuels with lower GHG emissions intensity and fuel technology progress as the most likely impacts of FQD Art.7A. However, FQD Art.7A is perceived as less relevant for improving air quality, human health, vehicle engine efficiency than other provisions in the FQD. Because Art.7A does not provide for a full harmonisation of national fuel markets, consulted stakeholders assert that it does not enhance the functioning of the European single market for transport fuels and vehicles.

Furthermore, the study confirms the relevance of the quantitative targets set in FQD Art.7A in terms of reduction of the life cycle GHG emission intensity of transport fuels.

Last, but not least, the study finds that stakeholders appreciate particularly the current technology-neutral approach as it leaves fuel suppliers and producers free of choosing the most appropriate methods to attain the targets.

Effectiveness of FQD Art.7A

According to 2018 monitoring data, the 28 reporting Member States were on average behind their objective of reducing the GHG intensity of transport fuels by 6% by 2020, compared with 2010. Reductions in GHG intensity were enabled by an increased share of biofuels in national fuel mixes.

The study confirms the effectiveness of FQD Art.7A in creating the conditions for the development of markets for biofuels and other fuels with lower GHG intensity. However, in the views of the consulted stakeholders, FQD Art.7A has not yet contributed to its expected societal and environmental impacts and did not give a renewed impetus to technological developments for more efficient engines.

Reported barriers include uncertainties caused by perceived overlaps between FQD Art.7A and RED, lack of available feedstock, lack of harmonisation of national transpositions, among others.

Efficiency of FQD Art.7A

The study highlights that consulted stakeholders have difficulties disentangling the administrative costs induced by FQD Art.7A from those caused by RED II. Consequently, the efficiency of FQD Art.7A varies across countries and is dependent on how they transpose it as well as RED in their national law. There is no evidence of unreasonable costs induced by Art.7A. More specifically, the administrative costs for Member States and fuel suppliers induced by the current monitoring and reporting obligations under FQD Art.7A and RED are evaluated as marginal (1-2 FTE).

The harmonisation of the penalties structure and its rationale, as well as a possible policy guidance with long-term objectives would be two components of relevance for both the efficiency and effectiveness of FQD Art.7A as reported in interviews with industry and associations and revealed by the analytical work on the substantive costs and penalties.

Coherence of FQD Art.7A

The evidence provided by the study is not conclusive regarding the coherence of the reporting with national initiatives, with international obligations of the EU, and with other EU initiatives (e.g. inconsistencies and overlap between FQD-REDII). On this last aspect, implementation of both FQD Art.7A and RED are strongly intertwined, and their interactions are considered, by a vast majority of stakeholders, to have negative impacts.

EU-added value of FQD Art.7A

The study confirms the added value of FQD Art.7A in decreasing GHG emission intensity from transport. It remains nonetheless difficult to make assumptions as to whether national initiatives alone would have achieved similar or higher GHG intensity reductions of transport fuels.

In addition, the contribution of FQD Art.7A to contribute to reduce the fragmentation of the European market for transport fuels and vehicles is not demonstrated by the evidence analysed.

B. Calculation of the GHG emission intensity of fuels under various fuel mix scenarios and assessment of policy options to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050

Calculation of the GHG emission intensity of fuels under various fuel mix scenarios

The main scenario considered from the 2030CTP in the study is the so-called "MIX55" scenario, which comprises a mix of policies for the decarbonization of the various economic sectors and leading to a ca. 55% reduction of the total GHG emissions in 2030 as compared to 1990.

Focusing on the sectoral GHG emission reductions, simulations of the MIX55 scenario anticipate a 16.3% GHG emission reduction in the transport sector by 2030 compared to 2015. According to the reported modelling results, in road transport annual GHG emissions reduction doubles in the 2015-2030 period as compared to the period 2005-2015 but the sector still sees only a decrease in emissions of ca. 20% in the period 2015-2030.

A total of about 26%of RES share in the transport sector is projected by the MIX55 scenario. For this share to be achieved, total alternative fuels[1] are projected at around 14% (in real energy terms, i.e. excluding the multipliers of RED II Directive 2018/2001) of the transport fuel mix. The share of liquid biofuels and biomethane reaches 6.6% of transport energy demand, thanks to dedicated fuel policies, including policies for aviation and maritime navigation, while e-fuels are expected to represent around 0.2% of the transport energy demand, driven by fuel obligations for the aviation and maritime transport sectors. Electrification of transport adds a 3.8% share of transport fuel mix, while natural gas accounts for the remaining percentage of alternative fuels in transport in 2030.

- On the basis of the above framework, calculations for the overall GHG intensity of the assumed transport fuel mix in 2030 have been performed based on the following steps:

[1] According to the Directive 2014/94/EU, the term 'alternative fuels' means fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include, inter alia: electricity, hydrogen, biofuels, synthetic and paraffinic fuels, natural gas, including biomethane, in gaseous form (compressed natural gas (CNG)) and liquefied form (liquefied natural gas (LNG)), and liquefied petroleum gas (LPG).

- Step 1: Identification of the allocated quantities of fuels or energy carriers (expressed in ktoe) in the transport fuel mix of the MIX55 scenario of the 2030CTP.
- Step 2: Determination of the greenhouse gas intensity (GHGi, expressed in terms of grCO2e/MJ) for each identified fuel or energy carrier of Step 1, following the life cycle approach of the FQD Art. 7a.
- Step 3: Performance of calculations for the overall GHG intensity of the assumed transport fuel mix in 2030 and parametric analysis (to the extent it is needed) to support the assessment of policy Options in Task 3 (Impact Assessment of Policy Options).

Considering the reported fuel quantities for the MIX55 scenario of the 2030CTP, the assumed 2030 transport fuel mix is calculated to feature an overall GHG intensity of 83,2 grCO2e/MJ, resulting thus in a reduction of 11,5% as compared to the baseline of 94 grCO2e/MJ.

Fossil liquid fuels confirm their dominance in the formation of the overall GHG intensity, having a value of 88,4 grCO2e/MJ (or, +4% as compared to the overall average value of 83,2 grCO2e/MJ).

Gaseous fuels moderately contribute to the reduction of the overall GHG intensity, despite the significantly lower individual value of 64,9 grCO2e/MJ (or, -24% as compared to the overall average value of 83,2 grCO2e/MJ).

Assessment of policy options to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050

The study details and assesses three sets of policy options considering the respective environmental, economic, and social impact to reduce the GHG intensity of transport fuels to deliver on the targets set forth in the 2030 Climate Target Plan and on the 2050 climate neutrality objective:

- Option 1 (**baseline**): Continuing with the obligation to reduce the GHG intensity of fuels based on the current approach used in FQD and the sustainability architecture for renewable fuels introduced under RED II.
- Option 2: **Discontinuing the obligation to reduce the GHG intensity of fuels**.
- Option 3: **Strengthening the obligation to reduce the GHG intensity of fuels**:
  - Sub-option A: Extension of the scope of fuels covered to gaseous fuels.
  - Sub-option B: Introducing a market-based instrument for fuel suppliers to trade GHG reduction credits for the supply of transport fuels.
  - Sub-option C: Regulating directly fuel suppliers with an EU Regulation.

The assessment of the **baseline** (Option 1) points to the mainstreaming of low carbon fuels (e.g. advanced biofuels) and zero carbon fuels (e.g. electricity), and a phase-out of crop-based biofuels, of which particularly biofuels derived from high-ILUC feedstocks, such as palm oil. With the rise of advanced biofuels as well as other alternative fuels, the need for agricultural area is expected to decrease. Based on calculations on the land use associated with crop-based biofuel production as provided in Appendix K, there will be a significant reduction in land use albeit an overall increase in biofuel demand between 2020 and 2030, due to the decreasing importance of crop-based biofuels. By 2030 and 2050, the associated land use will be reduced by respectively 3.9 and 7.2 million ha. From an economic perspective, the higher demand for advanced biofuel feedstocks and other low carbon fuels can contribute to further innovation and cost-savings of these fuels, as well as to further employment in the EU and global low carbon fuel sector. The growth of employment in the EU will depend on several factors, such as the location of production or the extent of export of EU technology, which have not been investigated as part of this study.

The administrative burden associated with Art.7A has been quantified in conjunction with the RED and assessed to be limited for both public administrations and fuel suppliers. In terms of the substantive costs for fuel suppliers, it is estimated that the production cost of fuel will increase. However, these increases are assessed to lead to limited impacts on the affordability of road transport.

The study also shows that the **discontinuation of the obligation** (Option 2) would have no effects on the distribution of the feedstocks, as the sustainability requirements, which are identical for the FQD and RED, would continue to be governed by RED II. The discontinuation of the obligation would therefore not change the demand of different types of imported biofuel feedstocks.

In addition, a discontinued GHG reduction obligation does not change the administrative burden for Member States and fuel suppliers compared to the baseline, as Member State authorities and fuel suppliers still need to use resources on i) the reporting to the EU Commission and ii) the monitoring of life cycle GHG emissions as part of the RED. Even if the GHG reduction obligation is withdrawn, the market fragmentation might persist. The drivers behind this fragmentation might be reduced, but will not disappear, due to the approach that will be followed in national RED II transpositions and foreseen, national GHG reduction obligations in major biofuel markets.

Regarding the analysis of the impacts of a **strengthening of the obligation to reduce the GHG intensity of fuels** (Option 3), the study finds that the higher share of advanced bioethanol (e.g from agricultural residues) in the feedstock distribution would lead to a stronger decrease in the share of crop-based bioethanol. The estimated impact is however not significant for third countries, as about 75% of the bioethanol production occurs in the EU. For biodiesel however, Option 3 would lead to a significant reduction in associated direct and indirect land use change, owing to a higher share of an industrial processing waste feedstock, i.e. Palm Oil Mill Effluent (POME), listed in RED II Annex IX-A. The assumed growth of POME in the feedstock distribution also has implications for other feedstocks, i.e. rapeseed and soybean. Compared to the baseline thus, biofuel production would be shifted away from rapeseed and soybean producers, i.e. Argentina, Brazil, and the EU and USA, towards the two POME producing countries, Indonesia, and Malaysia.

Given the underlying assumption of Option 3 that a strengthened GHG obligation leads to a stronger mainstreaming of advanced biofuels, the option could - compared to the baseline - lead to stronger impacts for third countries. From an environmental perspective, less direct and indirect pressure on land use will be associated with biofuel feedstocks. From an economic perspective, the higher demand for advanced biofuels will lead to stronger innovation and cost-savings, leading to potentially stronger employment effects in the EU and global low carbon sector. As for Option 1, the growth of employment in the EU will depend on several factors, such as the location of production or the extent of export of EU technology.

Even though Option 3 leads to a stronger reduction in the direct and indirect land use change for crop-based biofuels, leading in turn to a loss of production for sourcing countries, the strengthening of the obligation to reduce the GHG intensity of fuels would provide opportunities of further developing and transitioning to more sustainable low carbon fuels. Compared to the baseline, the impact of Option 3 is therefore assessed to be positive.

As regards Sub-option 3A, gaseous fuels in transport will gain a limited, but strongly increasing, importance by 2030. For hydrogen, there will however only be notable demand from 2040 onwards. The increased uptake of renewable gaseous fuels may lead to a higher demand for residual/waste-based feedstocks, further supporting the transition away from crop-based fuels.

The addition of gaseous fuels to the scope of the fuel quality requirements would not entail significant changes to the administrative burden for Member States and fuel suppliers, compared to the baseline. However, specific fuel suppliers who currently do not follow the existing EN standards would incur costs to follow the standard but information on the extent of this issue is not available.

A **market-based instrument** (Sub-option 3B) will provide an incentive for individual fuel suppliers to operate in such a way to ensure as much credits as possible. Depending on the exact annual GHG reduction target, fuel suppliers will act in a way to better fulfil their obligation. The impact on the GHG emissions reductions will be positive compared to the baseline assuming that the market-based instrument will have a strong monitoring and compliance mechanism actually obliging fuel suppliers to meet their GHG reduction targets on an annual basis. The market-based instrument will have a positive impact on the demand for low- and zero carbon fuels, as the system rewards higher GHG savings of fuels.

The market-based instrument will entail additional administrative costs compared to the baseline such as start-up costs and recurrent costs like annual running costs of the trading platform, administration of participants and enforcement costs. For fuel suppliers, it is assessed that the sub-option introduces only a marginal administrative burden as compared to the baseline. The market-based instrument can provide additional revenue for fuel suppliers, which can be crucial for the financial situation of small innovative fuel suppliers who provide low and zero carbon fuels.

Although the market-based instrument is not directly related to innovation activity development, it is reasonable to assume that implementation of this sub-option will help in the development of a friendlier investment environment that can potentially enhance innovation activity and the effort to reduce the production cost of low- and zero carbon fuels.

Finally, as the market-based instrument entails a direct regulation of fuel suppliers through an EU Regulation, a seamless market can be established, eliminating the market fragmentation of low carbon fuels.

Last, but not least, **replacing the current Directive with an EU Regulation** (Sub-option 3C) will not have any effects on the composition of biofuel feedstocks and therefore also have no impacts on the import of biofuel feedstocks. However, a direct regulation on fuel suppliers will create the conditions for facilitating the development of a seamless market, removing the currently observed fragmentation that result from, for example, non-harmonious types of sanction structures across the Member States. Clarity in targets and the way to achieve them will promote the uptake of fuels that will contribute to the reduction of the GHG emission from transport and the reduction in GHG intensity of carbon fuels.

NOTE DE SYNTHÈSE

L'analyse réalisée par Technopolis Group pour la DG CLIMA, en coopération avec COWI et Exergia, comprend deux parties traitant de questions ayant été identifiées par la DG CLIMA comme pertinentes pour son travail et sur lesquelles Technopolis Group s'est donc concentrée. Les deux parties (résultats présentés dans les sections 3 et 4 du présent rapport) ont été définies comme suit :

A. Évaluation de l'article 7A de la directive 98/70/CE concernant la qualité de l'essence et des carburants diesel, ou « directive sur la qualité des carburants » (art. 7A de la FQD) ;

B. Calcul de l'intensité des émissions de GES des carburants selon divers scénarios énergétiques pour le transport et évaluation des options stratégiques pour orienter la réduction progressive de l'intensité des GES des carburants destinés aux transports à l'horizon 2030 et à l'horizon 2050.

Conformément aux lignes directrices pour une meilleure réglementation, l'analyse évalue l'efficacité, l'efficience, la pertinence, la cohérence et la valeur ajoutée européenne de l'art. 7A de la directive pour la qualité de l'air (FQD). L'évaluation de la **pertinence** de cet article met en évidence l'alignement (en cours) de ses objectifs sur les besoins identifiés. Le critère de l'**efficacité** concerne la mesure dans laquelle les objectifs de l'art. 7A de la FQD ont été atteints, ainsi que les éléments facilitateurs et/ou les obstacles à ce niveau. L'évaluation de l'**efficience** se concentre sur les effets de l'art. 7A de la FQD par rapport aux coûts des intrants et à tous les autres coûts liés à sa mise en œuvre. En ce qui concerne le critère de la **cohérence**, il s'agissait d'évaluer le positionnement et le lien de l'art. 7A de la FQD avec d'autres dispositions de cette directive et d'autres initiatives européennes et/ou internationales/nationales/locales poursuivant des objectifs similaires. Enfin, et surtout, l'étude comprend une analyse de la **valeur ajoutée** apportée par l'intervention à l'échelon européen par rapport à ce qui aurait pu être réalisé aux niveaux national ou local.

Les résultats de cette analyse sont résumés ci-dessous :

A. Évaluation de l'article 7A de la FQD

Pertinence de l'article 7A de la FQD et de ses objectifs

Les parties prenantes consultées par le biais d'enquêtes et d'entretiens, ainsi que dans le cadre d'ateliers estiment que l'art. 7A de la FQD et ses objectifs quantitatifs en termes de réduction de l'intensité des émissions de gaz à effet de serre (GES) des carburants destinés aux transports apportent globalement une contribution pertinente à la politique et aux ambitions climatiques de l'UE.

Les parties prenantes consultées considèrent que l'accroissement de la compétitivité des carburants à faible intensité d'émission de GES et les progrès technologiques dans le domaine des carburants sont les incidences les plus probables de l'art. 7A de la FQD. Cet article est toutefois jugé moins pertinent pour l'amélioration de la qualité de l'air, de la santé humaine et du rendement des moteurs de véhicules que d'autres dispositions de la directive. L'article 7A ne prévoyant pas une harmonisation complète des marchés nationaux des carburants, les parties prenantes consultées affirment qu'il n'est pas de nature à améliorer le fonctionnement du marché unique européen des carburants et des véhicules destinés au transport.

L'étude confirme en outre la pertinence des objectifs quantitatifs fixés dans l'art. 7A de la FQD en termes de réduction de l'intensité des émissions de GES sur tout le cycle de vie des carburants de transport.

Enfin et surtout, l'étude révèle que les parties prenantes apprécient particulièrement l'approche actuelle, neutre sur le plan technologique, car elle laisse aux fournisseurs et aux producteurs de carburant la liberté de choisir les méthodes les plus appropriées pour atteindre les objectifs.

Efficacité de l'article 7A de la FQD

Selon les données de suivi recueillies en 2018, les 28 États membres ayant présenté des rapports afficheraient en 2020 un retard moyen de 6 % par rapport à 2010 sur leur objectif de réduction de l'intensité des émissions de GES des carburants destinés au transport. Les réductions de l'intensité des émissions de GES ont été rendues possibles par l'augmentation de la part des biocarburants dans les bouquets énergétiques nationaux.

L'étude confirme l'efficacité de l'art. 7A de la FQD dans la mise en place de conditions propices au développement de marchés de biocarburants et autres carburants à plus faible intensité d'émission de GES. Les parties prenantes consultées estiment cependant que l'art. 7A de la FQD n'a pas encore eu les incidences sociétales et environnementales attendues et n'a pas donné une nouvelle impulsion aux avancées technologiques pour la conception de moteurs affichant un meilleur rendement.

Les obstacles mis en avant par les parties prenantes incluent entre autres les incertitudes liées à ce qu'ils perçoivent comme des chevauchements entre l'art. 7A de la FQD et la directive sur les énergies renouvelables (« RED »), le manque de matières premières disponibles et l'absence d'harmonisation en ce qui concerne la transposition des dispositions dans les législations nationales.

Efficience de l'article 7A de la FQD

L'étude souligne que les parties prenantes consultées rencontrent des difficultés à distinguer les coûts administratifs induits par l'art. 7A de la FQD de ceux générés par la directive RED II. Par conséquent, l'efficience de l'art. 7A de la FQD varie d'un État membre à l'autre et est liée à la façon dont ils transposent ses dispositions, ainsi que celles de la directive RED, dans leur législation nationale. Aucun élément ne met en avant des coûts déraisonnables associés à l'article 7A. En particulier, les coûts administratifs pour les États membres et les fournisseurs de carburant générés par les obligations actuelles de surveillance et de déclaration aux termes de l'article 7A et de la directive RED sont considérés comme marginaux (1 à 2 ETP).

L'harmonisation de la structure des sanctions et sa logique, ainsi que d'éventuelles orientations stratégiques assorties d'objectifs à long terme seraient deux aspects déterminants tant en ce qui concerne l'efficacité que l'efficience de l'article 7A de la FQD, comme l'ont montré des entretiens avec le secteur et des associations, ainsi que le travail d'analyse sur les coûts afférents et les sanctions.

Cohérence de l'article 7A de la FQD

Les éléments de preuve fournis par l'étude ne sont pas concluants pour ce qui est de la cohérence des obligations de déclaration vis-à-vis des initiatives nationales, des obligations internationales de l'UE et d'autres initiatives européennes (avec par exemple des incohérences et des chevauchements entre la FQD et la directive RED II). Sur ce dernier aspect, les mises en œuvre de l'art. 7A de la FQD et de la directive RED sont étroitement liées, et une grande majorité de parties prenantes estiment que les interactions entre celles-ci entraînent des conséquences négatives.

Valeur ajoutée européenne de l'article 7A de la FQD

L'étude confirme la valeur ajoutée de l'art. 7A de la FQD pour la réduction de l'intensité des émissions de GES liées au transport. Il n'en demeure pas moins difficile de formuler des hypothèses pour savoir si à elles seules, les initiatives nationales auraient permis d'atteindre des réductions d'intensité des émissions de GES similaires ou supérieures.

En outre, les éléments analysés n'indiquent pas une contribution de l'art. 7A de la FQD à la réduction de la fragmentation du marché européen des carburants et des véhicules destinés au transport.

B. Calcul de l'intensité des émissions de GES des carburants selon divers scénarios énergétiques pour les carburants et évaluation des options stratégiques pour orienter la réduction progressive de l'intensité des émissions de GES des carburants destinés aux transports à l'horizon 2030 et à l'horizon 2050

Calcul de l'intensité des émissions de GES des carburants selon différents scénarios énergétiques

Le principal scénario du plan cible en matière de climat à l'horizon 2030 (« CTP 2030 ») analysé dans le cadre de l'étude est le scénario « MIX 55 », qui associe un ensemble de mesures stratégiques pour la décarbonisation des différents secteurs économiques et qui conduit à une diminution d'environ 55 % des émissions totales de GES en 2030 par rapport à 1990.

S'agissant des réductions des émissions de GES au niveau sectoriel, les simulations du scénario MIX55 prévoient une réduction de 16,3 % des émissions de GES dans le secteur des transports d'ici 2030 par rapport à 2015. Les résultats de la modélisation montrent un doublement de la réduction annuelle des émissions de GES associées au transport routier au cours de la période 2015-2030 par rapport à la période 2005-2015, mais le secteur n'enregistrerait qu'une diminution d'environ 20 % des émissions au cours de la période 2015-2030.

Le scénario MIX55 prévoit une part totale d'environ 26 % des sources d'énergie renouvelables dans le secteur des transports. Pour atteindre ce pourcentage, la part totale des carburants alternatifs[2] devrait représenter environ 14 % (en termes énergétiques réels, c'est-à-dire sans tenir compte des coefficients multiplicateurs prévus par la directive RED II 2018/2001) du bouquet énergétique pour le transport. La part des biocarburants liquides et du biométhane couvrirait 6,6 % de l'approvisionnement énergétique du secteur, grâce à des politiques spécifiques à l'égard des carburants, notamment pour l'aviation et la navigation maritime, tandis que les e-carburants devraient représenter environ 0,2 % de l'approvisionnement énergétique pour les transports, compte tenu des obligations en matière de carburants imposées aux secteurs de l'aviation et du transport maritime. L'électrification des transports assurerait 3,8 % du bouquet énergétique pour les carburants du transport, tandis que le gaz naturel assurerait le pourcentage restant des carburants alternatifs dans le secteur des transports en 2030.

- Sur la base du cadre décrit ci-dessus, l'intensité totale des émissions de GES pour ce scénario de bouquet énergétique à l'horizon 2030 a été calculée selon les étapes suivantes :
  - Étape 1 : Identification des quantités allouées de carburants ou de sources d'énergie (exprimées en ktep) dans le bouquet énergétique « transport » du scénario MIX55 du CTP 2030.
  - Étape 2 : Détermination de l'intensité des gaz à effet de serre (GHGi, exprimée en g éq. CO_2/MJ) pour chaque combustible ou source d'énergie identifiée à l'étape 1, en suivant l'approche « cycle de vie » de l'art. 7 de la FQD.
  - Étape 3 : Calculs pour déterminer l'intensité totale des émissions de GES du bouquet énergétique « transport » à l'horizon 2030 (selon l'hypothèse) et analyse paramétrique (dans la mesure où elle est nécessaire) pour soutenir l'évaluation des options stratégiques de la tâche 3 (étude de l'impact des options stratégiques).

Compte tenu des quantités de carburant déterminées pour le scénario MIX55 du CTP 2030, l'intensité totale des émissions de GES pour le bouquet énergétique « transport » à l'horizon 2030 s'élève à 83,2 g éq. CO_2/MJ, soit une réduction de 11,5 % par rapport au niveau de référence de 94 g éq. CO_2/MJ.

Les combustibles liquides fossiles confirment leur part dominante dans l'intensité totale des émissions de GES, avec une intensité de 88,4 g éq. CO_2/MJ (soit +4 % par rapport à la valeur moyenne globale de 83,2 g éq. CO_2/MJ).

Les combustibles gazeux contribuent de manière modeste à la réduction de l'intensité totale des émissions de GES, malgré une intensité nettement inférieure de 64,9 g éq. CO_2/MJ (soit -24 % par rapport à la valeur moyenne globale de 83,2 g éq. CO_2/MJ).

Évaluation des options stratégiques pour orienter la réduction progressive de l'intensité des émissions en GES des carburants destinés aux transports à l'horizon 2030 et à l'horizon 2050

L'étude détaille et évalue trois groupes d'options stratégiques, en prenant en compte leurs incidences respectives sur l'environnement, l'économie et la société, en vue de réduire l'intensité des émissions de GES des carburants destinés aux transports et d'atteindre ainsi les objectifs fixés dans le plan cible en matière de climat à l'horizon 2030 et l'objectif de neutralité climatique à l'horizon 2050 :

[2] Selon la directive 2014/94/UE, le terme « carburants alternatifs » désigne les carburants ou sources d'énergie qui servent, au moins partiellement, de substitut aux carburants fossiles dans l'approvisionnement énergétique des transports et qui peuvent contribuer à la décarbonisation de ces derniers et à améliorer la performance environnementale du secteur des transports. Ils comprennent notamment : l'électricité, l'hydrogène, les biocarburants, les carburants de synthèse et les carburants paraffiniques, le gaz naturel, y compris le biométhane, sous forme gazeuse (gaz naturel comprimé [GNC]) et sous forme liquéfiée (gaz naturel liquéfié [GNL]), et le gaz de pétrole liquéfié (GPL).

- Option 1 (**scénario de référence**) : maintien de l'obligation de réduire l'intensité des émissions de GES des carburants sur la base de l'approche actuelle de la FQD et des critères de durabilité pour les carburants renouvelables instaurés aux termes de la directive RED II.
- Option 2 : **suppression de l'obligation de réduire l'intensité des émissions de GES des carburants**.
- Option 3 : **renforcement de l'obligation de réduire l'intensité des émissions de GES des carburants** :
  - Sous-option A : élargissement des combustibles couverts aux combustibles gazeux.
  - Sous-option B : introduction d'un instrument fondé sur le marché (« instrument de marché ») permettant aux fournisseurs de carburants d'échanger des crédits de réduction des GES pour la fourniture de carburants pour le transport.
  - Sous-option C : réglementation visant directement les fournisseurs de carburants, par le biais d'un règlement européen.

L'évaluation du **scénario de référence** (option 1) met en avant la généralisation des carburants à faible teneur en carbone (par exemple, les biocarburants avancés) et des carburants sans carbone (par exemple, l'électricité), ainsi que l'élimination progressive des biocarburants d'origine agricole, notamment les biocarburants dérivés de matières premières à haut risque de CIAS, telles que l'huile de palme. L'essor des biocarburants avancés ainsi que d'autres carburants alternatifs devrait diminuer la pression exercée sur les terres agricoles. Les calculs sur l'utilisation des terres associée à la production de biocarburants d'origine agricole, présentés à l'Annexe K, mettent en avant une diminution significative de l'utilisation des terres, et ce malgré une augmentation globale de la demande de biocarburants entre 2020 et 2030, en raison de la diminution de la part des biocarburants d'origine agricole. D'ici 2030 et 2050, la surface des terres affectées à la production de ces biocarburants d'origine agricole diminuera de respectivement 3,9 et 7,2 millions d'hectares. D'un point de vue économique, la demande accrue de matières premières pour la production de biocarburants avancés et d'autres carburants à faible teneur en carbone peut contribuer à encourager l'innovation et faire baisser le coût de ces carburants, tout en créant des emplois dans le secteur européen et mondial des carburants à faible teneur en carbone. La croissance de l'emploi dans l'UE dépendra toutefois de plusieurs facteurs, tels que la localisation de la production ou l'importance des exportations des technologies européennes – des aspects n'ayant pas été examinés dans le cadre de cette étude.

La charge administrative associée à la mise en œuvre des dispositions de l'art. 7A a été quantifiée par rapport à celles de la directive RED. Elle est considérée comme limitée, tant pour les administrations publiques que pour les fournisseurs de carburant. En ce qui concerne les coûts afférents à la mise en œuvre pour les fournisseurs de carburant, il faut s'attendre à une augmentation du coût de production des carburants. Ces augmentations devraient toutefois n'avoir qu'un effet limité sur le coût du transport routier, qui resterait abordable.

L'étude montre également que la **suppression de l'obligation** (option 2) n'aurait aucun effet sur la répartition des matières premières, étant donné que les exigences de durabilité (identiques pour la FQD et la RED) seraient toujours régies par la directive RED II. La suppression de l'obligation ne modifierait donc pas la demande pour les différentes catégories de matières premières importées utilisées pour la production des biocarburants.

En outre, la suppression de l'obligation de réduction des GES ne modifie pas la charge administrative des États membres et des fournisseurs de carburant comparé au scénario de référence. En effet, les autorités des États membres et les fournisseurs de carburant doivent toujours affecter des ressources à i) la communication de données à la Commission européenne et à ii) la surveillance des émissions de GES tout au long du cycle de vie des carburants, conformément aux exigences de la directive RED. Même si l'obligation de réduction des GES est supprimée, le marché pourrait rester fragmenté. Les facteurs à l'origine de cette fragmentation pourraient certes être réduits, mais ils ne disparaîtront pas, en raison de l'approche suivie pour la transposition de la directive RED II dans les législations nationales et des obligations attendues de réduction des émissions de GES imposées aux principaux marchés des biocarburants.

En ce qui concerne l'analyse des effets d'un **renforcement de l'obligation de réduction de l'intensité des émissions de GES des carburants** (option 3), l'étude constate que la part plus élevée du bioéthanol avancé (issu par exemple de résidus agricoles) dans le « mix » des matières premières s'accompagnerait d'une diminution plus importante de la part du bioéthanol d'origine agricole. L'effet prévu n'est toutefois pas significatif pour les pays tiers, étant donné qu'environ 75 % du bioéthanol est produit dans l'UE. En revanche, pour ce qui est du biodiesel, l'option 3 entraînerait une réduction significative des changements directs et indirects d'affectation des sols, en raison d'une part plus élevée d'une matière première de déchets de traitement industriel, par exemple l'effluent d'huile de palme (*Palm Oil Mill Effluent*, POME), répertorié dans l'annexe IX-A de la directive RED II. L'hypothèse d'augmentation de la part du POME dans la répartition des matières premières a aussi un effet sur d'autres matières premières, à savoir le colza et le soja. Par rapport au scénario de base, la production de biocarburants passerait donc, dans l'option 3, des producteurs de colza et de soja, c'est-à-dire l'Argentine, le Brésil, l'UE et les États-Unis, aux deux pays producteurs d'huile de palme, à savoir l'Indonésie et la Malaisie.

Vu l'hypothèse qui la sous-tend (un renforcement de l'obligation de réduction des GES augmente la part des biocarburants avancés), l'option 3 pourrait avoir des effets plus importants pour les pays tiers que le scénario de référence. D'un point de vue environnemental, la pression directe et indirecte sur l'utilisation des terres sera moins importante pour les matières premières utilisées pour la fabrication des biocarburants. Sur le plan économique, l'augmentation de la demande de biocarburants avancés stimulera l'innovation et générera des économies de coûts supérieures, d'où un effet plus important sur la création d'emplois dans le secteur européen et mondial des carburants à faible teneur en carbone. Comme c'est le cas pour l'option 1, la croissance de l'emploi dans l'UE dépendra de plusieurs facteurs, tels que la localisation de la production ou l'ampleur des exportations des technologies européennes.

Même si l'option 3 atténue davantage les changements directs et indirects d'affectation des sols aux fins de la production de biocarburants d'origine agricole, ce qui se traduit par des pertes de production pour les pays fournisseurs, le renforcement de l'obligation de réduire l'intensité des émissions de GES des carburants améliorerait les possibilités de développer des carburants plus durables, à faible teneur en carbone, et dès lors la transition énergétique dans ce domaine. Par rapport au scénario de référence, l'incidence de l'option 3 est donc jugée positive.

Concernant la sous-option 3A, les **carburants gazeux dans les transports gagneront une importance limitée, mais fortement croissante d'ici 2030**. Pour l'hydrogène, il n'y aura cependant de demande notable qu'à partir de 2040. L'utilization accrue de carburants gazeux renouvelables peut entraîner une augmentation de la demande de matières premières résiduelles ou issues des déchets, ce qui favorisera l'abandon progressif des carburants à base de produits agricoles.

L'ajout des carburants gazeux au champ d'application soumis aux exigences en matière de qualité des carburants n'entraînerait pas de modifications significatives de la charge administrative pour les États membres et les fournisseurs de carburant, par rapport au scénario de référence. Cependant, certains fournisseurs de carburants qui ne sont pour l'instant pas soumis à l'obligation de respecter les normes EN existantes encourraient des coûts pour suivre les norms existantes, mais les informations sur l'étendue de ce problème ne sont pas disponibles.

Un **instrument de marché** (sous-option 3B) incitera les fournisseurs de carburant à agir de façon à obtenir un maximum de crédits. Ils veilleront à mieux remplir leurs obligations, en fonction de l'objectif annuel précis de réduction des GES. L'effet sur la réduction des émissions de GES sera supérieur à celui du scénario de référence, à supposer que l'instrument de marché soit doté d'un solide mécanisme de surveillance et de conformité obligeant les fournisseurs de carburant à atteindre leurs objectifs de réduction des GES sur une base annuelle. L'instrument fondé sur le marché aura aussi un effet positif sur la demande de carburants à faible teneur en carbone ou sans carbone, étant donné qu'un tel système récompense les carburants émettant moins de GES.

L'instrument de marché entraînera des coûts administratifs supplémentaires par rapport au scénario de référence, tels que des coûts de lancement et des dépenses récurrentes, comme les dépenses de fonctionnement annuelles pour la plateforme d'échange, les frais de gestion des participants et les coûts de mise en œuvre. S'agissant des fournisseurs de carburant, l'on estime que cette sous-option ne s'accompagne que d'une charge administrative minimale par rapport au scénario de base. L'instrument fondé sur le marché peut fournir des revenus supplémentaires aux fournisseurs de carburant, un facteur qui peut être déterminant pour la situation financière des petits fournisseurs de carburants innovants, à faible teneur en carbone ou sans carbone. Bien que l'instrument fondé sur le marché ne stimule pas directement l'innovation, l'on peut raisonnablement supposer que la mise en œuvre de cette sous-option contribuera à la mise en place d'un environnement d'investissement plus favorable, susceptible de renforcer l'activité d'innovation et les efforts visant à réduire les coûts de production des carburants à faible teneur en carbone ou sans carbone.

Enfin, comme l'instrument fondé sur le marché va directement de pair avec une réglementation des fournisseurs de carburants, par le biais d'un règlement de l'UE, il peut faciliter la mise en place d'un marché harmonisé, avec à la clé, une défragmentation du marché des carburants à faible teneur en carbone.

Enfin, et surtout, le **remplacement de la directive actuelle par un règlement de l'UE** (sous-option 3C) n'aura pas la moindre incidence sur les matières premières entrant dans la fabrication des biocarburants et dès lors aucune incidence sur les importations de ces matières premières. Cependant, un règlement visant directement les fournisseurs de carburant mettra en place des conditions qui facilitent le développement d'un marché homogène, en supprimant la fragmentation actuelle du marché résultant, par exemple, de la non-harmonisation des structures de sanction au niveau des États membres. La clarté des objectifs et des approches à mettre en œuvre pour les atteindre favorisera l'adoption de carburants qui contribueront à la réduction des GES émis par le secteur des transports et à la réduction de l'intensité des émissions de GES des carburants fossiles.

1 INTRODUCTION AND OBJECTIVES OF THE REPORT

This is the Final Report for the support study on the evaluation of Art.7A of Directive 98/70/EC relating to the quality of petrol and diesel fuels, so-called Fuel Quality Directive (FQD) and assessment of approaches to reduce greenhouse gas (GHG) emissions from transport fuels. The study was commissioned in June 2020 by the European Commission, DG CLIMA to Technopolis Group in association with COWI and Exergia under the Framework Contract between COWI and DG CLIMA (CLIMA.A.4/FRA/2019/011).

1.1 Policy context to the study

1.1.1 *EU climate policy context*

With the anthropogenic emissions of greenhouse gasses highest in our history climate change represents an existential threat that is having unprecedented impacts on both human and natural systems in the world. There is a solid body of scientific evidence[3] proving that this is happening because of human influences, in particular since the industrial revolution of the 18th century. Since then, the world's use of fossil fuels – the major contributor to climate change – has kept increasing to today's levels. Scientists agree that, if we want to avoid the most severe, pervasive, and irreversible impacts of climate change for people and ecosystems, we should not allow the average global temperature to rise beyond 2°C compared to pre-industrial levels. Consequently, the world as a whole should halve its emissions by 2050.

The EU has been a dynamic leader of international climate policy over the last thirty years from the 1992 United Nations Framework Convention on Climate Change to the new negotiations that will occur at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow at the end of 2021. EU climate policy efforts began with the Single European Act, which entered into force in 1987, where the first set of environmental legislation was developed, mainly leading in 2005 to setting up a system (Emission Trading Scheme) based on putting a price on greenhouse gas emissions and using market forces to contribute to the necessary emission reductions[4]. In 2009, the Lisbon Treaty[5] incorporated the field of energy policy in the EU Treaty and allowed for the alignment and coordination of energy and climate policies. This arose from the strategic view that, as the EU is largely dependent on imports of fossil fuels, the instruments and technologies to achieve a more competitive and secure energy system largely coincide with those needed to reduce greenhouse gas emissions.

Up until 2020, the EU's climate targets were guided by the principle of "20-20-20 by 2020": a 20% reduction in GHG emissions (compared to a 1990 baseline), a share of 20% renewable energy, and a 20% increase in energy efficiency.[6, 7] The 2020 targets gave rise to the introduction of the EU's 2008 Climate and Energy Package, which entailed the introduction of various policy measures to address, among others, GHG emissions in the transport sector. The most notable legislative documents in this respect are the Renewable Energy Directive (RED; Directive 2009/28/EC), recasted in 2018[8], the Regulation on CO_2 emission standards for light-duty vehicles (Regulation (EC) No 443/2009), repealed in 2019[9], and the Fuel Quality Directive (Directive 2009/30/EC), amending Directive 98/70/EC.

As part of the Effort Sharing Decision, the Member States furthermore committed themselves on binding targets to reduce/limit the increase of GHG emissions from transport. As of 2018, the EU reduced its GHG emissions by 23% since 1990 and has thus overachieved the 2020 GHG emissions reduction target.

The EU climate agenda post-2020 continued to pursue the above three-fold targets on GHG reduction, increase in renewable energy, and increase in energy efficiency. In 2014, the European

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3 https://www.ipcc.ch/assessment-report/ar5/

4 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC

5 Treaty on the Functioning of the European Union, consolidated version, article 194.

6 European Council, Presidency Conclusions — Brussels 8/9 March 2007, Council of the European Union, 7224/1/07, 2007.

7 https://ec.europa.eu/clima/policies/strategies/2020_en.

8 Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast).

9 By Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011.

Council agreed to the 2030 Climate and Energy Policy framework, which saw among others a GHG reduction target of 40% by 2030 (compared to a 2005 baseline).[10] This reduction target was split up into ETS and non-ETS sectors, of which the latter has a reduction target of 30%. This reduction target was manifested in 2018 with the introduction of the Effort Sharing Regulation.[11]

Since 2005 to date, overall emissions from transport as well as only from road transport have however not decreased and remain higher than in 1990[12]. Road transport constitutes the highest proportion of overall transport emissions (around 71% in 2018). The assessment of the Member State's NECPs indicates that Effort Sharing legislation sector emissions in the EU-27 were 10 % below 2005 levels. However, emission levels during the period 2015-2019 remained above 2014 levels. This was largely due to increased emissions observed in the transport sector[13]. Regarding the overall GHG intensity of fuels, the EU is lagging behind its 2020 target set in the Fuel Quality Directive (98/70/EC) with a projected reduction of 4.7 %, instead of the targeted 6 % in 2020, compared with 2010 levels. Between 2021 and 2030, Member States will place obligations on fuel suppliers to ensure that at least 14 % of transport fuels stem from renewable sources with a maximum 7 % contribution of biofuels from food and feed crops. Generally, progress in the transport sector is much slower compared with overall growth rates in renewable energy for all sectors[14].

The 2018 Commission's communication on "A Clean Planet for all" confirmed Europe's commitment to lead in global climate action and to present a vision that can lead to achieving net-zero greenhouse gas emissions by 2050 through a socially fair transition in a cost-efficient manner[15]. In 2019, the EU with the Green Deal upscaled its ambitions[16] to transform the EU into a modern, resource-efficient, and competitive economy, ensuring no net emissions of greenhouse gases by 2050, economic growth decoupled from resource use, and no person and no place left behind.

These goals are no longer aspirations or ambitions, but obligations laid down in the first European Climate Law[17]. On July 14th, the European Commission has further strengthened its commitment by issuing a package of proposals aiming to make the EU 'Fit for 55'[18], where targets were set for reducing net emissions by at least 55% by 2030 and with the ambition of making the EU the first climate neutral continent by 2050. The 2030 Climate Target Plan (CTP)[19] is an important milestone on the EU's path towards climate-neutrality in 2050, and further sets the level of ambition that the policy options investigated in this study ought to achieve.

1.1.2 *The role of fuel GHG intensity in reaching climate targets*

Policies aiming at the reduction of emissions intensity from transport fuels discourage the use of conventional fossil fuels and promote the development of low-carbon alternatives without placing restrictions on the total volume of fuel sold (and therefore to the effective coverage of transport energy demand).

The Fuel Quality Directive (hereafter referred as FQD) generally aims at reducing the climate impacts arising from road transport fuels. A specific objective of the FQD is the reduction of life cycle greenhouse gas emissions from transport fuels. To this end, Art. 7A sets an obligation on fuel suppliers to reduce the GHG intensity of fuels by minimum 6% by 2020 against a common baseline

[10] https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145356.pdf
[11] Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States
[12] Statistics covering the period between 1990 and 2019. Greenhouse gas emissions from transport in Europe — European Environment Agency (europa.eu)
[13] EEA, 2020, Trends and projections in Europe 2020, Report n.13/2020
[14] EEA, 2020, Trends and projections in Europe 2020, Report n.13/2020
[15] COM (2018) 773 final
[16] Communication From the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions the European Green Deal COM/2019/640 final.
[17] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality ('European Climate Law').
[18] Brussels, 14.7.2021 COM (2021) 550 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality.
[19] Brussels, 14.7.2021 COM (2021) 550 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality.

(2010). Art. 7A also sets out reporting requirements concerning the volume and type of fuels (including fossil fuels, biofuels, electricity, and renewable fuels of non-biological origin) supplied for road vehicles and non-road mobile machinery, as well as their life cycle greenhouse gas (GHG) emissions (from their extraction, processing, and distribution), including reporting on the emissions resulting from indirect land use change (ILUC) for biofuels.

The use of biofuels (substitution of fossil fuels), electric vehicles (EVs) and upstream emission reductions (UERs) contribute to meeting the 6% reduction target. However, biofuels have proven so far to be the main compliance option. For a biofuel to be counted for the purposes of meeting the FQD target, it must meet the sustainability criteria as set out in the FQD consistently with the RED. Annex IV of the FQD contains default values for the GHG intensity of biofuels produced from various feedstocks and processes. These values can be used by suppliers to demonstrate their progress towards the FQD target and are the same as the values that are contained in the RED. Further, the Council Directive (Directive (EU) 2015/652) specifies relevant calculation methods and reporting requirements, and provides GHG emission intensity and/or savings values, while also sets the fuel baseline standard of 94.1 g CO_2 e/MJ.

Last year (May 2020), the European Topic Centre on Climate change mitigation and energy published a report [20], providing a summary of the information on the quality of fuels in the European Union (EU) in 2018, as per the reporting obligations of the FQD.

Total fuel supply reported for the 28 Member States 14 028 petajoules of which 95 % came from fossil fuels and 5 % from biofuels. The fuel supply was dominated by diesel (59.8 %) and petrol (23.3 %), followed by gas oil (9.7 %), biodiesel (FAME) (3.6 %), bioethanol (0.8 %) and HVO (0.7%). No renewable fuels of non-biological origin were reported in 2018. The Table 1 provides the list of the main fossil fuels and biofuels reported, whereas several feedstock and production pathways were considered as well.

Overall, the European Topic Centre on Climate change mitigation and energy analysis concluded that the average GHG intensity of the fuels consumed in the countries which participated in the reporting exercise in 2018 was 3.7% lower than the 2010 levels (excluding the ILUC emissions intensity for biofuels). Taking ILUC emissions into account, the average GHG intensity of the fuels consumed in 2017 was 2.1% lower than the 2010 levels. Therefore, "extra efforts from fuel suppliers are necessary to meet the 6 % target by 2020".

Table 1 Fossil fuels and biofuels reported by the MS in 2018

Fossil fuels	Biofuels
Petrol	Biodiesel
Diesel	Bioethanol
Liquid petroleum gas (LPG)	Hydrotreated vegetable oil (HVO)
Compressed natural gas (CNG)	Bio-ETBE
Gas oil	Biogas
Liquefied natural gas (LNG)	Other
Other	

Source: ETC/CME, 2020

For the 2020 -2030 period, the transition to sustainable renewable transport fuels characterised by lower GHG intensity is largely driven by the recast Renewable Energy Directive (REDII; Directive 2018/2001/EU).

RED II sets European Union targets for the use of sustainable alternative fuels in transport in the period to 2030. RED II sets a 14% transport sub-target of renewables in energy consumed in road and rail transport by 2030. A key difference to the previous directive is that Member States must require fuel suppliers to supply a minimum of 14% of the energy consumed in road and rail

[20] ETC/CME Report 2/2020: Greenhouse gas intensities of road transport fuels in the EU in 2018. Monitoring under the Fuel Quality Directive

transport by 2030 as renewable energy. RED II includes minimum sub-targets for advanced biofuels (feedstocks listed in Annex IX Part A of the REDII), at 0.2% in 2022, to reach 3.5% by 2030. RED II has also revised the sustainability criteria and the default values of GHG emission savings.

The above provisions of RED II may lead to potential inconsistencies with the rules of the FQD. Further, the transposition and implementation of RED II by Member States is still an open issue, especially as regards the policies towards (advanced) biofuels, the methodology for lifecycle carbon emissions reductions calculation of RFNBOs and RCFs as well as for co-processed fuels in RED II is not yet defined. At the same time, the implementation of the FQD Art. 7A to date indicates that its enforcement across the EU is linked, among others, to blending mandates and GHG reduction quota defined at national level. Overall, the above creates a complex matrix that fuel suppliers (and Member States) will have to navigate to meet the EU climate targets of 2030.

1.2 Objectives of the study

The **objectives** of this study are to support the European Commission in:

- Evaluating the implementation by Member States of the current FQD with specific respect to the implementation of the GHG intensity reduction of emissions over the lifecycle of transport fuels, as mandated in FQD Art.7A. Thus, the study has a summative dimension (ex-post evaluation) that focuses on taking stock of what has been done so far in the Member States and in the EU through the implementation of the FQD in general and of Art.7A in particular.
- Assessing options to steer the progressive reduction of road transport fuels' GHG intensity towards 2030 and 2050, while ensuring consistency with relevant legislation and ongoing other policy initiatives, including RED II and its possible revision, as well as aviation and maritime initiatives under the 2020 Work Programme. Thus, the study has a formative dimension that focuses on forward-looking analysis of possible impact under various policy options.

1.3 Structure of the study

The study is composed of **five sections** and **Appendixes**.

Following this introduction presenting the policy context, objectives, and structure of the study, **Section 2** illustrates the methodology underpinning the study, followed by the description of the results of the analysis.

Notably, according to the Better Regulation Guidelines[21], the findings of the evaluation of the implementation of FQD Art.7A in the EU Member States (**Section 3**) are shown against the criteria of Effectiveness, Efficiency, Coherence, Relevance, and EU added value.

This is complemented in **Section 4** by the calculation of the GHG emission intensity of fuels in selected fuel mix scenarios of the 2030CTP, based on the life-cycle approach of the FQD, and by the assessment of policy options to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050.

Section 5 closes the study with conclusions and recommendations.

This Final Report also includes in **appendices** the following documents:

A. Literature consulted
B. Evaluation matrix
C. List of stakeholders consulted
D. Survey report

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21 European Commission, Better regulation: guidelines and toolbox: https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en.

E. Cost Benefit Assessment Report
F. Report on calculations of GHG emission intensity of fuels
G. Initial Workshop report
H. Final workshop report
I. Problem definition
J. Assessment of inclusion of gaseous fuels and introduction of a market-based instrument
K. Assessment of the impacts.

2 METHODOLOGY

This section presents the key features of the methodological approach underpinning each part of the study, i.e. Part A focusing on the evaluation of FQD Art.7A, and Part B devoted to the assessment of policy options, based on calculated GHG emission intensities of the fuel mix under various scenarios, designed to steer the progressive reduction of transport fuels' GHG intensity reduction towards 2030 and 2050.

2.1 Part A: Evaluation of FQD Art.7A

2.1.1 *Methodological approach*

The European Commission's Better Regulation recommends conducting evaluations based on a so-called "Theory of change". This theory does not correspond to a scholarly conceptual framework but refers instead to the (implicit) understanding of policymakers and stakeholders of how the evaluated policy intervention is supposed to foster changes in the behaviours and activities of the relevant actors to produce ultimately the expected impacts.

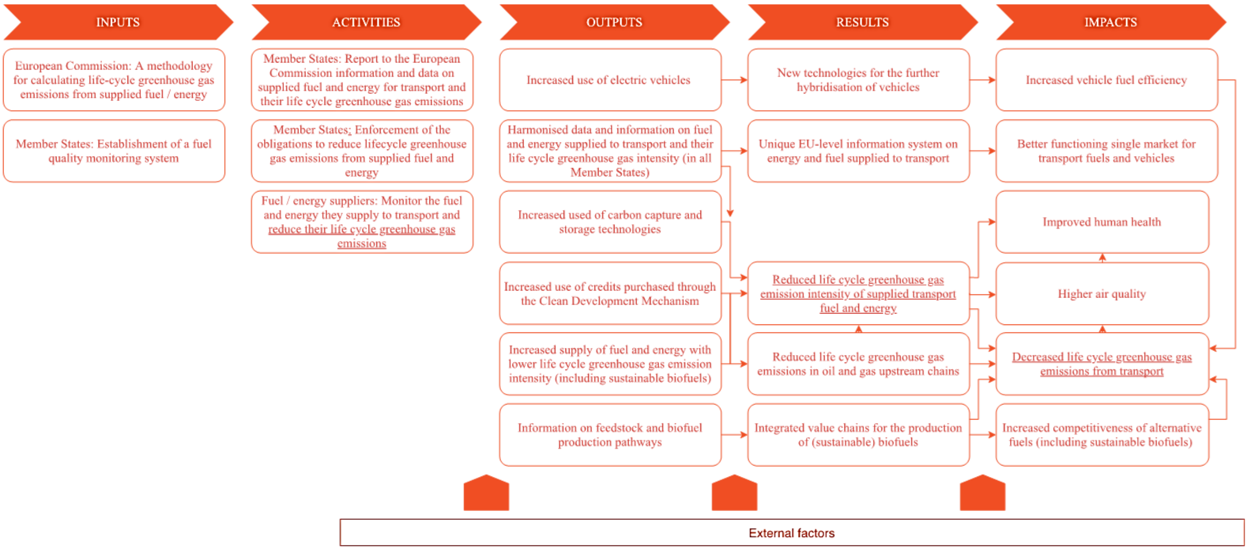
This implies (1) developing the intervention logic that underpins FQD Art.7A and represents how its inputs can be transformed in outputs, then outcomes and finally impacts, and (2) defining the conditions that must be met to allow for this transformation. By reviewing the Theory of Change of FQD Art.7A, the study contributes to clarify "how the FQD has worked" and to draw policy recommendations to inform the impact assessment carried out in the second part of the study.

Figure 1 below represents the intervention logic of FQD Art.7A. It relies on the following assumptions:

- The following factors have been singled out as key to attain the targets in FQD Art.7A:
  - Use of liquid and gaseous biofuels produced from food and feed crops (whose uptake is nevertheless capped), liquid and gaseous biofuels produced from waste and residue feedstock, electricity for road transport, and Renewable Liquid and Gaseous Transport Fuels of Non-Biological Origin (RFNBOs)
  - Use of upstream emission reductions (an optional tool)
  - Lowered capital expenditure and production costs induced by (technically and commercial mature) non-food/feed-based biofuels and emerging technologies
  - Absence of or lower blending constraints on ethanol and biodiesel that would otherwise affect the uptake of non-fungible (drop-in) fuels.
- The targets in FQD Art.7A are sufficiently ambitious and realistic to foster and orient efforts from fuel / energy suppliers and Member States towards reduction of GHG emission intensity of transport fuels.
- In instances where the EU-level targets set in Art.7A and the associated penalties do not provide by themselves sufficient incentives to change sustainably the behaviour of fuel and energy suppliers, Member States have in place enforcement mechanisms to ensure that suppliers reduce the GHG emission intensity of transport fuels.
- National enforcement mechanisms decided and implemented at the national level do not hamper the functioning of the single market for transport fuels and vehicles.
- Fuel suppliers contribute to reducing life cycle GHG emissions from transport by increasing the share of sustainable biofuels and alternative fuels (with lower greenhouse gas emission intensity) and/or by increasing the use of new technologies, such as electric vehicles and carbon capture and storage, and/or credits purchased through the Upstream Emissions Reduction option.
- FQD Art.7A cannot be considered a success if it had induced fraudulent claims by suppliers and Member States and practices to reduce artificially the GHG emission intensity of transports fuels and energy.
- The data and information reported to the EEA by the Member States are accurate. As EEA does not have access to the raw micro data that would allow for an EU-level quality control, the quality and accuracy of the data and information reported relies on the control and

checks performed by the Member States. This also implies that the Member States are provided with all the information and data they need to make such quality control.

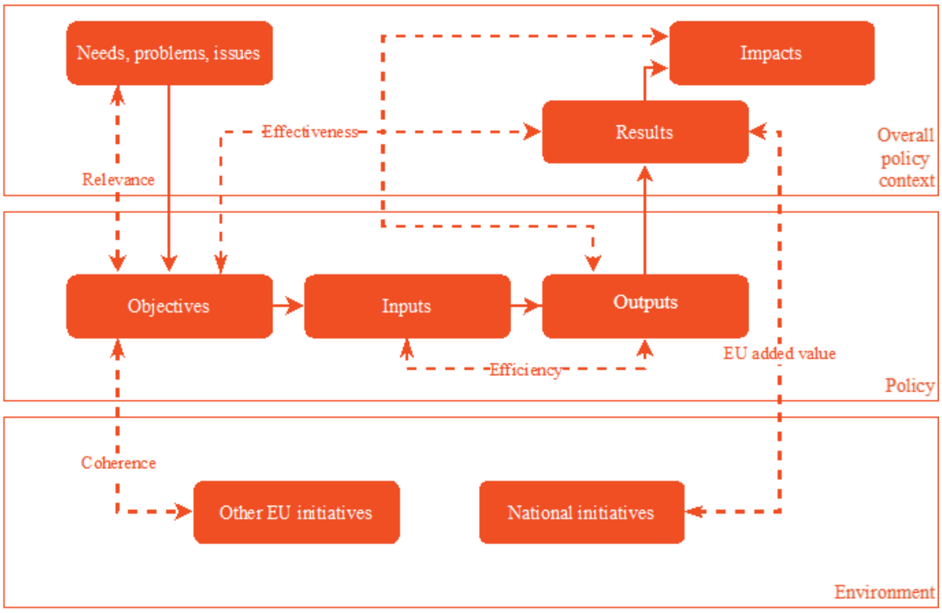
Figure 1 FQD Art.7A intervention logic



Analysis

FQD Art.7A is evaluated against five evaluation criteria defined in the Better Regulation Guidelines, namely relevance, effectiveness, efficiency, coherence, and EU added value. The relation between the intervention logic and the evaluation criteria and questions is depicted in Figure 2.

Figure 2 Evaluation criteria



While the criterion of **relevance** considers the (ongoing) alignment of the objectives of FQD Art.7A with the needs it addresses, the criterion of **effectiveness** aims at assessing the extent to which these objectives were reached, and the related facilitators and/or barriers. The criterion of **efficiency** sets the effects of FQD Art.7A in relation to the costs of the inputs provided as well as all other costs induced by its implementation. **Coherence** regards the positioning and relationship of FQD Art.7A with other provisions in the FQD, and other EU and/or international/national/local initiatives that have similar objectives. **EU added value** concerns the additional value resulting from the intervention at the EU level, compared to what could have been achieved at the national or local levels.

Based upon the intervention logic above, **evaluation questions** are defined (see Table 2 below), and then divided into sub-questions or more precise 'topics for investigation'. These (sub)questions and the relevant indicators are then matched with the most appropriate sources and methods for the data collection and analysis, resulting in the 'evaluation matrix'.

Table 2 Evaluation questions per evaluation criterion

Evaluation criteria		Evaluation questions
Relevance	1	To what extent do the target in FQD Art.7A correspond to the ambitions and obligations of the European Union in terms of reduction of GHG emissions?
	2	How relevant is the monitoring of supplied fuels and energy to Member States?
	3	How relevant are the targets in terms of reduction of the life cycle GHG emission intensity of transport fuels?
Effectiveness	4	Does FQD Art.7A contribute to reducing the life cycle GHG emission intensity of transport fuels until end of 2020?
	5	What are the technological, environmental, and economic impacts of the implementation of FQD Art.7A?
	6	What factors contribute to or hinder the monitoring and reporting of the life cycle GHG emission intensity of transport fuels?
	7	What factors contribute to or hinder the reduction of the life cycle GHG emission intensity of transport fuels?
Efficiency	8	Are the reporting and monitoring processes of the life cycle GHG emission intensity of transport fuels cost-effective?
	9	Is the obligation to reduce the life cycle GHG emission intensity of transport fuels cost effective?
	10	Which factors influence the efficiency of the observed results?
	11	How can the efficiency of FQD Art.7A be improved?
Coherence	12	To what extent is FQD Art.7A been coherent with other provisions in the FQD?
	13	To what extent is FQD Art.7A coherent with other EU initiatives?
	14	How coherent is FQD Art.7A with national initiatives?
	15	How coherent is FQD Art.7A with the international obligations of the European Union?
EU added value	16	Did the definition of the FQD Art.7A target at the EU level allow for the achievement of the overarching objectives relative to GHG emissions intensity reduction of transport fuels?

Data and information collection

To answer these evaluation questions, the study collects evidence from:

- **Desk research** and **literature review**, more precisely, the review of relevant publications and sources of data-based evidence. This includes: EU policy documents on the FQD and, more specifically, on its Art.7A; position papers on FQD Art.7A and its implementation; Member States monitoring reports and information on progress in and towards life cycle GHG emission reduction; academic and grey literature on policy and industry initiatives for the reduction of life cycle GHG intensity of transport fuels.
- Preliminary consultation with representatives of industry associations, fuel suppliers / producers, national competent authorities and other experts during a dedicated **stakeholder workshop** held on 3rd September 2020.

- A **targeted survey** with national competent authorities, industry associations, fuel suppliers / producers, other relevant industries, NGOs, and research organisations
- A series of **interviews** with the same categories of stakeholders.
- A **final stakeholder workshop** with representatives of the industry, industry associations, fuel suppliers / producers, national competent authorities, and other experts to present and validate the preliminary findings.

With regards to desk research and literature review, the following groups of the literature was selected each focusing on specific important aspect or date for this study, i.e.:

- Data sources and literature on the volume, type and quality of petrol/diesel /biofuel in EU
- Data sources and literature on the GHG emissions from transport
- Data sources and literature providing perspectives for policymaking for potential to reduce the GHG emissions
- Data sources and literature on EU investments and contributions to R&I in alternative fuel
- Data sources and literature on initiatives, projects, and technical advancement to reduce GHG emissions
- Volume, type and quality of petrol/diesel/biofuel in EU.

The literature review gathered quantitative data on trends in petrol/diesel/biofuel consumption for transport in the European Union, the average GHG intensity of the fuels and energy supplied in the 22 reporting Member States. The literature also showed the transposition of the biofuel's legislation across the EU Member States, including national targets and present different fuel quality monitoring programmes with different organizational schemes and financial resources among the MS. Data highlighted the average share of energy from renewable sources in transport among Member States, and assessments of the Member States progress in reaching the 10% renewable energy target. The desk review also allowed to have an overview of production capacities of the main European bioethanol producers and biodiesel producers.

Regarding data on GHG emissions in transport, the literature review made an inventory of CO2 emissions from transport in UE including shipping, aviation, electric vehicles, and trains powered by the present European electricity mix.

As for the literature on perspectives for policymaking, the analysis of those documents allowed to extract an overview of the behaviours that have the potential to reduce the GHG emissions associated with the production of transport fuels and energy sources; to identify market barriers that hamper their use and uncertainty about which technical options are market ready; to discuss the preconditions for and risks of introducing policy options for promoting decarbonisation in EU; to provide a comprehensive overview of economic and non-economic costs and benefits of EU biofuel policies; then to compare the effectiveness of supporting one sector against other policy options.

A specific section of literature was analysed on EU investments and contributions to R&I in alternative fuel with an overview of demonstration and scale-up activities.

Similarly, regarding initiatives, projects, and technical advancement to reduce GHG emissions, the study team investigated alternative fuels or technologies that can contribute to significant reduction of transport related GHG emissions (including aviation and shipping) compared with the estimates for conventional diesel and petrol fuels.

The literature and relevant data sources above were compiled in a data repository. The team compared different information sources to achieve a critical assessment of previous findings. The reporting of the documents review followed a logical and effective structure and maintained the focus on the topics of the study. Desk research also focused in gaining better understanding of the details and quality of the data provided by various reports, studies, and statistical sources. The team identified the gaps in available evidence that it needed to fill through stakeholder consultations. Furthermore, already at the inception phase, the systematic analysis of the data available contributed to design the statistical analysis strategy.

2.2 Part B: Calculation of the GHG emission intensity of fuels under various fuel mix scenarios and assessment of policy options to steer the progressive reduction of transport fuels' GHG intensity

Part B consists of two main elements: (a) calculation of the GHG emission intensity of fuels under various fuel mix scenarios and assessment of environmental, economic, and (b) social impacts of different policy options. The calculations on the fuel mix feed either quantitatively or qualitatively into the assessment of the policy options to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050. The sections below present the methodology used for these two elements of Part B of the study.

2.2.1 *Methodological approach to calculation of the GHG emission intensity of fuels*

Part B of the study deals with the calculation of the well-to-wheels (WtW) GHG emission intensity of the overall fuels mix in transport in 2030, based on the life-cycle approach of the FQD, and its reduction from the 2010 baseline set in the FQD. For the calculations, the projected fuel-mix under the scenarios underpinning the 2030 CTP is considered. In particular, the main 2030 CTP scenario considered in the study is the so-called "MIX55" scenario, which comprises a mix of policies for the decarbonization of the various sectors and leading to a ca. 55% reduction of the total GHG emissions in 2030 as compared to 1990[22], both expanding carbon pricing to the transport and buildings sectors (be it via EU ETS or other carbon pricing instruments) and moderately increasing the ambition of policies.

The difference between the GHG emission reductions reported in the overarching target of the 2030CTP and the GHG emission intensity target of the FQD Art. 7A should be highlighted. Simulations in the 2030CTP refer to the actual number of tonnes of GHG emissions that are saved because of the implementation of the considered policies. Savings refer to the entire energy system but also to individual sectors and sub-sectors, including road transport. These GHG savings are calculated on a tank-to-wheels approach and the corresponding number cannot be directly related to the requirement of the FQD Art. 7A for GHG emission intensity over a well-to-wheels approach. The well-to-wheels GHG emission intensity methodology of the FQD has to be applied on 2030CTP quantities of different fuel categories used in road transport to derive the number to be considered in the frame of the Art. 7A obligation. Further, the scope of the FQD is mainly on road transport, whereas the modelling exercise supporting the 2030CTP considers all transport modes. Adjustments and interpretations are therefore needed when drawing conclusions on FQD Art. 7A.

Brief overview of the MIX55 scenario

Focusing on the **sectoral GHG emission** reductions, simulations of the MIX55 scenario anticipate a 16.3% GHG emission reduction in the transport sector in 2030 compared to 2015, as illustrated in Table 3.

Table 3 Total GHG emissions and reduction in the transport sector in 2030 in the MIX55 scenario of the 2030CTP

	MIX55
CO_2 emissions (% change 2030 GHG emissions versus 2015)	-42.6%
Transport (incl. road transport, intra EU aviation and maritime navigation)	-16.3%
of which Road Transport	-19.6%
Road transport and Rail and Inland Navigation	-19.2%

Source: Elaboration of Table 6 and Figure 64 of Annex 1 of the 2030CTP

[22] It is noted that the 2030CTP also presents a MIX50 scenario but following the adoption by the EC of the target of 55% reduction of GHG, only the MIX55 is considered.

According to the reported modelling results, although in road transport annual CO_2 emissions reduction doubles in the 2015-2030 period as compared to the period 2005-2015 period, the sector still sees only a decrease in emissions of ca. 20% in the period 2015-2030.

A total of 25,8% of **RES share in the transport sector** is projected by the MIX55 scenario, including multipliers for specific fuel categories and transport modes, applied in accordance with RED II provisions. Excluding RED II multipliers, total alternative fuels[23] are projected at around 14% of the transport fuel mix[24]. The share of liquid biofuels and biomethane reaches 6.6% of transport energy demand, thanks to dedicated fuel policies, including policies for aviation and maritime navigation, while e-fuels would represent around 0.2% of the transport energy demand, driven by fuel obligations for the aviation and maritime transport sectors.

Focusing on **gaseous fuels**, the MIX55 scenario predicts an increase in the consumption of gaseous fuels in the transport sector of more than a factor of 3,5 in 2030 as compared to 2015, while the uptake in 2050 is such that results in an increase of about 14 time (42 Mtoe in 2050 as compared to 11 and 3 Mtoe in 2030 and 2011 respectively). Biogas, including waste gas, is increased by 40% in the period 2015-2030, while hydrogen and e-gases are only considered into significant shares after 2040[25].

Longer term projections of the CTP2030 suggest that by 2050, the MIX55 scenario will result in an almost 90% reduction of the total GHG emissions (% change from 1990 levels). Further, most fossil fuels will be replaced in all sectors, including transport, to reach the overall targeted climate neutrality. Over 85% of fuels will not be based on fossil oil sources, with oil products remaining primarily in sectors such as aviation and maritime navigation[26].

The above fuels mix results in a calculated decline of total CO_2 emissions from transport (excluding international maritime navigation) by approximately 13% by 2030. This reduction comes despite of the fact that there is a significant increase in transport activity; the latter is compensated via the increased fuel efficiency of cars, as well as vans[27], and by the shift of the overall transport fuel mix into cleaner fuels, as briefly described above.

Renewable energy and transport policies in the MIX55 scenario

As it was mentioned before, the MIX55 scenario has been designed in a way to achieve approximately 55% GHG reductions, and assumes the implementation of several policies, such as an increase, as compared to the currently existing policies, of the ambition of energy efficiency, renewables, and transport decarbonization policies, as well as it assumes expansion of the scope of carbon pricing, be it via EU ETS or other carbon pricing instruments, to the transport and buildings sectors.

In particular, the MIX55 scenario assumes an EU ETS sector carbon price ca. 37% higher than the relevant price considered in the baseline scenario of the 2030CTP (where the 2030CTP baseline scenario essentially considers the extension of the implementation of the current policies to the 2020-2030 period), while also considers a carbon price for the non-ETS sector equal to approximately to one fourth (25%) of the ETS sector price.[28]

- Focusing on the instruments that drive developments in the transport sector, the MIX55 scenario follows REDII in its current form, but also assumes a moderate intensification of RES-uptake policies, including the following measures[29]:
- The overall renewable energy target for transport in 2030 accounts for the *ReFuelEU* aviation and *FuelEU* maritime initiatives.
- An increased ambition for deployment and further mainstreaming of renewable and low carbon fuels, including advanced biofuels and biogases as well as RFNBOs in transport.

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[23] According to the Directive 2014/94/EU, 'alternative fuels' means fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include, inter alia: electricity, hydrogen, biofuels, synthetic and paraffinic fuels, natural gas, including biomethane, in gaseous form (compressed natural gas (CNG)) and liquefied form (liquefied natural gas (LNG)), and liquefied petroleum gas (LPG).
[24] see Figure 62 of the 2030CTP.
[25] see Figure 49 of the 2030CTP.
[26] see Figure 63 of the 2030CTP.
[27] see Figure 64 of the 2030CTP.
[28] see Table 38 of the 2030CTP.
[29] Following the nomenclature of the 2030CTP, the MIX scenario considers RES_3 and TRA_3 policies

- Medium intensification of the CO_2 emission standards for cars, vans, trucks, and buses (as of 2030) as compared to low ambition increase case, supported by large scale roll-out of recharging and refuelling infrastructure. For cars this corresponds to a reduction of around 50% in 2030 compared to the 2021 target.

Table 4 provides a summary of the policies considered within the frame of the abovementioned MIX55 scenario of the 2030CTP.

Table 4 Description of the main characteristics of the MIX55 policy scenario of the 2030CTP

Scenario code name	MIX55 scenario
Description of GHG reduction targets	Policies measures and carbon pricing combined for GHG emission reduction of 55% as compared to 1990
Scope to assess GHG target ambition	All sectors including intra EU bunkers and LULUCF
ETS scope/Carbon pricing*	ETS scope: 1. power, industry 2. Intra-EU aviation and navigation 3. Road transport, buildings
EE policies	Medium intensification policies
RES policies	Medium intensification policies
Transport Measures	Medium intensification policies (CO_2 standards in road transport + RES, aviation and maritime fuel mandates + measures improving transport system efficiency)
Non-CO_2 policies	Medium intensification policies
LULUCF policies	Baseline policies

*[*Carbon pricing and carbon values are applied on extra EU aviation and navigation to represent ETS or other policy instruments regulating these sector's emissions (which can also stand for other policy instruments like CORSIA for aviation and technical and operational measures for both aviation and maritime.]*

Source: Elaboration based on Figure 3 of Annex 1 of the 2030CTP.

Relevant issues within the frame of the present work

This sub-section presents issues that are relevant to the present work in the context of the CTP modelling exercise with a view to support FQD Art.7A analysis with quantitative results.

Effect of the CO_2 emission standards

The 2030CTP reveals that the intensification of the CO_2 emission standards for vehicles in 2030 has an important impact on emission reduction by 2030 and on fleet composition. However, it is noted that as CO_2 emission standards affects tailpipe emissions of vehicles (i.e. Tank-to-Wheels), its effects cannot be directly translated in terms of the FQD 7A target (Well-to-Wheels).

In all scenarios considered in the 2030CTP, intensification of CO_2 standards for vehicles is an effective and important driver for higher efficiency and switch toward electric vehicles and ultimately to GHG emission reductions.

The importance of the analysis of the effect of the CO_2 emission standards on the transport fuel mix stems also from the fact that several stakeholders interviewed within the scope of the evaluation of FQD Art.7A (see Section 4 of the present report) have expressed the opinion that a link between Art.7A and the CO_2 standards would constitute an enabler providing additional flexibility to achieve the GHG emission intensity reduction target.

Effect of the measures related to the transport sector decarbonization considered within the frame of MIX55 scenario

The following non-fuel assumptions included in CTP modelling impact on the transport fuel mix composition and evolution:

- Measures related to the functioning of the transport system and a possible modal shift with respect to freight activity.
- Deployment of solutions such as smart traffic management systems and transport digitalisation on the promotion of electromobility and/or increase in the effectiveness that a specific transport activity is covered (e.g. through the deployment of smart traffic management systems and the provision incentives for behavioural change)
- Measures to reduce emissions and air pollution in urban areas and their effect in the uptake of electromobility.
- Measures in relation to energy taxation and their effect in the uptake of renewable fuels.
- Measures related to the incentivisation of behaviour change impacting consumers' choices for cleaner fuels and technologies, as well as triggering a shift in mobility demand between modes.
- The effect of the *ReFuelEU* aviation and *FuelEU* maritime initiatives on the availability of fuels suitable to be used in the road transport sector (competition for securing the required feedstock for the needed fuel volumes).

Use of fossil fuels in the road transport sector

Although the contribution of biofuels and electromobility (including hydrogen) can be expected to play a dominant role in the fuel suppliers' efforts to comply with the Art. 7A target, fossil fuels with lower carbon intensity such as CNG, LPG, LNG, could, if decided, also partially contribute towards 7A target, supporting the relevant benefits from the increasing role for bio-methane uptake in transport. Consideration of the above fuels in the 2030CTP is addressed taking into account relevant elements of the Alternative Fuels Infrastructure Directive revision, while within the scope of the present study are considered only for the purpose of formulating concrete options forward which are of relevance for FQD Art.7A in the following sections of this study.

Data and information collection

Calculations within the scope of the present study are based on data extracted from the results of the modelling exercise conducted within the frame of the 2030CTP. Extracts from PRIMES and PRIMES-TREMOVE model runs using the MIX 55% climate ambition scenario accounting for COVID-19 impact were provided by Commission services, covering the EU27, in 5-year intervals for the 2005-2050 period as follows:

- Key trends for EU27 and per MS: energy intensity; import dependency; energy costs (Net Cost of Energy, Average Price of Electricity); RES in gross final energy demand, RES in transport, GHG in ETS and non-ETS sectors
- Energy demand for EU27 in transport per transport mode, per fuel
- WtW CO_{2eq} emissions per transport mode
- Summary of transport activity and energy demand per mode, activity type, fuel type; energy efficiency and emissions intensity to energy
- Summary on fleet stock and costs
- Summary of non- CO_2 emissions per transport mode
- The FQD/7A data reported by the Member States to EEA for 2018

It is noted that the WtW emission calculation in the 2030CTP does not follow the same methodology as in the FQD. The provided WtW figures could be used to get an understanding of projected GHG intensity based on a calculation not accounting for the detailed information on the specific feedstock types used for road transport fuels.

As the study focuses on FQD Art.7A, the assumption of the modelling work of the 2030CTP needs to be understood in terms of its effect on the resulting transport fuel mix (and to the associated overall GHG emission intensity of the mix).

2.2.2 *Methodological approach for impact assessment of policy options to steer progressive reduction of GHG intensity of transport fuels*

The objective of this task is to provide evidence in detailing and assessing policy options to achieve progressive reduction of GHG intensity of transport fuels towards 2030 and 2050. The assessment of policy options is guided by the Impact Assessment steps set forth in the Better Regulation Guidelines (BRG) and its Toolbox. [30]

The study first analyses the problem and the drivers behind the problem, based on evidence collected from existing literature, interviews and the survey. The assessment of the problem definition can be found in Appendix I. Once the problem definition has been elaborated, a range policy options, and sub-options are proposed to address the problem.

The definition of policy options takes outsets in the Terms of Reference (ToR) provided by the European Commission and is further elaborated based on the findings from the problem assessment. The policy options and relevant sub-options are further refined and operationalised through a literature review. The initial policy options have been discussed with the stakeholders at the first virtual stakeholder workshop and further validated during the second virtual stakeholder workshop.

The baseline scenario is then defined against which the options are compared. The baseline scenario reflects the status quo, corresponding to the MIX55 scenario of the 2030CTP.

Once the options and sub-options are defined, the economic, social, and environmental impact are assessed following the BRG principles. The impacts are first screened and mapped, assessing the type of the impact, who is bearing/benefiting from it and whether the impact is recurring or one-offs. Once the impacts are identified, the study describes each of the impact, outlining the indicators and data used as well as methodology on how the impact is assessed. The detailed description of the impacts and the methodology used are presented in Appendix K. The study aims to quantify the impacts as much as possible. Whenever quantification is not possible, a qualitative assessment is performed.

2.3 Stakeholders' selection and consultation

Stakeholders' views were collected on the evaluation of FQD Art.7A and on the options for the further reduction of GHG emissions from transport through interviews, a web survey, and two virtual stakeholder workshops.

In particular, 34 **interviews** were conducted between November and December 2020 with a list of stakeholders approved by Commission services from the private sector, including industry associations, national public authorities, environmental NGOs, and research organisations (Cf. Appendix C).

The **web survey** was launched between November and December 2020. It received responses from more than 100 stakeholders from the private sector, i.e. industry associations, producers / suppliers of fuels (including biofuels), from the public sector, i.e. intergovernmental organisations, National authorities, research organisations, think-tanks and consultancies.

The **first virtual stakeholder workshop** was held on the 3rd of September 2020 to introduce the study and collect feedback for refining the methodological approaches for the evaluation and impact assessment. The workshop targeted experts and relevant stakeholders involved in the implementation of Art.7A, including representatives of industry and industry associations (with a focus on the fuel industry and the transport sector), national competent authorities involved in the monitoring and reporting of life cycle GHG emission intensity of transport fuels, research organisations, consultancy and think tanks, individual experts, and representatives of relevant European Commission services, EEA, and other international organisations. 121 people registered, and 62 participated in the event – of which around 54% were representatives of industry (including

[30] Tool #12 on Format of the IA Report

industry associations), and 24% representatives of national public administrations. They represented 18 Member States.

The **second virtual stakeholder workshop** took place on 20th of April 2020 to present, discuss, and collect feedback on the main findings of the study, and on the policy options for reducing GHG emissions from transport. The target audience was the same of the first workshop. 215 people registered to the event, whilst the actual number of participants was 195. Among the participants, the majority was either representatives of companies (47%), national authorities (23%) or business associations (17%) from 25 EU Member States.

3 PART A: RESULTS OF THE EVALUATION OF FQD ART.7A

3.1 Relevance

3.1.1 *To what extent do the target in FQD Art.7A still correspond to the ambitions and obligations of the European Union in terms of reduction of GHG emissions?*

The approach of FQD Art.7A is relevant for the achievement of its objectives in terms of reduction of GHG intensity and in the overall context of the EU climate policy and ambitions. Consulted stakeholders view increased competitiveness of fuels with lower GHG intensity and fuel technology progress as its most likely impacts. According to the study, FQD Art.7A is nevertheless less relevant for improving air quality, human health, vehicle engine efficiency, and the functioning of the European single market for transport fuels and vehicles.

The overall objective of FQD Art.7A to reduce GHG intensity of transport fuels is relevant considering the ambition of the European Union to curb GHG emissions from the transport sector. The European Commission's 2011 Transport White Paper[31] included indicative targets for the reduction of transport GHG emissions, namely 20% by 2030 from 2008 levels, and 60% by 2050 from 1990 levels. Further legislative initiatives on road transport vehicles and infrastructure have been proposed by the European Commission in the second[32] and third[33] Mobility Packages, in 2017 and 2018 respectively. Such initiatives support the uptake of low-emissions alternative fuels and vehicles, with the objective of reducing GHG emissions and air pollutant emissions[34]. In the context of the European Green Deal, the European Commission's new Sustainable and Smart Mobility Strategy and its Action Plan[35] – presented in December 2020 – aim to achieve a smart, competitive, safe, accessible, and affordable transport system that will enable a 90% reduction in the transport sector's emission by 2050 in comparison with 1990 levels.

In 2020, with the 2030 Climate Target Plan adopted by the European Council[36] the EU increased the EU's target for GHG emission reductions to at least 55% below 1990 levels by 2030, substantially raising the EU's ambition compared to the existing 40% target (from 2005 levels) set in the 2030 Climate and Energy Package[37]. Most of the interviewed stakeholders agree that the objectives of FQD Art.7A are therefore well aligned with the EU climate policy and its ambitions.

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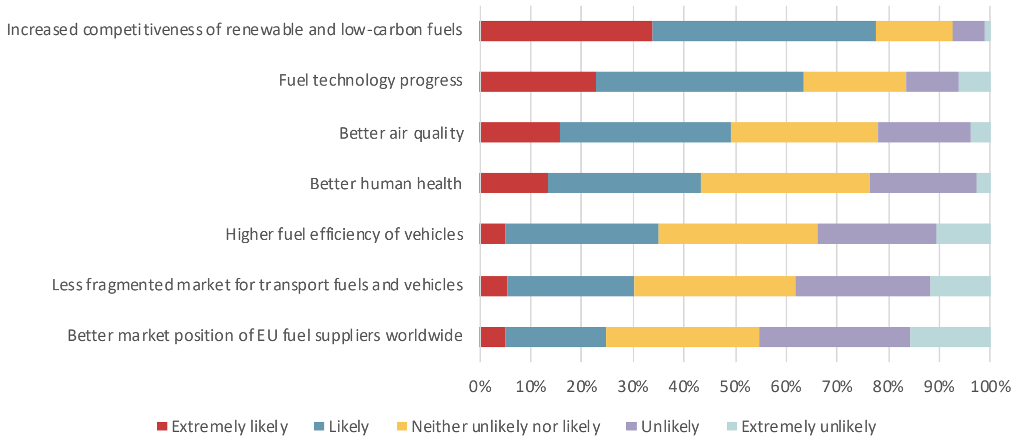
[31] European Commission. 2011. *White Paper: Roadmap to a Single European Transport Areas - Towards a Competitive and Resource Efficient Transport System*.
[32] European Commission. 2017. *Delivering on Low-Emission Mobility: A European Union That Protects the Planet, Empowers Its Consumers and Defends Its Industry and Workers*.
[33] European Commission. 2018. *Sustainable Mobility for Europe: Safe, Connected, and Clean*.
[34] EEA. 2018. 'Progress of EU Transport Sector towards Its Environment and Climate Objectives'. Briefing. https://www.eea.europa.eu/themes/transport/term/term-briefing-2018.
[35] European Commission. 2020. *Sustainable and Smart Mobility Strategy – Putting European Transport on Track for the Future*.
[36] European Commission. 2020. *Stepping up Europe's 2030 Climate Ambition Investing in a Climate-Neutral Future for the Benefit of Our People*.
[37] European Commission. 2013. *Green Paper: A 2030 Framework for Climate and Energy Policies*.

Figure 3 Impacts that could be reasonably expected from the attainment of the targets in Art7A of the FQD (as a % of respondents)



Source: Study survey.

The stakeholder consultations highlight nevertheless the lack of consensus as regards the relevance of FQD Art.7A and its approach to achieve the general objectives of higher air quality, better human health, and enhanced functioning of the single market for transport fuels and vehicles. Only the increased competitiveness of fuels with lower GHG intensity and fuel technology progress are impacts that are considered (extremely) likely by most of the respondents to the survey (see Figure 3).

Interviews provide further elaboration as to why some actors do not perceive FQD Art.7A to be relevant for achieving its social, economic, and, to some extent, technological impacts (see also Section 5):

Air quality depends on many other factors than GHG emissions. Other air pollutants have a negative effect on human health and are not addressed by FQD Art.7A. Other provisions of the FQD have been more effective in improving air quality and preventing emissions of air pollutants affecting also human health[38].

Technological progress in vehicle engines is better stimulated with direct (financial) support than via mandatory targets respective to GHG intensity of fuels. The study provides no evidence of perceived synergies and/or complementarities between such schemes and FQD Art.7A.

As directives leave some freedom to Member States as regards their implementation, there might be no harmonisation in their transposition and the measures to ensure the attainment of their objectives. In the views of interviewed stakeholders, this reduces the relevance of FQD Art.7A for enhancing the functioning of the European single market for transport fuels and vehicles. The evaluation of the FQD (excluding some provisions including Art.7A) already concluded that the directive "has not been constructed as an instrument to fully harmonise the internal transport fuel market [, but] allows certain margin for national measures related to transport fuels, including while not limited to the blending of biofuels"[39]

FQD Art.7A poses requirements for the EU fuels suppliers / producers. Even though these obligations may accelerate their transition towards fuels with lower GHG intensity, a few interviewed stakeholders are concerned that Art.7A induces costs for European fuel suppliers / producers, increasing their prices and potentially reducing their global competitiveness. However, most interviewees state that the main impediment to an enhanced global competitiveness of the EU fuel industry is the fragmentation of its markets caused by national regulations not being fully harmonised.

3.1.2 *How relevant is the monitoring of supplied fuels and energy to Member States?*

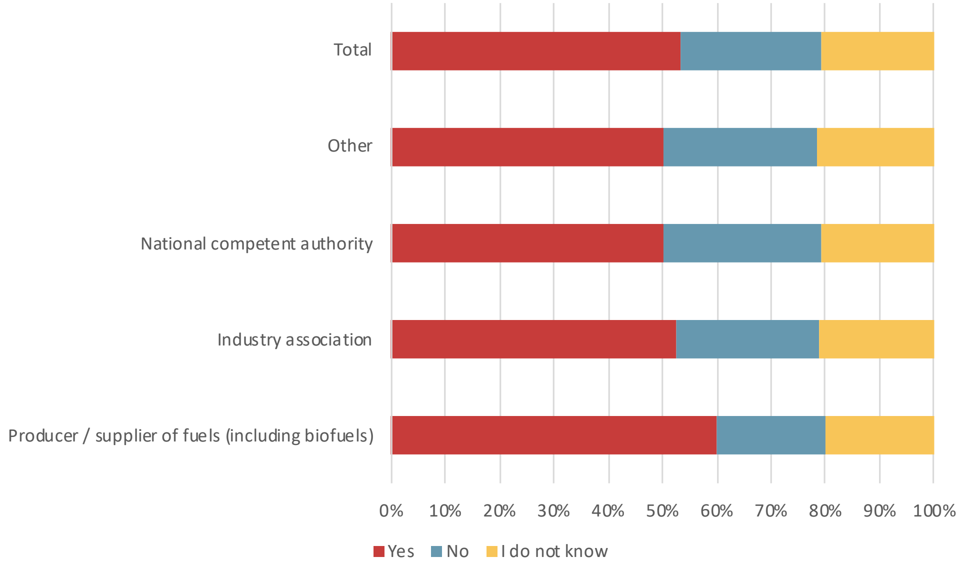
A vast majority of the consulted stakeholders declared that the calculation method in place is easy to use and allows for an accurate measurement of GHG intensity of transport fuels and its

[38] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'). Commission Staff Working Document. SWD(2017) 179 final.
[39] *Ibid*.

reduction. Despite general consensus on its relevance, some criticisms were expressed regarding specific elements of the calculation method.

The study does not provide evidence of any major issue with the method in place to calculate GHG intensity. Slightly more than half of the respondents to the survey (50% of the responding national competent authorities and 60% of the responding fuel suppliers / providers) considers that this method allows for an accurate measurement of GHG intensity of transport fuels (see Figure 4). The study workshop and the interview made similar findings. Many participants similarly appraised the usability of the calculation method in place.

Figure 4 Stakeholder views as to whether the method in place to calculate GHG intensity of transport fuels is accurate (as a % of the respondents)



Source: Study survey.

Aspects of the calculation method nevertheless pose problems to a few interviewed stakeholders:

- The default values used in the calculations are seen, for some consulted actors, as not reflecting the actual performance of the fuels, especially the provision of a weighted life cycle GHG intensity attributed to a fuel, produced using widely different raw material sources and process characterised by very different lifecycle GHG intensity values, such as conventional crude, natural gas-to-liquid, coal-to-liquid, natural bitumen, oil shale. The same stakeholder proposed "to separate the different production ways into different default values for the fossil production routes".
- A few stakeholders noted, in interviews, that the fossil fuel comparator used in the calculation of the GHG emission savings from biofuels has not yet been updated regularly (even though the reporting requirement under FQD Art.7A should have served also this purpose[40]) and lacks transparency. This opinion nevertheless stands out from the rather general consensus on the accuracy of the current fossil fuel comparator.
- Many interviewed stakeholders claim that ILUC emissions should be considered to determine the attainment of the targets in FQD Art.7A. However, their views should be confronted again with the consideration that ILUC-risk feedstocks are *de facto* capped.
- Finally, some stakeholders criticised the method to account for the contribution of the provision of electricity for use in road vehicles, on the one hand, and UERs, on the other hand. In 2018, only ten Member States reported data on electricity consumption. *Mellios*

[40] See Recital (14) of the Council Directive 2015/652 of 20 April 2015 laying down the calculation methods and reporting requirement pursuant to the Fuel Quality Directive 98/70/EC.

and *Gouliariou* (2020) noted that the data were partial for one of them and inconsistent for another. Also, they argued that the "data on GHG intensity are not directly comparable as individual Member States may have used a calculation methodology different from that used by the JRC" (p. 10). Regarding UERs, no data have been yet reported[41]. These views must be again confronted with the fact that reporting on electricity supplied for use in road transport is optional and that the calculation is based on estimates instead of actual measurement to limit administrative costs[42].

3.1.3 *How relevant are the targets in terms of reduction of the life cycle GHG emission intensity of transport fuels?*

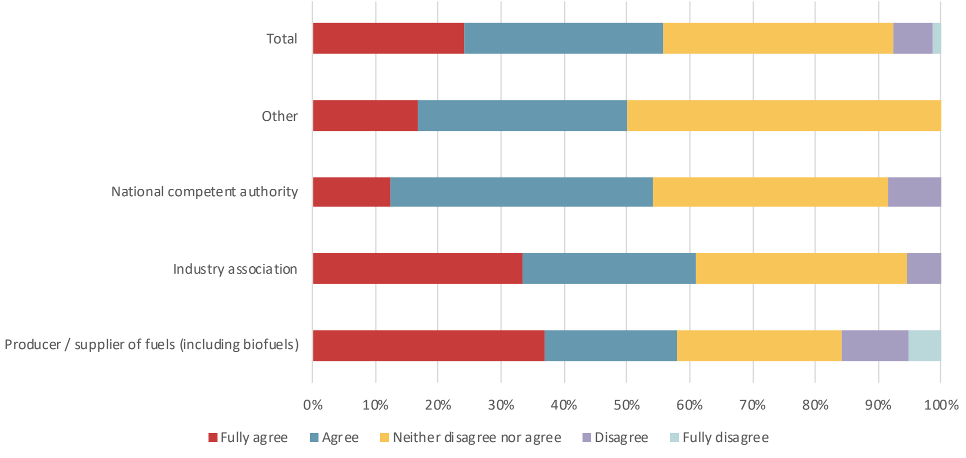
The study found evidence that there is a large support for the current quantitative goals in FQD Art.7A in terms of GHG intensity reduction and for the approach in place ensuring technology-neutrality by leaving fuel suppliers / producers with the choice of the most appropriate methods to attain these targets.

Among the few fuel suppliers / producers that reported in the survey difficulties with attaining the targets of FQD Art.7A, 15% claimed that a hampering factor was that these targets are too ambitious and unachievable.

In interviews, most of the consulted national competent authorities similarly claim that the quantitative goals (mainly the 6% reduction target) are relevant considering the objectives of FQD Art.7A. Only a few claimed that they were too high and unachievable for countries where insufficient biofuels are available (e.g. Croatia) or where most, if not all, fuels are imported (e.g. Lithuania). On the contrary, others claim that the targets are too low in comparison with the national targets (e.g. Sweden) and/or considering the EU climate ambition.

FQD Art.7A does not prescribe any specific means or efforts to achieve the compulsory 6% reduction of GHG intensity of transport fuels. In interviews, consulted stakeholders, especially representatives of industry associations and fuel suppliers / producers, mostly appraised this technology-neutral approach that they deem to be the most relevant and effective. Similarly, more than half of the respondents to the survey, whatever category they belong to, (fully) agree that the fuel suppliers / producers should be given the choice of the method to attain the targets set in FQD Art.7A (see Figure 5 below).

Figure 5 Degree of agreement on leaving fuel suppliers / producers the choice with respect to the most effective method(s) to attain the targets in Art7A of the FQD (as a % of the respondents)



Source: Study survey

[41] Mellios, Giorgos, and Evi Gouliariou. 2020. *Greenhouse Gas Intensities of Road Transport Fuels in the EU in 2018: Monitoring under the Fuel Quality Directive*. Mol: European Environment Agency, European Topic Centre on Climate change mitigation and energy. Eionet Report.

[42] Council Directive 2015/652 of 20 April 2015 laying down the calculation methods and reporting requirement pursuant to Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels. Recital (11).

3.2 Effectiveness

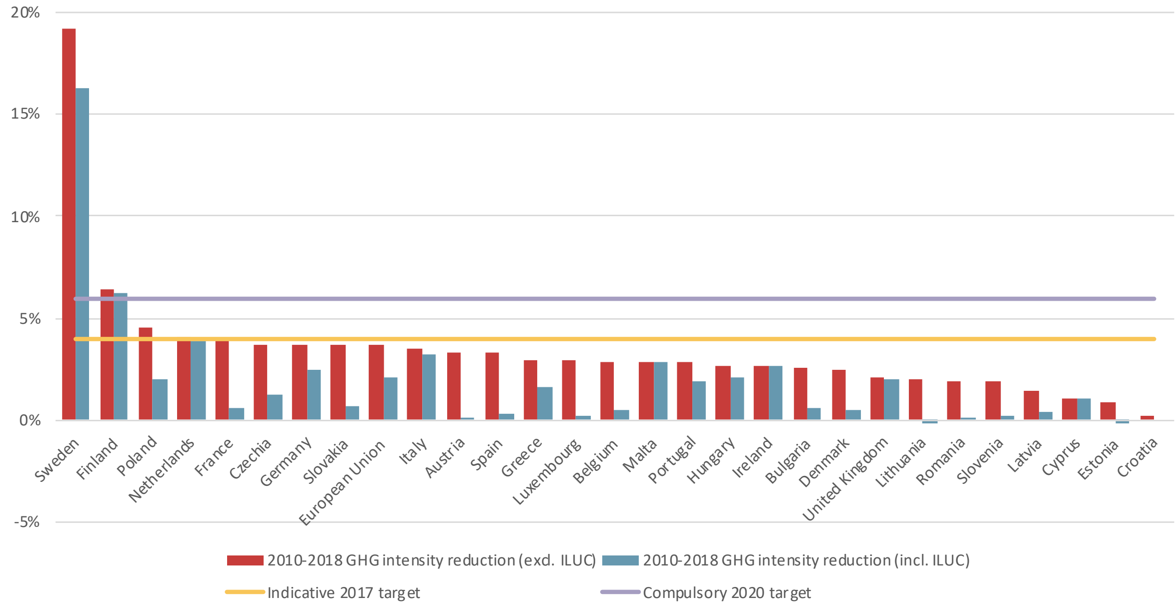
3.2.1 *Does FQD Art.7A contribute to reducing the life cycle GHG emission intensity of transport fuels by the end of 2020?*

The data reported by Member States demonstrate that a few (four) Member States have met the 2017 intermediate non-binding targets in FQD Art.7A. Reductions in GHG intensity were achieved by increased shares of biofuels in national fuel mixes. UERs have not yet made any contribution to these reductions.

In 2018, according to the latest data on the quality of petrol and diesel fuel reported to the EEA[43], a large majority of the 28 reporting EU Member States were behind their compulsory 2020 target of a 6% reduction and the indicative 2017 target of a 4% reduction (in comparison with 2010 levels). On average, GHG emission intensity (excluding ILUC) was reduced by 3.7%, compared to 2010 levels, in the European Union (see Figure 6).

The distance to the 2020 target varied between 1.4% (Poland) and 5.9% (Croatia). Only two EU Member States already achieved the 2020 targets, namely Finland and Sweden. Three other countries (France, the Netherlands and Poland) had reduced their GHG emission intensity by 4% or more (thereby meeting the 2017 target).

Figure 6 Average GHG emissions intensity reported by fuel suppliers



Source: Mellios & Gouliarou, 2020

The EEA notes that the performance of the EU Member States against the targets in FQD Art.7A depends on the share and type of fuels in their total national fuel mix, and that "substitution with HVO (15.6 g CO_2 e/MJ, excluding ILUC) and biodiesel (26.4 g CO_2 e/MJ, excluding ILUC) reduces significantly the GHG intensity"[44]. Similarly, most of the fuel suppliers / producers that responded to the study survey, reported they purchased and blended, and/or invested in fuels with lower GHG intensity to attempt to meet the targets in FQD Art.7A. This behaviour is in line with the assumption underpinning FQD Art.7A. Because few (ten) Member States reported data on electricity consumption and because *Mellios* and *Gouliarou* (2020) do not consider these data

[43] Mellios, Giorgos, and Evi Gouliariou. 2020. *Greenhouse Gas Intensities of Road Transport Fuels in the EU in 2018: Monitoring under the Fuel Quality Directive*. Mol: European Environment Agency, European Topic Centre on Climate change mitigation and energy. Eionet Report.
[44] *Ibid.*, p. 11.

comparable[45], it is still too early to assess at EU level the contribution of electricity use in road transport to the reduction of GHG emission intensity.

Upstream Emission Reductions (UERs) have not yet contributed towards the target, as only those generated in 2020 can count in the calculation of the achievement of the 2020 targets in FQD Art.7A. A2014 study by ICCT concluded that this contribution could be significant[46].

Only 3% of the respondents to the study survey (i.e. 5% of both the responding fuel producers / suppliers and industry associations) argued that FQD Art.7A had positive effects on the use of carbon credits. In both interviews and the survey, respondents pointed to the lack of harmonised rules (and European centralised system) for the accounting of UERs and still the risk of double counting. Furthermore, several stakeholders questioned the opportunity of using UERs to achieve the objectives of FQD Art.7A.

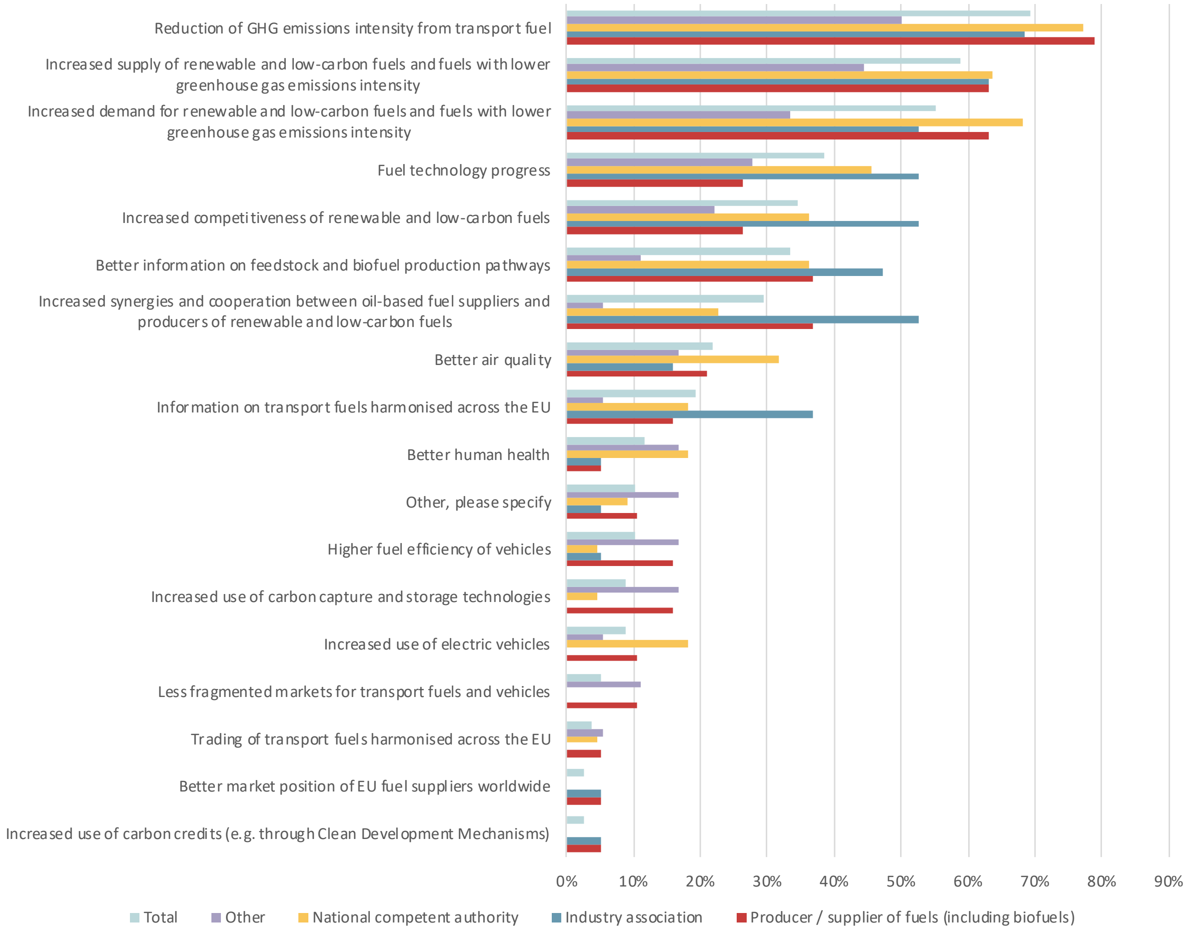
3.2.2 *What are the technological, environmental, and economic impacts of the implementation of FQD Art.7A?*

Consulted stakeholders stated that FQD Art.7A has created the conditions for the further development of markets for fuels with lower GHG intensity. Our study found little evidence of environmental and other economic impacts of FQD Art.7A. While survey respondents report some fuel technology advancement, a relatively low share of them consider that FQD Art.7A has had positive impacts on engine efficiency.

The main impacts of FQD Art.7A are, for more than half of the survey respondents, an increase in the supply of, and demand for, fuels with lower GHG intensity. According to most responding industry associations, FQD Art.7A also permitted progress in fuel technology, increased competitiveness of fuels with lower GHG intensity, better information on feedstock and biofuel production pathways, and higher synergies and cooperation between oil-based fuel suppliers and producers of renewable and low-carbon fuels. In short, the study survey shows that FQD Art.7A has been particularly effective in creating the conditions for the development of markets for biofuels and other fuels with lower GHG intensity (see Figure 7). Even if there is a general consensus among both survey respondents and interviewees regarding these positive impacts of FQD Art.7A, some stakeholders discussed as to whether dedicated national and EU policies could be more effective in stimulating the development and uptake of fuels with lower GHG intensity. Our study does not provide nevertheless sufficient evidence to answer this question.

[45] *Ibid.*
[46] ICCT. 2014. Reduction of Upstream Greenhouse Gas Emissions from Flaring and Venting. Washington D.C.: The International Council on Clean Transportation.

Figure 7 Main impacts of FQD Art.7A (as a % of the respondents)



Source: Study survey.

This part of the study finds less evidence on other impacts of FQD Art.7A:

- According to the stakeholders consulted via both the survey and interviews, technological progress could be, at best, an indirect effect of FQD Art.7A. It is rather widely admitted that dedicated policies may give better incentives in this respect. A few stakeholders also reported in interviews that fuel producers and suppliers are reluctant to invest in the development of new technologies mainly because of the uncertainties due to the perceived overlaps between FQD and RED and the lack of visibility on the EU targets in terms of GHG intensity reduction beyond 2020.
- There is no observed consensus on the impact of FQD Art.7A on air quality and human health. In interviews, some stakeholders recognised the positive effects of a reduction of GHG, but many others noted that air quality depends on many air pollutants. Other provisions in the FQD, including the fuel specifications, have been considered more effective to reduce emission of air pollutants affecting air quality and human health[47].
- According to stakeholder responses to the study survey, the positive impact of FQD Art.7A on the harmonisation of the EU markets of transport fuels and vehicles is not evident (see Section 4). The evaluation of the FQD (excluding Art.7A among other provisions) noted already that the directive "has not been constructed as an instrument to fully harmonise the internal transport fuel market. It therefore allows certain margin for national measures related to transport fuels, including while not limited to the blending of biofuels"[48]. However, this does not entail that the overall objectives of the FQD would be compromised.
- Likewise, the survey respondents barely report any positive impact of FQD Art.7A on the global competitiveness of EU fuel supply. Even if FQD Art.7A may prepare the EU fuel suppliers and producers for the transition towards a more sustainable and lower carbon economy and give them a first-mover advantage, some interviewed stakeholders highlight that FQD Art.7A provisions induce some costs (see Section 4) for fuel suppliers / producers, which may increase the price of fuels produced in Europe and reduce the competitiveness of EU-produced fuels.

3.2.3 *What factors contribute to or hinder the monitoring and reporting of the life cycle GHG emission intensity of transport fuels?*

According to study findings, monitoring and reporting on the GHG intensity of transport fuels encounters no major difficulties or hampering factors.

In 2018, the reporting coverage demonstrated efforts from Member States to comply with their monitoring and reporting obligations defined in FQD Art.7A. While only 22 EU Member States submitted data for 2017[49], the 28 EU Member States reported data on fuel quality for 2018 in accordance with the requirements of the FQD[50].

The present study found evidence that neither the fuel producers / suppliers nor the national competent authorities have experienced major difficulties with the compulsory monitoring and reporting of fuel quality and GHG intensity under FQD Art.7A. The form provided by the EEA was reported to significantly ease the difficulties around the reporting and the calculation of GHG intensity and national competent authorities' quality control. Interviewed representatives of industry associations similarly noted that the costs induced by the monitoring and reporting obligations are very low compared to other costs (see Section 4).

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[47] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'). Commission Staff Working Document. SWD(2017) 179 final.
[48] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'). Commission Staff Working Document. SWD(2017) 179 final.
[49] EEA. 2019. *Quality and Greenhouse Gas Intensities of Transport Fuels in the EU in 2017: Monitoring under the Fuel Quality Directive in 2017 (2018 Reporting)*. Luxembourg: Publications Office of the European Union. EEA Report.
[50] Mellios, Giorgos, and Evi Gouliariou. 2020. *Greenhouse Gas Intensities of Road Transport Fuels in the EU in 2018: Monitoring under the Fuel Quality Directive*. Mol: European Environment Agency, European Topic Centre on Climate change mitigation and energy. Eionet Report.

The method for the calculations of GHG intensity is nevertheless not free of any criticism (see Section 4). A few consulted stakeholders also anticipated some difficulties with calculating the possible contribution of UERs to the reduction of GHG intensity.

In interviews, industry associations noted that the penalty systems in place were sufficient to convince fuel suppliers / producers to comply with their monitoring and reporting obligations (See Section 4).

The study interviews do not provide systemic evidence of the presence of control mechanisms in Member States to avoid fraudulent claims by fuel suppliers / producers. A few national competent authorities mentioned (quality) control mechanisms and procedures. However, collected data do not allow to assess the respective effectiveness of these control mechanisms, nor to determine to what extent there is an actual risk of fraudulent claims justifying such quality control mechanisms.

3.2.4 *What factors contribute to or hinder the reduction of the life cycle GHG emission intensity of transport fuels?*

Our study provides evidence of factors hampering the increase of the share of biofuels and other fuels with lower GHG emission intensity in total fuel mixes. In the views of consulted stakeholders, the perceived inconsistencies in the regulatory frameworks create uncertainties regarding the returns on the investments made by fuel suppliers / producers to curb GHG emission intensity of transport fuels. FQD Art.7A does not provide supporting schemes which may stimulate these investments. Other hampering factors include insufficient availability of sustainable feedstock on the one hand, and blending limits on the other, which lower both supply of, and demand for, fuels with lower GHG intensity and therefore slow down their uptake and ultimately the attainment of the targets in FQD Art.7A.

It is worth to note that a quarter of the fuel suppliers / producers that responded to the study survey did not encounter any major difficulties in achieving the targets in FQD Art.7A in terms of reduction of GHG intensity in transport fuels.

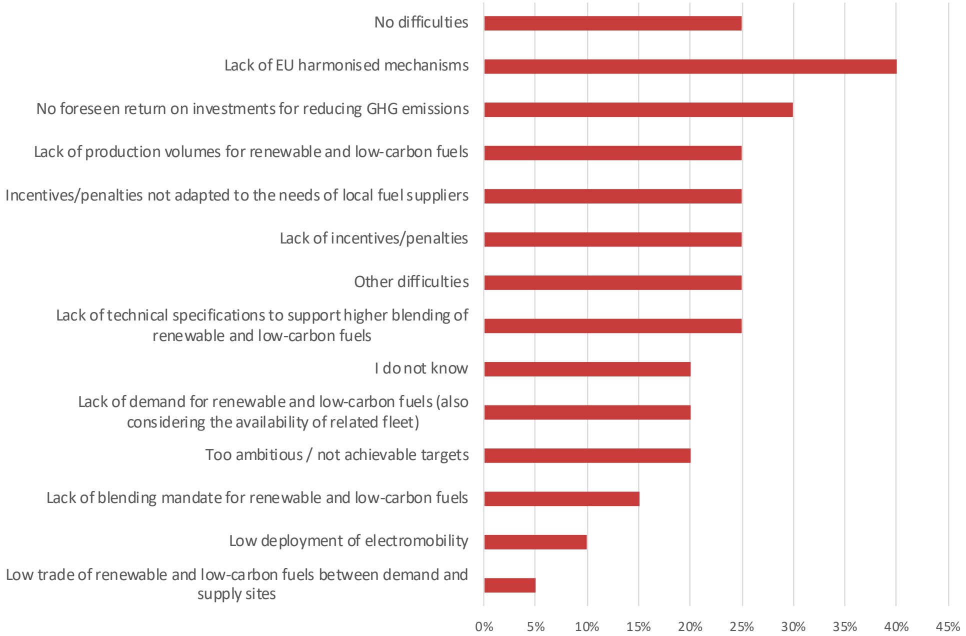
A larger share reported two experienced difficulties: on the one hand, the lack of harmonisation with other EU policies, especially with the REDII, and the foreseen low return on investments for reducing the GHG intensity of transport fuels, on the other.

Other difficulties (experienced by a quarter of the responding of the fuel suppliers / producers) are low supply of renewable or low-carbon fuels, which several interviewed stakeholders linked to insufficient availability of sustainable feedstock; inappropriate or missing incentives; and blending limits[51] (see Figure 8). Interviewees explained that different blending grade in the EU Member States have resulted in market fragmentation – an observation also made in the 2017 evaluation of the FQD[52] – which has, in turn, lowered demand for biofuels and hampered the attainment of the targets in FQD Art.7A.

The fuel suppliers / producers consulted in interviews stressed also that the low availability of sustainable feedstock slows down the uptake of fuel production technologies which could contribute to reducing the GHG intensity of transport fuels in line with the requirements of FQD Art.7A[53].

[51] It should nevertheless be noted that the corresponding questions got only 20 responses.
[52] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels (‘Fuel Quality Directive’). Commission Staff Working Document. SWD (2017) 179 final.
[53] The issue with the lack of availability of sustainable feedstock is related to several factors limiting the possibility to expand the current supply, including the efficiency of the process chain, technological development, R&I policies, stakeholder support, investments in the sector.

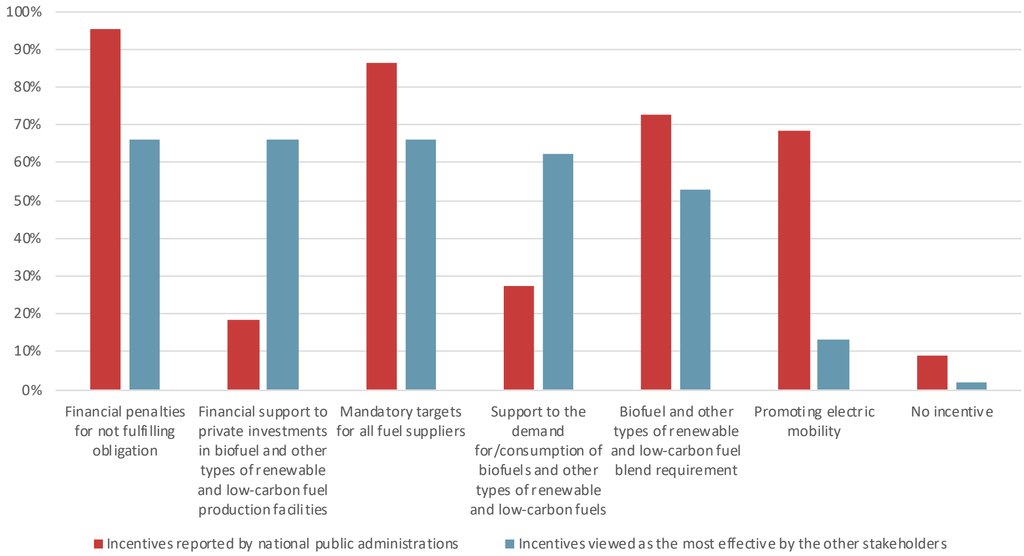
Figure 8 Difficulties and challenges encountered in achieved the targets in Art7A of the FQD (as a % of the responding fuel suppliers / producers)



Source: Study survey

The study survey provides further evidence of some mismatch between the available incentives and the incentives that the market thought as the most effective to curb GHG intensity of transport fuels (see Figure 9). While the policy mix implemented by national public administrations include financial penalties, mandatory targets, fuel blending requirements, and promotion of electric mobility (this aspect being also widely covered by some interviewed national competent authorities), the fuel suppliers / producers, industry associations and other respondents to the survey mostly called for (financial) support to private investments in, and demand for, fuels with lower GHG intensity. In interviews, many representatives of industry associations similarly complain about the lack of "national support systems" which would help fuel suppliers / producers achieve the compulsory targets in FQD Art.7A. Such initiatives at national level would be particularly relevant to address the fuel producers' / suppliers' perception of a low return on their investments to curb GHG intensity. However, no detailed descriptions were given by stakeholders with respect to possible national support systems.

Figure 9 Incentives to encourage the enforcement of the obligations in Art7A of the FQD in terms of reduction of GHG intensity in transport fuels (as a % of the respondents)



Source: Study survey

The study survey highlights particularly the discrepancies between the needs of fuel suppliers / producers to attain the targets in FQD Art.7A and the available incentives. While more than 60% of the responding national competent authorities deems that the low deployment of electromobility significantly hinders the reduction of GHG intensity of transport fuels, barely 10% of the responding fuel suppliers / producers state that this is a major difficulty and, in consequence, do not share the view that support to electric mobility is an appropriate and effective incentive.

3.3 Efficiency

The present section summarises the main findings per evaluation question of the Cost-benefit analysis (CBA), whose results are further elaborated in Appendix E of this report.

The conceptual framework applies the Better Regulation Guidelines Tool#59. It has been designed based on scoping interviews with industry and Member States and concluded after the in-depth consultations with industry and Member states. Table 5 describes the final typology of costs used in the CBA.

Table 5 Cost categories

Regulatory cost				**Suppliers of fuel**	**Public authorities**
DIRECT	**Compliance cost**	**Regulatory charges**	Penalties from non-compliance	x	n.a.
		Admin burden	Internal or external personnel handling administrative tasks (verification, management, reporting, etc.). Administrative costs of public authorities include: › Annual report to EU (EEA) › Cost for collecting data and reports from companies › Cost of calculation of GHG emissions on MS level › Online system management Examples of administrative burdens for suppliers of fuel includes: › Annual reports to the national authorities on fuel supplies › Monitoring system for tracking various fuels › Cost of calculation of GHG emissions	x	x
		Substantive obligations as a result of 'obligations' included in FQD Art.7A	Cost of fuel for suppliers and capital expenditures for public authorities such as electronic reporting system	x	x
			Personnel cost	n.a.	x
			Operation and maintenance e.g., maintenance of reporting system	n.a.	x

Regulatory cost				Suppliers of fuel	Public authorities
ENFORCEMENT		**Costs related to monitoring activities** that do not fall under administrative burdens	One-off adaptation costs, information costs and administrative burdens related to monitoring, monitoring costs, pure enforcement costs, adjudication/ litigation costs are source of concern (e.g., cost for establishing a supervisory body). Litigation costs equally apply for fuel suppliers.	x	x

Notes: X= applicable and n.a.= not applicable

3.3.1 *Are the reporting and monitoring requirements of the life cycle GHG emission intensity of transport fuels cost-effective?*

The study finds compelling evidence that neither fuel suppliers / producers nor national competent authorities can disentangle administrative costs induced by the monitoring and reporting obligations under FQD Art.7A from those caused by RED. Both assess annual costs around 1-2 FTEs per year.

The assessment of costs for suppliers/producers is based on six in-depth interviews using a partly pre-filled cost template and the survey. Administrative costs for large companies range between 1-2 FTEs which can be estimated between €41.000 and €82.000 yearly. On average most companies indicated 1 FTE handling administrative obligations. This is consistent with findings from both interviews and survey. The case of 2 FTEs results from the choice of some (large) companies to include monitoring regulatory trends for FQD Art.7A and RED as an administrative cost. The timeline accounted is from 2018 onwards in terms of reporting requirements.

The assessment of costs for national competent authorities is based on six interviews. Some Member States report 1 to 2 FTE, while one country reported 15 FTE[54]. The cost therefore ranges from €41.000 to € 623.000 yearly. However, this cost usually covers more than the implementation of FQD Art.7A, and usually includes costs for RED and other legislations.

To arrive to cost estimates for administrative costs, archetypes were defined, to account for differences in national transposition and hence, also country of operations (see Table 6). The archetypes were necessary for this exercise with suppliers and national competent authorities who would otherwise not be able to attribute costs to FQD Art.7A. In other words, no supplier nor national competent authority would be able to distinguish administrative costs for FQD Art.7A separately from RED obligations as compliance follows national laws.

While there was an early expectation that different archetypes would lead to different results, this has not been demonstrated in the case of the administrative cost archetypes.

Table 6 Archetypes for administrative costs

Archetypes for administrative costs	
Archetype A:	Countries that transposed the legislation with FQD Art.7A target as leading target
Archetype B:	Countries that transposed the legislation with RED target as leading target
Archetype C:	Countries that transposed the legislation with both RED and FQD Art.7A

[54] The Netherlands, including inspectors.

3.3.2 *Is the obligation to reduce the life cycle GHG emission intensity of transport fuels cost-effective?*

Substantive costs induced by efforts for an increased use of renewables amount to €0,20 per thousand litre of blended petrol and €1,30 per thousand litre of blended diesel in countries implementing the minimum 6% greenhouse gas intensity reduction. In countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets substantive costs amount to €7,10 per thousand litre of blended petrol and €19,0 per thousand litre of blended diesel.

Substantive costs are associated to the increased use of renewables. For substantive costs there is a clear link between the national stringency of countries' legal framework and the use of renewables by suppliers i.e., the countries with additional targets under other legislations which render the 6% target irrelevant (e.g., Finland and Sweden). For instance, Sweden implements a national GHG reduction obligation quota, which means that fuel suppliers must reduce greenhouse gas (GHG) emissions from petrol and diesel by blending sustainable biofuels. The costs associated to the Petrol GHG reduction quota for 2020 is 4.2% and to the diesel GHG reduction quota it is 21%. The two archetypes are described below (Table 7). By design, the archetypes were proposed as the industry was explicit that no attribution of the costs to the FQD Art.7A is possible but rather its transposition to national law. To better reflect this point the distinction between countries based on national transposition has been retained in the calculations.

Table 7 Archetypes typologies

Target level archetypes	
Archetype 1:	Countries implementing the minimum 6% greenhouse gas intensity reduction
Archetype 2:	Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets (Finland, Sweden)

The baseline for the calculations is the year 2010, which is also the baseline for the emission reduction target. With the latter baseline in mind, the increase of the cost per thousand ton between 2010 and 2019 is estimated as follows:

- In countries implementing the minimum 6% greenhouse gas intensity reduction:
  - €0,20 per thousand litre of blended petrol
  - €1,30 per thousand litre of blended diesel
- In countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets. These estimates correspond to costs attributable to practices motivated by a higher than 6% greenhouse gas intensity reduction target:
  - €7,10 per thousand litre of blended petrol
  - €19,0 per thousand litre of blended diesel

The assumptions on blending shares are based on Eurostat national reporting, and fuel prices are based on desk research (see Table 8).

Assumptions:

(1) Assumptions had to be made on the cost of fuel for suppliers. A distinction was originally made between the theoretical cost which corresponds to quoted prices that are publicly available and the actual cost which depends on companies' strategies. To simplify the latter the study assumes the average purchase price of term contracts during the period 2017-2019 to correspond to the term contract price.

Table 8 Fuel prices

Theoretical price: quoted price/term contract price (without taxes) in EUR	
Measurement	Period 2017-2019 (3-year average)
Source	Desk research[55]
Petrol price per 1000 lt[56] of fuel	€537
Diesel price per 1000 lt of fuel	€574
Biodiesel price per 1000 lt of fuel	€717
Bioethanol price per 1000 lt of fuel	€733

(2) Blending assumptions before and after FQD have been made using Eurostat data for the period 2017-2019 and validated via interviews with industry. A distinction is made according to the target level archetypes described in Table 7. This distinction is necessary as it is impossible for companies to hypothesize what they would have done for FQD in the absence of the more stringent targets set nationally. The baseline before FQD is set as 2010 and uses the EU average of renewables shares.[57]

Table 9 Blending shares

Blending assumptions	Baseline before FQD/RED (2010)	Countries implementing the minimum 6% greenhouse gas intensity reduction (2017-2019)	Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets (2017-2019)
Share of petrol	95.3%	95.2%	91.7%
Share of bioethanol	4.7%	4.8%	8.3%
Share of diesel	94.4%	94.5%	83.6%
Share of biodiesel	5.6%	5.7%	16.9%

The additional substantive cost for fuel suppliers operating in countries implementing the minimum 6% greenhouse gas intensity reduction is low (estimated at € 0,20 per thousand litre of blended petrol and € 1,30 per thousand litre of blended diesel). This is not surprising as their average uptake of renewables between 2010 and the period 2017-2019 has only increased marginally remaining at the level of 5-6%. None of these countries meet the target of 6% against the 2010

[55] See: https://ec.europa.eu/energy/data-analysis/weekly-oil-bulletin_en; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0951; https://www.indexmundi.com/commodities
[56] 1,000lt equals 1,119t.
[57] ***Based on the following Eurostat dataset:*** Supply, transformation and consumption of oil and petroleum products [nrg_cb_oil], Final Consumption Transport Sector Road.
Data used:
Petrol: "Motor gasoline"
Diesel: main dataset "Road diesel", and "Gas oil and diesel oil" for Bulgaria (years 2017-2018-2019. Explanation: for these years the road diesel dataset reports 0, and for previous years it reports the same data as this second dataset. We assume the coverage is the same)
Bioethanol: Combination of "motor gasoline" and "Motor gasoline (excluding biofuel portion)" Biodiesel: "Blended biodiesels".
Baseline: EU average, 2010.
Archetype - Countries implementing the minimum 6% greenhouse gas intensity reduction: Average of all MS but Finland and Sweden, Three-year average (2017-2019).
Archetype - Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets: Average of Sweden and Finland, Three-year average (2017-2019).

baseline which shows that the uptake of 5-6% of renewables is insufficient. The total cost hence for those countries will account for the penalties imposed which are still unknown.

3.3.3 *Which factors influence the efficiency of the observed results?*

The study finds strong evidence that the transposition of FQD Art.7A in national laws has a strong influence on its efficiency. More specifically, the main factors include the presence or not of multiple-counting systems (even if not possible in the FQD, multiple-counting impacts companies' compliance due to national transposition of RED where this accounting mechanism is possible) and national trading schemes, the local market conditions, the terms of the incentives and the penalty system in place. The study finds that distinct and easily quantifiable targets (i.e. penalty per excess ton of CO_2 equivalent) are directly linked to a company's achievement towards the target, ensure predictability and should work as an effective price signal. Other types of penalties such as a fixed fine are not easily predictable and therefore send a less clear price signal. Their efficiency will depend on supplier's expectations (which can be based on a combination of factors such as the country's judiciary history, previous cases, government's communication, etc.). While specific types of penalties might ensure greater transparency and predictability for companies, their price signal will largely depend on the level of penalties.

During the interviews on the mapping of costs with fuel suppliers, the main parameter influencing costs has consistently been the transposition of FQD Art.7A in national law.

Parameters influencing the ability of companies to meet the target include the availability of the **multiple counting system** [58] (even if not possible in FQD it impacts companies' compliance due to national transposition accounting of RED where this accounting mechanism is possible). Distinct and easily quantifiable targets (i.e. penalty per excess ton of CO2 equivalent) are directly linked to a company's achievement towards the target, ensure predictability and should work as an effective price signal. Likewise, the existence of **UERs** could facilitate reaching the 6% target but there is none reported yet and **local market conditions** (e.g., the uptake in use of EVs or markets for LPG and natural gas).

Finally, the **penalties scheme** impacts the final costs attributable to FQD Art.7A but also the substantive costs via the incentives or lack thereof resulting from the regime in place. It should be noted that penalties are ultimately passed on to the consumers, although the ability to pass on the cost fully depends on market conditions and competitiveness of suppliers.

Table 10 Penalties – Typology

Penalties

Penalty systems vary across Member States and usually include a mix of a financial fine (definitions may vary), administrative Table 10s (licence removal, etc.), and, eventually, criminal charges. We have combined indications provided by stakeholders and documentation on transposition, although this information remains incomplete. There are also uncertainties as to whether sanctions apply to failure to meet the target or other compliance issues (such as related to reporting), this relates in particular to type 3 countries. Finally, uncertainties remain as to how severe effective penalties will be across Member States, in terms of effective fine levels or severity of other sanctions (e.g., will criminal charges be applied, how long licences will be suspended, etc.). Therefore, the possibility to quantify expected penalty levels for 2020 is compromised and the analysis should be viewed with caution.

We established the following typology:

[58] According to the survey, double counting is used in: NL, FI, Iceland, GR, IT, CZ, HU, SK, BE, HR, FR, SW, IR, DK, CY, SP, FR, LU.

Penalty type	Countries	Characteristics
Distinct and easily quantifiable penalties directly related with FQD 7a (type 1)	Austria, Czechia, Finland, Germany, Hungary, Luxembourg, Slovakia, Sweden, UK	A penalty per each excess ton of CO2 equivalent released in 2020. Levels vary per country.
Other forms of penalties directly related with FQD 7a (type 2)	Italy, Lithuania, Poland	Usually includes a fixed fine regardless of the reduction effort, and other sanctions.
Other types, not strictly related to FQD 7a target (type 3)	Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, France, Ireland, Latvia, Malta, Netherlands, Portugal, Romania, Slovenia, Spain	Non-financial sanctions and fines. Usually in RED-led transposition systems, or where more general environmental regulations apply.

The analysis on penalties, typology proposed and available information, lead to the following remarks regarding the incentives created by penalty systems:

Type 1 and type 2 sanctions are **directly linked to the target** set by each MS, which creates a **price signal which is easy to read, and potentially easier to assess** than other types of sanctions that are not explicitly linked to FQD art 7A.

Regarding **Type 1 sanctions**, the fact that a set level of penalties is indicated and directly linked to a company's achievement towards the target **ensures predictability** and should work as an effective price signal. Greece and Slovakia have opted for a progressive penalty to account for incomplete efforts to reach the target (the closer a company is to meeting the target, the lower the penalty per excess ton of CO_2 equivalent). While this might be a way to acknowledge the industry's effort, it might also act as an incentive to reach a sub-optimal result if the lowest penalty level ends up being below the cost of compliance. However, it might be an option for countries subject to unfavourable external local conditions limiting compliance modalities.

Regarding **Type 2 sanctions,** fines are not easily predictable and therefore send a less clear price signal. Their **efficiency will depend on supplier's expectations** (which can be based on a combination of factors such as the country's judiciary history, previous cases, government's communication, etc.).

While specific types of penalties might ensure greater transparency and predictability for companies, their **price signal will largely depend on the level of penalties**. In the case of Austria for example, the adoption of a particularly low Type 1 penalty (€15 per excess ton of CO_2 e) is acting as a disincentive to comply, as reported throughout our consultations. This can also be the case in countries where the expected level of penalties is considered low, as is the case in Poland, Czech Republic, and Germany, which were therefore considered incorrect in the Conformity checking.[59]

Therefore, **financial sanctions should be expected to exceed the cost of compliance** to incentivise fuel suppliers to comply. For Type 1 countries, this will certainly be the case in Finland, where the penalty is the highest in Europe and set at €1000 per excess ton of CO_2 e. Particularly high fines are also expected in Hungary, UK, Belgium, Denmark, Estonia, Ireland, the Netherlands.

In addition to financial sanctions, several countries have opted for **non-financial sanctions** (**Type 3**) such as:

- Imprisonment or criminal charges in Austria, Luxembourg, Belgium, Cyprus, Denmark, Malta.
- Withdrawal of licence in Bulgaria, Cyprus, the Netherlands (including confiscation of property), and Spain.

These cases could be further examined as per their effectiveness, especially in situations where a mix of sanction apply.

Regarding countries that do not have a penalty system directly linked to FQD Art.7A, our analysis does not allow us to assess their dissuasiveness beyond the learning of the Compliance Check. Besides other non-

[59] Milieu Consulting, 2019, Conformity Checking of measures of Member States to transpose Council Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC, Final comparative report.

financial sanctions, fines range from below 5000€ (Bulgaria) to 30M€ (Spain), with a wide variety. Several remarks apply to these:

In most cases, it is unclear if the penalty applies to failure to meeting the target or only to failure to monitor and report.

In Belgium and in the Netherlands, the application of other (more general) regulations for penalties has been chosen.

In RED-led countries, while there might not be an FQD 7A target related penalty, the penalties related to the failure of meeting RED targets will apply. These penalties are not reported. Some RED-led countries nonetheless adopted FQD 7A sanctions (Hungary, Finland)

In terms of costs variability between large companies and SMEs, this is not considered relevant. The few SMEs (typically only classified as such due to employment not turnover or balance sheet) are not obligated by the legislation. Rather, it is the larger companies, from whom they buy their supply, that are obligated.

3.3.4 *How can the efficiency of FQD Art.7A be improved?*

The study did not find compelling evidence of practices that would allow for an improvement of the efficiency of FQD Art.7A. However, the harmonisation of the penalties structure and rationale and policy guidance with long-term objectives are two relevant components for both the efficiency and effectiveness of FQD Art.7A. Likewise, there is a case for allowing for flexibility to adapt to local conditions. Interesting cases are Finland and Sweden, where an additional and higher emission reduction target set at the national level, combined with high sanctions and clear communication from the government on the long-term perspective have resulted in a stronger shift in the industry's blending practices.

According to industry representatives, incentives for companies to increase the investment/use of renewables to achieve further decarbonisation are predominantly associated to the ratio between level of penalty and costs. For instance, it was argued that if the cost from the increased use of renewables is lower than the penalty this leads to decarbonisation. Also, incentives for long lasting investments or R&D efforts are said to be limited given the time-based objective of FQD Art.7A.

As such an examination of the effectiveness of penalty levels and mechanisms across EU MS is one of the parameters to be considered.

For instance, given the very high level of fragmentation in the penalty systems across the EU MS there is a case for considering harmonisation in terms of the structure and rationale of a penalty system. At the same time however it is important to allow for flexibility to adapt to local conditions. Some additional reflections include the following:

- Although centrally defined min/max targets are not proposed it is useful to note that in the case of countries with distinct and easily quantifiable penalties directly related with FQD Art.7A which are simultaneously above or equal to EU median GHG intensity reduction (incl. ILUC) according to EEA (2019) the median penalty applied is €470 per excess ton of CO_2 equivalent. Very low penalties which are not accompanied with additional sanctions are not considered dissuasive. The case of Austria is an example used during interviews with industry.
- Countries with favourable conditions for the use and access to renewables could aim at more stringent penalties per excess ton of CO_2 equivalent and/or other sanctions such as for instance the case of Finland with €1000 per excess ton of CO_2 equivalent.
- Among other types of sanctions, the Netherlands is one case of a multi-layered penalty system including (1) Administration fines up to 10% of annual sales value, high reputational damage risk and (2) provisions to require the complete or partial cessation of the convicted person's enterprise, confiscation of property, community service and cessation of the convicted person's rights in relation to the enterprise. Such cases could be further examined as per their effectiveness.

- The examples of Finland and Sweden, where an additional and higher emission reduction target has been set at the national level, combined with high sanctions and clear communication from the government on the long-term perspective, have resulted in a stronger shift in the industry's blending practices.

With respect to the proportionality, i.e. whether costs are proportionate to the benefits, according to industry, the environmental (i.e. air quality) and health impacts are inconclusive as per the survey. Benefits associated with long lasting investments or R&D efforts are said to be limited given the time-based objective of FQD Art.7A as understood by industry which did not incentivise investments. While no industry stakeholder challenged the need for curbing and monitoring GHG intensity of transport fuels or the need to use renewables, the discussion around disproportionality is ultimately linked to the penalties that will be applied, notably, whether too low or too high penalties are imposed.

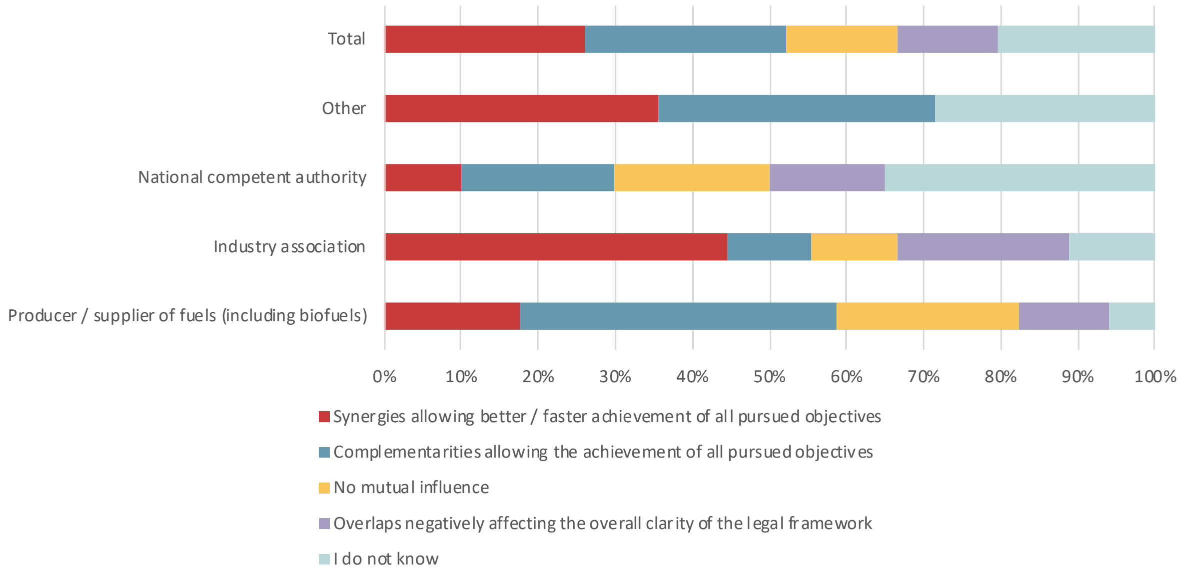
3.4 Coherence

3.4.1 *To what extent has FQD Art.7A been coherent with other provisions in the FQD?*

The main findings of our study show that consulted stakeholders find FQD Art.7A to be overall coherent with other provisions in the directive.

More than half of the survey respondents believes that the methodology for the calculation of lifecycle GHG emissions from renewable low carbon-fuel creates synergies and/or is complementary to other provisions in the directive. It shows that the fuel producers/suppliers and industry associations are the stakeholders that most of all agree that the proposed methodology is coherent with Art.7A and its objectives (see Figure 10).

Figure 10 Coherence of FQD Art.7A and its methodology for the calculation of the lifecycle GHG emissions from renewable and low-carbon fuels (as a % of the respondents)

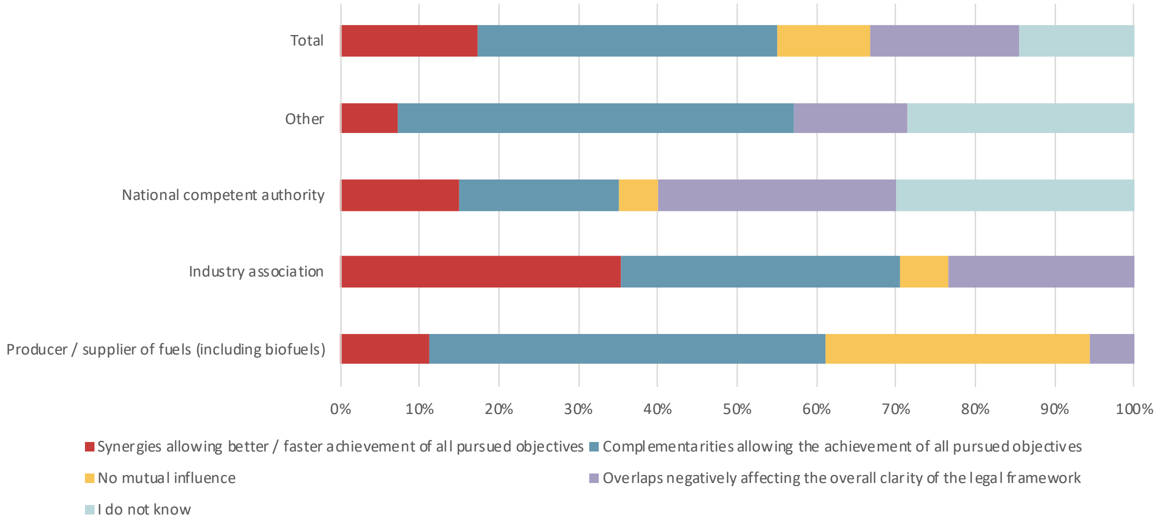


Source: Study Survey

Most of survey respondents agree that FQD Art.7A influences the enforcement of the sustainability criteria, allowing for synergies and complementarities in the pursuit of the directive's objectives. Especially, the producer/suppliers of (bio)fuels support this perspective.

However, it is noteworthy that almost one-fifth of the respondents reports that the sustainability criteria overlap negatively and hence affects the clarity of the Directive's legal framework (see Figure 11). This group of respondents emphasises especially the lack of harmonisation of EU recognised and certified biofuels across Member States.

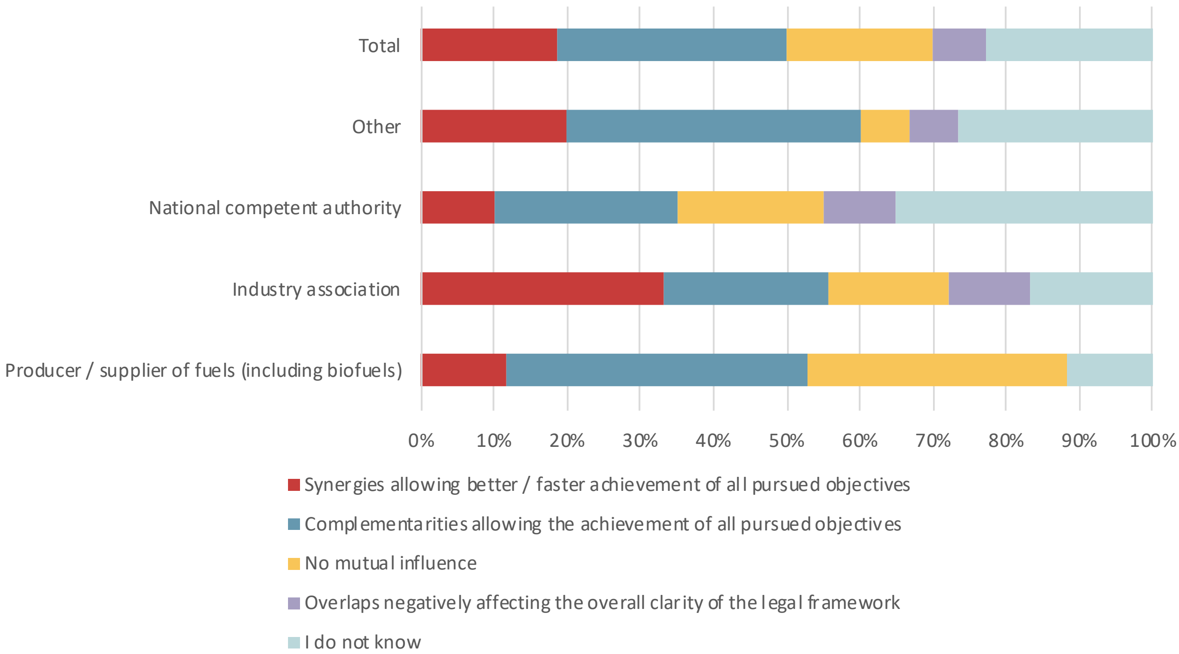
Figure 11 Coherence of FQD Art.7A with the provisions relative to the sustainability criteria (as a % of the respondents)



Source: Survey Study

Approximately half of the survey respondents supports that the FQD allows for synergies and complementarities between Art.7A and its provision relative to reporting. Also, 20% of the respondents report that there is no mutual influence. While very few believe that it overlaps negatively, approximately one-fourth of the respondents (and almost one third of the national competent authorities in charge of monitoring and reporting) are seemingly unsure about the coherence between FQD Art.7A and other reporting provisions in the Directive (see Figure 12). An explanation to this uncertainty of the respondents could be the lack of close familiarity with the reporting provisions or the reporting elements of FQD, making the comparison difficult.

Figure 12 Coherence of FQD Art.7A with the provisions relative to reporting (as a % of the respondents)



Source: Survey Study

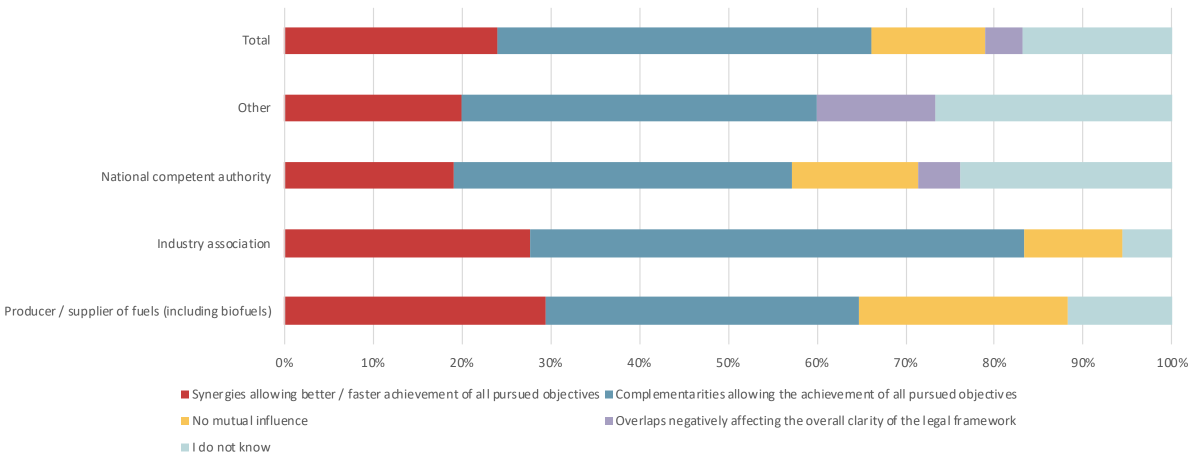
As regards the synergies and complementarities between Art.7A and other provisions in the FQD the study shows that most of the respondents either do not know what to respond or consider this aspect to have no influence.

3.4.2 *To what extent is FQD Art.7A coherent with other EU initiatives?*

A large majority of the consulted stakeholders confirm that there are synergies and complementarities between FQD Art.7A and the Council Directive 2015/652 aimed at easing its implementation. Our study shows nevertheless that half of the respondents find FQD Art.7A incoherent with other EU initiatives. Their responses indicate concern primarily about the lack of consistency between FQD and REDII, but other EU initiatives are also mentioned.

In the view of the survey respondents, FQD Art.7A allows for synergies or complements well with the Council Directive (2015/652), creating a proper framework for FQD. Most positive responses come from industry associations and from producers and suppliers of fuels (including biofuels) (Figure 13). The responses confirm the overall understanding that the Council Directive has as main purpose to provide guidance for the implementation of FQD Art.7A.

Figure 13 Coherence of FQD Art.7A with the Council Directive 2015/652 (as a % of the respondents)



Source: Study survey.

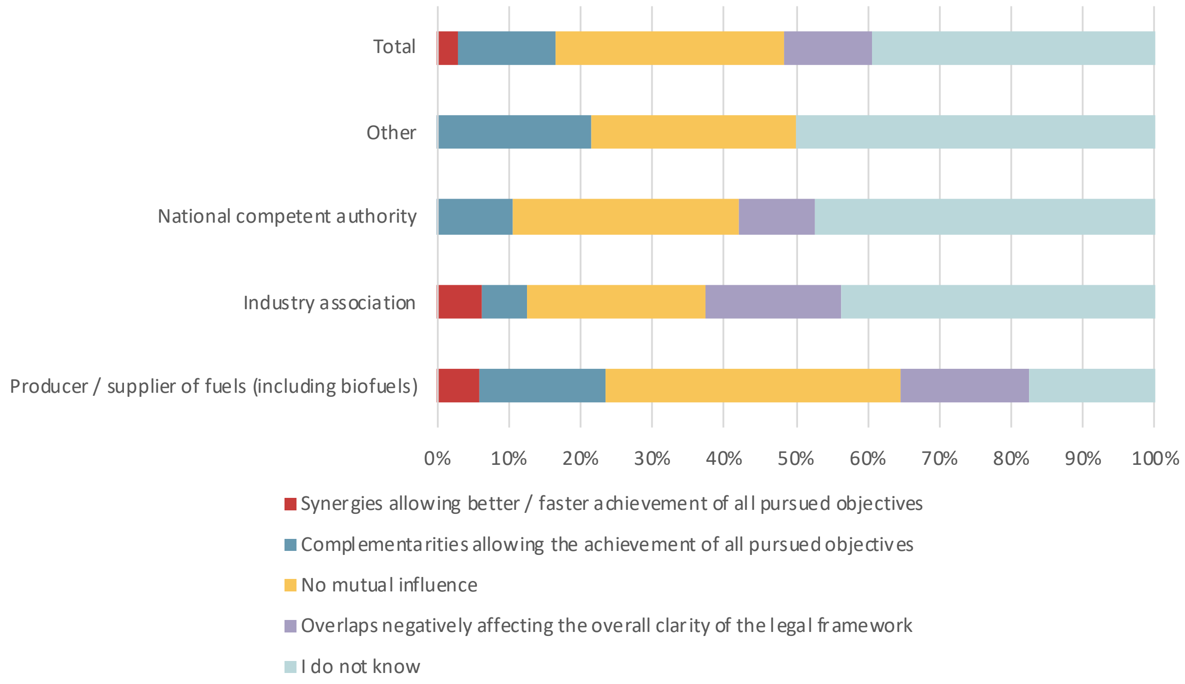
A representative of an industry association made an additional point in the survey, related to the coherence of FQD Art.7A and the Council Directive 2015/652 on related calculation methods and reporting requirements, with the REDII and the Regulation (EU) 2019/631 on CO_2 emission performance standards for cars and vans:

"We question the provisions of the Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to the FQD which adjust the efficiency factor of the battery and hydrogen electric powertrains. While we do recognise the better efficiency of these powertrains, the EC should carefully assess how this bonus interacts with all the benefits already given to these technologies such as the multiple counting in the RED II or the sales quotas for so-called Zero and Low-Emissions Vehicles in the CO_2 standards".

Other consulted stakeholders remark that regular updates on emission factors for novel fossil fuels, such as carbon capture and RFNBOs are also required.

More than half of the survey respondents (51%), mostly from industry associations and national authorities, stated that they find difficulties in complying with FQD Art.7A while abiding by other EU policy measures and rules. However, about one fourth of the 70 respondents answered that they find no difficulties in complying with other EU initiatives (Figure 14). Most respondents highlight that the REDII is the primary challenge, however incoherence with provisions of the Waste Framework Directive and the ETS Directive are also noted, according to the comments of the respondents.

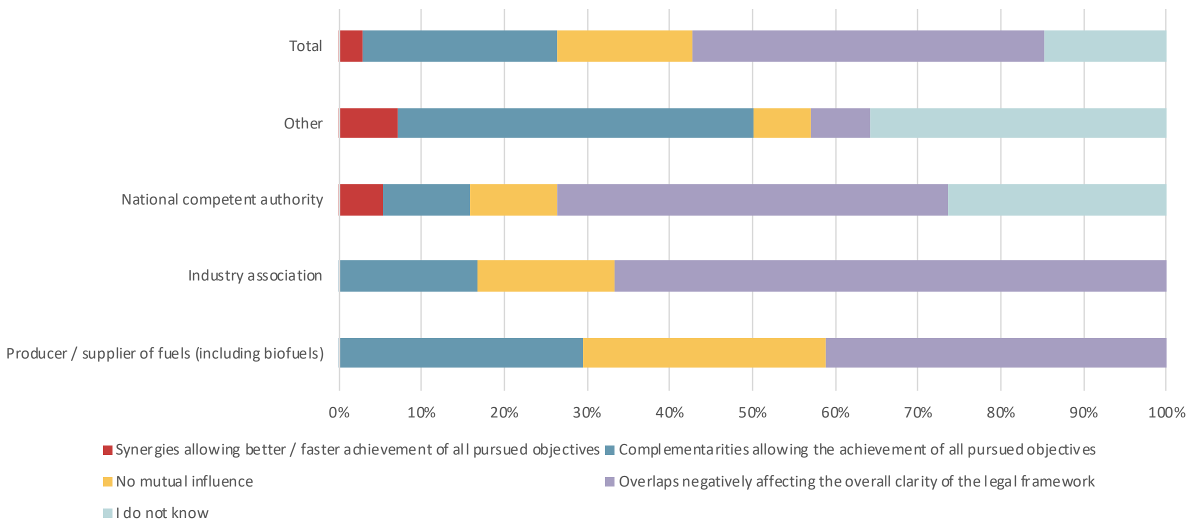
Figure 14 Coherence of FQD Art.7A with other EU policy measures and rules (as a % of the respondents)



Source: Study survey

Among the survey respondents that were asked if there are any difficulties complying with Art.7A of FQD while abiding by the incumbent transposition of the REDII, a consensus of 43% responded that they negatively overlap. These are mainly reported evenly by industry associations, fuel producers/suppliers and national competent authorities. This is in stark contrast to the low percentage of survey respondents (more than 7%) who believe that there are synergies between both directives that allows for better achievement of the objectives (see Figure 15).

Figure 15 Coherence of FQD Art.7A and the incumbent transposition of the recast RED (as a % of the respondents)



Source: Study survey.

In the views of both survey respondents and interviewees, the negative overlaps, and inconsistencies between FQD Art.7A and REDII consist of:

- Lack of alignment of the directives, especially as regard to biofuels and fossil fuels (despite efforts for a better alignment between both directives in this respect)
- Insufficiently harmonised implementation across Member States
- Higher RED targets than FQD targets
- Mismatch in the definition of the sustainability criteria between both directives
- The difficulties of calculating the level of compliance, for example: RED does not include non-road fuels while FQD does, a mandatory cap on crop fuels and cooking oil/animal fat is included into RED while it is voluntary in FQD. Furthermore, fuel suppliers have to report fuel supply data by pathway in the FQD, while this is not requested in the RED. It follows that compliance with the higher FQD reporting requirements may help Member States in ensuring compliance with the RED sustainability criteria.
- Double-counting rules (no double-counting in FQD)

FQD Art.7A was adopted in a policy space where also a renewable transport fuel target was operating. The RED sets a target of least 10% of the energy used in transport (via biofuels or electrification) to come from renewable sources by 2020. Reaching this target via biofuels requires compliance with the sustainability criteria in the RED and the FQD.[60] An interviewed representative of public administration remarked that "the sustainability criteria for biofuels are different from the new criteria introduced by the REDII. There is also a difference in the reporting of electricity. According to the REDII, it is possible to report 100% of electricity from renewable sources. FQD does not allow this, it is always necessary to use a national mix."

The two directives represent two models of policy design at EU level, both promoting transformation in the transport fuel sector, along different pathways. However, it is worth noting that while the FQD aims to decarbonise fuels, REDII aims to mainstream renewables in transport.

Respondents remark that the compliance with the biofuel target and the sustainability criteria in the directives limit the incorporation of more bio-components to petrol fuels which would contribute to further GHG savings. Interviewees also emphasise the difference in the respective scopes of the directives, as well as unsolved issues on UER projects.

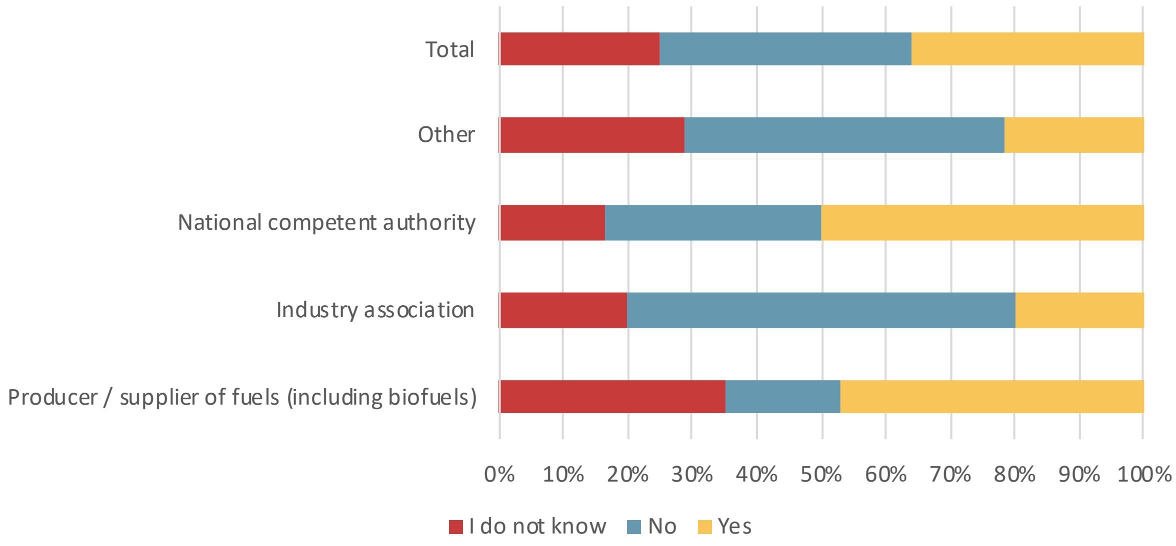
3.4.3 *How coherent is FQD Art.7A with national initiatives?*

The main findings of our study are that that there is no clear consensus among the respondents as to how coherent FQD Art.7A is with national initiatives.

About one-third of the survey respondents, representing mostly industry, believe that FQD Art.7A is coherent with national initiatives. However, about one-third of the respondents, representing mostly national authorities, also conclude on incoherence. Among those who believe they face difficulties in abiding by the implementation of national rules and the Directive, national competent authorities and producers and supplier of (bio)fuels are at the top. Among those who believe in the opposite, industry associates score high. The rest of the respondents give no clear response on their opinion regarding this issue (see Figure 16).

[60] EEA (2020). Transport: increasing oil consumption and greenhouse gas emissions hamper EU progress towards environment and climate objectives https://www.eea.europa.eu/themes/transport/term/increasing-oil-consumption-and-ghg

Figure 16 Difficulties experienced in complying with FQD Art.7A while abiding by national initiatives (as a % of the respondents)



Source: Study survey.

While some respondents and interviewees report on more ambitious national regulation in some Member States, most of the respondents report that there are inconsistencies and overlaps between the national transposition of the FQD and the REDII, and the lack of flexibility at the national level to accept or refuse some types of low GHG intensity fuels.[61]

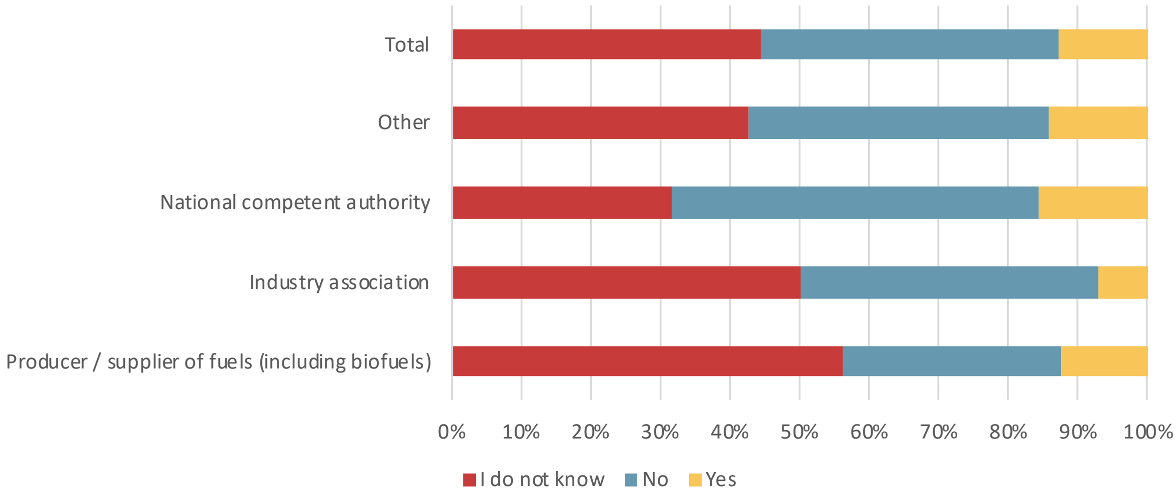
3.4.4 *How coherent is FQD Art.7A with the international obligations of the European Union?*

This study finds that overall, more than one third of the survey respondents find no problem with complying with both FQD Art.7A and international initiatives. However, with the high number of respondents who were uncertain about their position on this question, it is difficult to conclude on a clear consensus.

The results of the study survey show that 43% of the respondents find no difficulties with the compliance of FQD Art.7A while abiding by international initiatives, as opposed to the 13% of respondents that have experienced problems. Of the respondents that find coherence, the majority consists of national competent authorities (53%) followed by industry associations (43%) and producers and suppliers of (bio)fuels (31%). Elaborating on their answers, many stakeholders refer to the Paris Agreement and state that they have encountered no difficulties with abiding by it while complying with their obligations induced by FQD Art.7A. Our stakeholder consultations provide evidence that stakeholders perceive coherence of FQD Art.7A with, on the one hand, international treaties, and national initiatives (mostly national transposition of its provisions) on the other, as two distinct and disconnected issues.

[61] A ranking developed by CAN Europe concludes that the overall action at the Member State level is still not sufficient to reduce carbon emissions in line with the Paris Agreement. In particular, there is scope for improvement in their policies and measures to reduce emissions from transport fuels and the transport sector. Country-specific recommendations include raising transport fuel taxes (e.g. Luxembourg), reducing or eliminating subsidies for fossil fuels (e.g. Austria), prioritizing alternatives to road transport, and stopping projects with high carbon emissions (e.g. France) (see CAN Europe 2018: Ranking of EU countries' ambition and progress in fighting climate change http://www.caneurope.org/docman/climate-energy-targets/3357-off-target-ranking-of-eu-countries-ambition-and-progress-in-fighting-climate-change/file)

Figure 17 Difficulties experienced in complying with FQD Art.7A while abiding by international obligations of the European Union (as a % of the respondents)



Source: Study survey.

In the survey, respondents, who believe there are various difficulties in the compliance between FQD Art.7A and international treaties and obligations, remarked that this is due to different methods of interpretation of the directive and mentioned that a lack of a single registry for UERs makes its application difficult as it may overlap with the CDM. Most of the interviewees remark upon the coherence between Art.7A of FQD and the Paris Climate Agreement. However, there is no clear consensus. While some believe that the FQD and its Art.7A are not ambitious enough, others find it in line with the Agreement.

While this response gives a certain indication of coherence, it is worth noting that an overwhelming share of respondents (44%) have answered "I do not know" to this the question. Most respondents who chose this alternative come from the category of producers and suppliers of (bio)fuels (56% of the respondents from this category), followed closely by the industry association (50% of respondents from this category). The respondents do not give indications as to why they express this uncertainty about the survey questions.

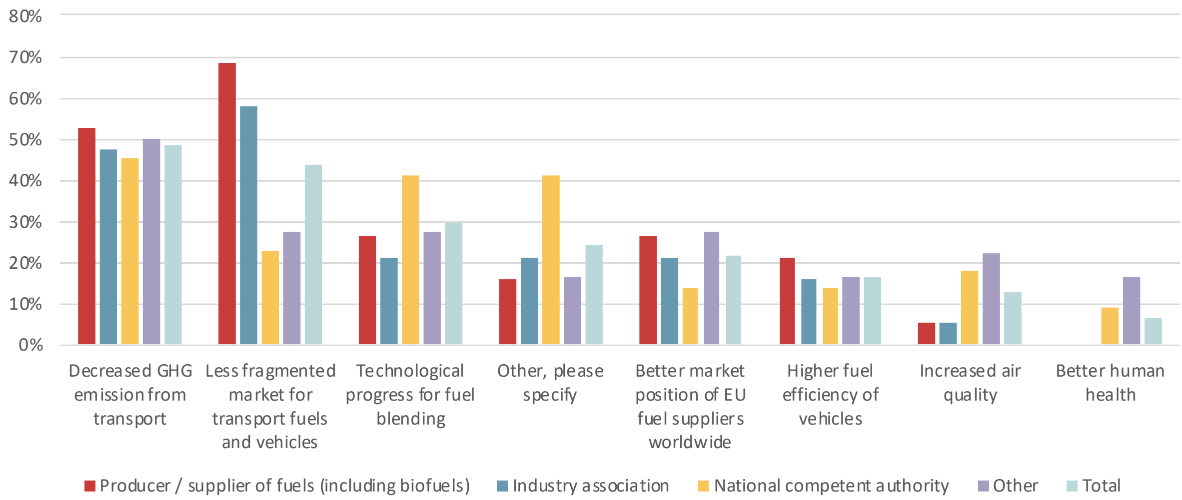
3.5 EU-added value

3.5.1 *Did the definition of goals at the EU level allow for the achievement of the overarching objectives relative GHG emissions?*

The definition of EU-level target may seem the most relevant approach for addressing cross-border challenges. However, there is no consensus among the consulted stakeholders that national initiatives would not have achieved similar or higher GHG intensity reductions of transport fuels. Also, according to consulted stakeholders, the national legislation transposing FQD Art.7A has not contributed to reducing the fragmentation of the EU market for transport fuels and vehicles.

To the extent that the general objectives of FQD Art.7A relate to cross-border challenges, several consulted stakeholders state that the definition of EU-level targets for the reduction of GHG intensity of transport fuels is the most relevant approach. Such targets would, in their views, ensure that all Member States pursue efforts in the same direction. More than half of the fuel producers / suppliers that answered the study survey stressed that national initiatives would not have made the same achievement in terms of reduction of GHG intensity of transport fuels. However, it is worth to note that other stakeholders do not systematically share these views. Overall, less than 50% of the survey respondents consider that the objectives of FQD Art.7A could not be achieved through national incentives (see Figure 18). The 2017 evaluation of the FQD (excluding Art.7A) provided evidence of the added value of the Directive in the protection for environment and human health[62].

Figure 18 Impacts of Art7A of the FQD that could not have been achieved through national initiatives (as a % of the respondents)



Source: Study survey.

For more than 40% of the survey respondents, the reduction of market fragmentation would not be achievable through national initiative. The 2017 evaluation of the FQD (excluding Art.7A among other provisions) already concluded that "a single market could not be delivered in the absence of the FQD" and that national and misaligned fuel specifications would fragment the internal fuel market[63].

However, less than 10% of the survey respondents declared that Art.7A had reduced the fragmentation of road transport fuels and vehicles. More than a third even thought that such an impact is even (extremely) unlikely. Interviews provide further elaboration on these positions.

Interviewees claimed that national transpositions of FQD Art.7A have to some extent accelerated the fragmentation of the European market. Member States do not pursue all the same targets, as they can adopt higher targets than those in FQD Art.7A. There are variations in their enforcement mechanisms too. In the views of some interviewed stakeholders, differences in penalties have caused the diversion of biofuels to the countries where demand and costs of non-compliance are higher due to higher penalties. Finally, it is worth noting that the ways through which Member States have transposed the FQD and the RED in national laws have had significant impacts on their coherence at the national level. They also resulted in different regulatory framework potentially leading to different behaviours among fuel producers / suppliers and market reactions. In sum, the national transpositions of FQD Art.7A hinder the reduction of market fragmentation even though this is what stakeholders viewed as one of its main potential EU-added values.

This conclusion is in line with those of the 2017 evaluation of the FQD (excluding Art.7A). It noted that, if the FQD was replaced with national specifications of fuel quality, the internal fuel market would be fragmented. However, it also provided evidence that the FQD had not contributed to the full harmonisation of the internal fuel market and even contended that "the FQD has not been constructed as an instrument to fully harmonise the internal transport fuel market"[64] as it leaves some flexibility to Member States in the definition of blending limits.

[62] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'). Commission Staff Working Document. SWD(2017) 179 final.
[63] *Ibid*., p. 31.
[64] *Ibid*., p. 34.

These conclusions point out to the fact that EU-level requirements for fuel blends may be of a better support to the harmonisation of the internal fuel market.

4 PART B: ASSESSMENT OF POLICY OPTIONS TO STEER THE PROGRESSIVE REDUCTION OF TRANSPORT FUELS' GHG INTENSITY

This chapter analysis the policy options to steer the progressive reduction of GHG intensity of transport fuels towards 2030 and 2050. The chapter first outlines the policy options and sub-options and elaborates on the assumptions made. The impacts of the policy options and sub-options are then assessed and presented. This chapter is supplemented with technical appendixes (Appendix I, J and K), where additional details are provided.

4.1 Overview of Policy Options

The policy options to steer the progressive reduction of GHG emissions of transport fuels take outsets in the Terms of Reference (ToR) provided by the European Commission. The options have been further defined after performing a detailed assessment of the problem definition and the main problem drivers, which can be found in Appendix I. The options have been validated during two virtual stakeholder workshops.

Three sets of policy options focusing on the GHG intensity reduction obligation are considered:

- Option 1: Continuing with the obligation to reduce the GHG intensity of fuels based on the current approach used in FQD and the sustainability architecture for renewable fuels introduced under RED II.
- Option 2: Discontinuing the obligation to reduce the GHG intensity of fuels.
- Option 3: Strengthening the policy measures towards reducing the GHG intensity of fuels.

The study considers the sub-options that are related to Option 3 as distinctive and significant policy measures:

- Sub-option A: Extension of the scope of fuels covered to gaseous fuels.
- Sub-option B: Introducing a market-based instrument for fuel suppliers to trade GHG reduction credits for the supply of transport fuels.
- Sub-option C: Regulating directly fuel suppliers.

The options and sub-options are summarised in Table 11.

Table 11 Overview of Options and Sub-options

Options/ Sub-options	Description
Option 1	Continued obligation (baseline)
Option 2	Discontinued obligation
Option 3:	Strengthened obligation
Sub-option 3A	Adding gaseous fuels to the scope of the FQD
Sub-option 3B	Introducing a market-based system to trade GHG reductions obligations
Sub-option 3C	Regulating directly fuel suppliers

4.2 GHG intensity reduction obligation

The GHG reduction obligation target of the FQD was introduced as part of the 2008 Climate and Energy Package, which had an ambition at the time of reducing GHG emissions with 20% by

2020.[65] This ambition has been replaced by the 2030 Climate and Energy Policy framework as well as the European Green Deal. The European Green Deal led to a significant rise in ambition to 55% GHG reductions by 2030 and a target towards climate neutrality by 2050.[66] The current ambition of Art.7A has hence not been adjusted to the rising European climate ambition. An increase of the GHG reduction obligation would therefore contribute to the current policy objectives.

In terms of reaching Art.7A's GHG reduction target, several Member States were still far away from achieving the target as of 2018, see Table 25 in Appendix I.[67] Only Finland and Sweden have achieved the 6% reduction target. On the EU28 level (including the United Kingdom), the GHG intensity reduction amounts to 3.7%, excluding the ILUC effects. If ILUC effects are considered, this reduction amounts to 2.1%. A study by CE Delft on the implications of the 55% target on Dutch climate policies similarly pointed to the fact that many Member States most likely will not meet the current 6% target.[68]

In 2019, the European Commission clarified to the Member States that the 6% GHG reduction obligation will remain in place after 2020.[69] The continuation of the 6% GHG reduction obligation is therefore chosen as the baseline scenario, as this corresponds to the situation in which the status quo is maintained.

4.2.1 *Option 1: Continued GHG reduction obligation (baseline)*

The continued GHG reduction obligation entails that the current 6% GHG reduction obligation is in place and will apply after 2020. This option represents the baseline scenario, reflecting the status quo. Further, new measures and policies will be introduced, corresponding to the MIX55 scenario of the 2030CTP, which entail carbon regulating and pricing measures that reduce the GHG emissions and intensity of transport. For the assessment of the baseline scenario, the MIX55 scenario established as part of the 2030 CTP is used.

4.2.2 *Option 2: Discontinued GHG reduction obligation*

The discontinuance of the GHG reduction obligation consists of a withdrawal of the lifecycle GHG reduction target after 2020. Member States are therefore not required to achieve the reduction target any longer and should base their carbon reduction compliance to European Green Deal in other initiatives like EU ETS, RED II, carbon restrictions of vehicles manufacturers.

4.2.3 *Option 3: Strengthened GHG reduction obligation*

The strengthening of the GHG reduction obligation assumes that the GHG reduction is supporting the achievement of the European Green Deal's transport sector target by 2030 through additional, complementary measures that further enable an increased GHG intensity reduction obligation in road transport, owing to an increased uptake of low carbon fuels.[70] More concretely, the following market policies could significantly facilitate the development, production, and trade of low carbon fuels:

- Increased blending ratio of biofuels into fossil fuels and/or single market trading in the EU:
  - establishing the utilization of fuel blends of higher biofuel content may facilitate GHG emissions reduction.
- More favourable financing framework at investment level:
  - improvement of the investment attractiveness through measures as e.g. lower financing costs through reduced interest rates and access to funds, which will result in the reduction of the risk of First-Of-A-Kind (FOAK) plants for low carbon fuels

[65] https://ec.europa.eu/clima/policies/strategies/2020_en
[66] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[67] EEA (2020). Greenhouse gas intensities of road transport fuels in the EU in 2018
[68] CE Delft (2020). Effects of an EU 55% GHG reduction target, Assessment of potential impacts on Dutch climate policies
[69] https://ec.europa.eu/clima/policies/transport/fuel_en#tab-0-0
[70] The option is assessed from a high-level perspective, due to the unavailability of key data that allow a precise assessment. The supplementary measures may introduce additional administrative and substantive cost. Due to the high-level specification of the complementary measures, their specific costs are however not assessed.

- Support during demonstration and early commercialization stages of novel low carbon fuel technologies:
  - a potential introduction of mandates on the market update of specific fuel categories will formulate a clear framework supporting the development of the relevant technologies
- Support the deployment of lower carbon intensity fuels through appropriate financing tools:
  - Tailored financing mechanisms (such as feedstock premiums, feed in tariffs and premiums) can de-risk capital investment and ease uncertainties of production costs of lower carbon fuels
- Establishment of binding intermediate targets (e.g. GHG intensity reduction, RES-T shares) to better monitor implementation of policies and enhance their effectiveness
- Support the deployment of lower carbon intensity fuels through appropriate capacity building measures:
  - enhancement of capacity building for SMEs and industries and awareness activities for stakeholders related to the production and use of lower carbon intensity fuels
- Intervention into the tax policy:
  - carbon taxation for fossil fuels will result in their limited use, and/or
  - tax exemptions for the use of low carbon fuels will constitute a clear driver for the development of the relevant technologies
- Broadening of use of lower carbon fuels, e.g. RFNBOs, such as e-fuels and renewable (green) hydrogen:
  - potential establishment of sectoral uptake quotas and other relevant mandates would help commercialization of such technologies and contribute to their cost reduction
- Establishment of a framework to support the valorisation of the potential for RCF; and/or
- Implementation of measures contributing to the completion of the single market and to the removal of trade barrier related to low carbon fuels.

4.2.4 *Assumptions on feedstock distribution of the Options*

To assess the impacts of Option 3 on the feedstock supply and the substantive costs, it is assumed that the improved policy mix leads to the changes in the feedstock distribution of biofuel demand as outlined in Table 12 and .

Table 12 presents the feedstock distribution for bioethanol in Options 1, 2, and 3. The baseline follows the JEC v5 2025+ scenario, in which the share of Annex IX-A ethanol (composed of only straw ethanol) is projected to grow from 4% in 2020 to 13% by 2030.[71] The feedstock distribution of ethanol builds on the RED II targets. This study assesses therefore that a discontinued GHG obligation (i.e. Option 2) leads to no changes to the baseline projection.

[71] JEC (2020), JEC Well-To-Wheels report v5, https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/jec-well-wheels-report-v5

Table 12 Assumed distribution of bioethanol feedstock in 2030 for Options 1, 2, & 3

Feedstock	Bioethanol		
	2020	Option 1 & 2	Option 3
Wheat	30%	26%	24%
Maize	38%	34%	30%
Sugars	21%	21%	20%
Other cereals (barley)	7%	6%	6%
Annex IX-A	4%	13%	20%

Source: authors' assessment based on JEC (2020), JEC Well-To-Wheels report v5

With respect to Option 3, the share of Annex IX-A feedstocks is illustratively increased by 50% to 20% to reflect a more ambitious uptake of advanced biofuels. This illustrative increase seeks to demonstrate the order of magnitude of the impacts that can be expected in the context of Option 3. The shares of the remaining feedstocks are reduced proportionally.

With respect to biodiesel, the feedstock distribution is also based on the JEC v5 2025+ scenario. This scenario makes the critical assumption that all palm oil is derived from an industrial processing waste feedstock, i.e. palm oil mill effluent (POME) by 2030, listed in RED II Annex IX-A. As for bioethanol above, the feedstock distribution builds on the RED II targets. Accordingly, the same feedstock distribution is assumed for Options 1 and 2.

With respect to Option 3, the share of Annex IX-A feedstock (i.e. POME) in 2030 is illustratively increased by 50% to 30% and 60% for respectively biodiesel and HVO. The shares of the remaining feedstocks are reduced proportionally.

Table 13 Assumed distribution of biodiesel feedstock in 2030 for Options 1, 2, & 3

Feedstock	Biodiesel			HVO		
	2020	Option 1 & 2	Option 3	2020	Option 1 & 2	Option 3
Rapeseed oil	52%	47%	41%	18%	16%	11%
Used cooking oil (UCO)	17%	15%	12%	25%	25%	17%
POME (Annex IX-A, in 2030)	20%	20%	30%	45%	40%	60%
Animal fats	5%	5%	5%	11%	11%	7%
Soybean oil	5%	5%	5%	2%	2%	1%
Sunflower oil	1%	6%	5%	0.4%	0.4%	0.4%
Other residual oils	0%	2%	2%	0%	5%	3%

Note: The feedstock distribution for HVO does not sum to 100% in the 2025+ scenario. Source: authors' assessment based on JEC (2020), JEC Well-To-Wheels report v5.

4.2.5 *Sub-option A: Extension of scope to gaseous fuels*

The product scope of the "core" FQD (Art 1 of the Directive 98/70/EC) consists of petroleum-derived liquid fuels that correspond to CN code 2710 (petroleum oils, containing at least 70% petroleum oil). Petroleum gases and other gaseous hydrocarbons (CN code 2711) are not currently in scope of the FQD. Art. 7A of Directive 2009/30/EC, which amended Directive 98/70/EC, considers also neat (100%) biofuels as transport fuels. Some of those biofuels can be used as components in gasoline or diesel fuel blends up to 30% but higher blends and the neat biofuels are not covered by the amended FQD and have therefore no legal quality requirements.

Gaseous fuel types, including those from biogenic sources, made up about 2% of all fuel supplied in 2018 among 28 Member States.[72] While the current role of gaseous fuels is limited, its role may however increase in the future, where other types of gaseous fuels are expected to enter the transport fuel mix (e.g. clean gas or e-gas). The relevant figures in the MIX55 scenario of 2030CTP suggest an increase in the share of gaseous fuels in the transport sectors covered by FQD Art. 7A, from 3.4% in 2020 to slightly above 8% in 2030. Moving towards 2050, natural gas is projected to be substituted by renewable and low-carbon gases.

Considering the individual fuels carbon intensity, bio-based gaseous fuel types, e.g. biomethane, offer significant GHG emissions savings as compared to fossil liquid fuels[73] and the FQD fossil fuel baseline, while other types of renewable gases such as e-gases, also feature a significantly lower carbon intensity value. Further, it is noted that policies such as the EU strategy on energy system integration[74], which supports the widespread promotion of biomethane[75] and green hydrogen in the natural gas infrastructure, directly contributes to the reduction of the carbon intensity of fossil gaseous fuels, contributing to the uptake of an eventual "cleaner" gaseous fuel mix by the final consumption sectors[76].

Gaseous fuels can be supplied in either pure form or as blends with fossil gas. There is, however, a need to also regulate the specifications for blending of gaseous transport fuels.[77]

For the biomethane, blending is no issue, provided that it is injected in the pipe and accounted through certificates that assert its biological origin and compliance with the technical and operational standards of the infrastructure. This discussion has been currently extended to the use of hydrogen (e.g. see the EU Strategy on Energy System Integration). However, irrespective of the availability of blends, it is necessary to add gaseous fuels to the scope of the FQD to ensure a harmonious single market for gaseous fuels.

Adding gaseous transport fuels to the scope of the FQD, corresponds to the requests of five Member States in the evaluation of the FQD (which had excluded Art.7A), as a wish to give better support to gaseous fuels[78] through: (a) expanding the scope of the FQD to include gaseous fuels and (b) allowing the use of fuels with a higher blending ratio (beyond the 70/30 ratio that currently stands for the liquid petroleum-based fuels).

There are available CEN standards that set the requirements for the use of gaseous fuels as automotive fuels, and therefore their use in the transport sector. However, CEN standards have, by themselves, no legal status, and only by establishing the relevant link in the "core" FQD would make these specifications legally binding.

The expansion of the scope can be coupled to both Option 1 (i.e. continuation of the FQD 7A implementation as it currently occurs) and Option 3 (i.e. strengthening the FQD Art 7A

[72] EEA (2020), Greenhouse gas intensities of road transport fuels in the EU in 2018, Eionet Report - ETC/CME 2/2020 – November 2020

[73] Annex I, Part 2, Implementing Directive (EU) 2015/652; Greenhouse Gas Intensity from Natural Gas in Transport (NGVA) http://ngvemissionsstudy.eu/)

[74] https://ec.europa.eu/energy/topics/energy-system-integration/eu-strategy-energy-system-integration_en

[75] EU strategy on energy system integration (COM(2020) 299 final, July 2020)): https://ec.europa.eu/energy/topics/energy-system-integration/eu-strategy-energy-system-integration_en

[76] A hydrogen strategy for a climate-neutral Europe (COM (2020) 301 final, 8.7.2020)); Powering a climate-neutral economy: An EU Strategy for Energy System Integration (COM(2020) 299 final, 8.7.2020))

[77] CE Delft (2020), Effects of an EU 55% GHG reduction target, Assessment of potential impacts on Dutch climate policies.

[78] SWD (2017) 178 final, and EC report on Evaluation of Directive 98/70/EC prepared by Amec (2017)

implementation) concerning the GHG obligation. It is understood however, that especially for the case of Option 3, expanding the scope to gaseous fuel would essentially constitute an expansion of the available options that would be employed to allow for an implementation of a strengthened FQD Art 7A. As such, this Sub-option A is assessed in detail in relation to the strengthened obligation option.

4.2.6 *Sub-option B: Market-Based Instrument*

The use of market-based instruments in the form of a market place for GHG reductions to further promote compliance with GHG emission intensity reduction obligations is widely regarded as a flexible and cost-efficient approach in the transport sector.[79] Market-based instruments in which credits (for the achievement of GHG reductions) can be traded enable those fuel suppliers with comparably lower costs of reducing their GHG intensity to trade their achievements with fuel suppliers that have comparably higher costs of reducing their GHG intensity. This provides an incentive for individual fuel suppliers to over-achieve the FQD's GHG reduction targets.

A marketplace provides a further advantage for (small) innovative fuel suppliers of low and zero carbon fuels: the sale of overachievements in GHG reductions provide an additional revenue stream.[80] This makes low carbon fuels more economically viable, as it de-risks the investment and lowers production costs, ultimately increasing the market penetration of renewable and recycled fuels. In addition, a marketplace can provide an incentive to supply additional renewable electricity for electric vehicles. This follows a similar logic as above: a marketplace establishes an additional revenue stream for suppliers of electricity for vehicles. This can increase the economic viability of supplying renewable electricity for transport, and possibly increase the penetration of electricity.[81]

Given the results of this evaluation, which indicated that the costs for fuel suppliers of achieving intensity reductions have been moderate, a trading scheme should be simple to keep administrative costs low. The operationalised sub-option is therefore defined with that aim. The main design elements of the market-based instrument are presented in Table 14. Additional details on the operationalisation of the market-based instrument as well as an overview of existing instruments, see Appendix J.

In short, a market-based instrument builds on annual GHG reduction targets, where the banking of credits is permitted. For the market for credits to be established, targets have to be defined regularly. Therefore, annual targets are necessary for a market-based instrument to work.

The market instrument produces GHG credits, measured in the quantity of GHG savings. The GHG saving is added to the calculation of GHG emissions by fuel suppliers, prior to the calculation of the intensity. Fuel suppliers who do not meet the annual target incur a GHG debt corresponding to the total GHG emissions above the target. These fuel suppliers have then the option to either purchase GHG credits or pay a penalty. A penalty should be above the expected price/costs of advanced biofuels so that there is no incentive to just pay the penalty.

Table 14 Proposed designed elements of the market-based instrument

Design Element	Description
Participation	• Wholesale and retail suppliers of fossil fuels • Wholesale and retail biofuel suppliers to end-use • Suppliers of electricity for transport • Suppliers of hydrogen for transport
Target	• Annual GHG reduction target
Traded unit	• g CO2 e/MJ

[79] IEEP, ICCT, T&E (2015). Low Carbon Transport Fuel Policy for Europe Post 2020; Frontier economics & Flick Gocke Schaumburg (2020). Crediting System for Renewable Fuels in EU Emission Standards for Road Transport. Report for the German Federal Ministry for Economic Affairs and Energy.
[80] Ibid.
[81] For example, the Californian Low Carbon Fuel Standard (LCFS) is for example reported to help boost the market penetration of EVs: the market-based instrument has generated EUR 83 million of additional funding to the electrification of transport in 2016. See: UCS (2020), California's Clean Fuel Standard Boosts the Electric Vehicle Market

Design Element	Description
Fuel type	• Gasoline, diesel, LPG, CNG, LNG, electricity
Banking	• Allowed
Penalty level and/ or price cap	• Penalty/price cap level to be defined above the expected price/costs of advanced biofuels
Verification	• Independent audits by accredited third-party auditors

A market-based instrument can be associated with high levels of administration from a regulator's point of view, as is for example reported for the Californian Low Carbon Fuel Standard (LCFS).[82] The European context can be considered as more complex, taking into account that all 27 national authorities will have a role in the administration of the instrument.[83] In relation to the options for the GHG reduction obligation, a market-based instrument is therefore only considered relevant for the strengthened obligation and thus is examined in combination with this option.

A market-based instrument requires a symmetric implementation across the EU and a centrally organised operation. Aspects like annual targets and penalty levels need to be uniform to ensure a level-playing field for the purchase and sale of reduction achievements. The market-based instrument is therefore only regarded as feasible if fuel suppliers are directly regulated via an EU Regulation. It is hence not applicable to the scenario of implementation through an EU Directive.

4.2.7 *Sub-option C: Regulating directly fuel suppliers*

The problem definition in Appendix I shows that the observed market fragmentation can be traced back to diverging national approaches in implementing Art.7A as well as the blending mandate of the FQD. Being an EU Directive, the "specific form and method" of complying with the FQD is left to the Member States.[84] There is therefore no basis within an EU Directive to require e.g. Germany to alter its blending mandate or its sanction structure.

An EU Regulation leaves the "specific form and method" to achieving the FQD's target at the EU's disposal. As the Better Regulation Toolbox highlights, Regulations can be a desired type of legislation when a uniform implementation of policy intervention is needed, including considerations for the internal market.

Fuel suppliers commonly operate in several Member States, having to comply with different requirements across Member States. A uniform regulation could therefore help large fuel suppliers benefit from uniform compliance requirements and reduced administrative burdens.[85] For small fuel suppliers, uniform compliance requirements and reduced administrative burdens can facilitate access to new markets in the EU and the scaling-up of production.

Lastly, a regulation can harmonise also the implementation of UERs across Europe, which is an optional mechanism to demonstrate the achievement of fuels' GHG intensity. The Union of European Petroleum Independents (UPEI) criticises, for example, a divergent implementation of UERs across the Member States.[86] Also, reportedly only a limited number of Member States allow the recognition of UERs from abroad. The UPEI therefore calls for an EU-wide system to recognise UERs. Theoretically, the decentralised implementation can constitute a barrier to a single market for transport fuels. However, this study has not obtained further evidence on the relevance of this issue. Nevertheless, the underlying Sub-option C would eliminate the issue of a divergent implementation of UERs, as it focuses on harmonious implementation.

[82] IEEP, ICCT, T&E (2015).
[83] The assessment of the impacts will shed more detailed light on this.
[84] Better Regulation Toolbox, Tool #18, p. 108.
[85] IEEP, ICCT, T&E (2015). Low Carbon Transport Fuel Policy for Europe Post 2020
[86] UPEI (2020), Avoiding regulatory inconsistencies in future policy frameworks; also e.g. EXERGIA (2015) for VDB, Options for Reduction of Upstream Emissions (UER) from Oil Production: Significance, Implementation and Consequences

Changing the regulated entity, by regulating fuel suppliers directly through an EU Regulation, implies that while the same GHG reduction obligation targets are in place, the implementation and enforcement are symmetric across the EU. In terms of implementation, fuel suppliers will need to comply with annual reduction targets, as is also encouraged by FQD Art.7A. As regards enforcement, a type 1 sanction structure is applied (see Table 10 on Types of penalties) and is set at a level that eliminates any economic advantage of non-compliance. This ensures a clear price signal to fuel suppliers. The option does not introduce any changes to the monitoring and reporting framework, so that Member States can continue using their current structures. This policy option is also related to Option 3 of strengthened obligation and is mentioned in the following paragraphs as Sub-option 3C.

4.3 Analysis of the impacts of policy options

This section presents the synthesis of the environmental, economic, and social impacts of the policy options and sub-options presented above. The following impacts are assessed:

- Environmental impacts:
  - Reduction in GHG emissions from transport
  - Reduction in GHG intensity of fuels
  - Impact on feedstock supply
  - Displacement of agricultural and other products
- Economic impacts:
  - Administrative burden for public administrations
  - Administrative burden for fuel suppliers
  - Substantive cost for fuel suppliers
  - Fragmentation of EU fuel markets
  - Increase in innovation and cost-savings of low carbon fuels
  - Competitiveness of EU fuel suppliers on the global market
  - Competition between renewable and recycled fuels, incl. initiatives for alternative fuels in aviation and maritime transport modes
- Social impacts:
  - Social equity impacts on affordability of road mobility
  - Social impact on rural areas
  - Changes in employment resulting from new compliance requirements
  - Impacts on 3rd countries

Not all impacts are relevant for each of the options and sub-options, thus, only the main impacts are presented below. The methodology and detailed assessment of the impacts are presented in Appendix K.

4.3.1 *Option 1: The continued GHG reduction obligation*

Environmental impacts

The assessment of the reduction of GHG emissions in the sector, GHG intensity of fuels and demand for fuels is based on the data from the MIX55 scenario of the 2030 CTP.

The MIX55 scenario estimates an expected GHG emissions reduction of 16.3 % in the whole transport sector in 2030, while in road transport the annual CO_2 emissions reduction doubles compared to the period 2005-2015. A significant driver for the reduction of GHG emissions in transport is the achieved penetration of RES in the sector.

In terms of the carbon intensity of the fuel mix in transport, computations based on the MIX55 transport fuel mix and following the methodology of the life cycle assessment of the GHG emissions of the FQD[87] result in an overall carbon intensity of 83,2 gr CO_2 e/MJ, suggesting that there will be a 11.5% reduction of the overall carbon intensity of the transport fuel mix as compared to the baseline of 94 gr CO_2e q/MJ, see Appendix F for the details on the calculations.

The demand for biomass-based fuels requires the supply of feedstock. In the case of 1st generation biofuels, which are currently the dominating type of biofuel, the production of feedstock requires agricultural area, the demand of which varies by the different types of feedstocks consumed. With the rise of 2nd generation biofuels as well as other alternative fuels however, the need for agricultural area is expected to decrease. Based on the calculations provided in Appendix K, there will be a significant reduction in land use albeit an overall increase in biofuel demand between 2020 and 2030, due to the decreasing importance of crop-based biofuels. By 2030 and 2050, the associated land use will be reduced by respectively 3.9 and 7.2 million ha.

The substitution away from crop-based biofuels will reduce land use, leading to less eutrophication of water bodies, water scarcity, soil erosion, soil compaction, air pollution, habitat loss and biodiversity loss associated with crop production. The environmental impact will therefore be positive – both in the EU as well as for third countries. Particularly for palm oil, which is expected to transition towards palm oil mill effluent, substantial reductions in land use can be expected.

In terms of the risk of displacement of agricultural and other products, the effects are very small given that the demand for crop-based biofuels are gradually decreasing. While marginal effects on food prices and on additional cultivation cannot be ruled out, overall, the displacement impacts are considered to be very small.

Economic impacts

Member State authorities incur an administrative burden for the GHG reduction obligation, composed of among others annual reporting to the EEA, cost for collecting data and reports from companies, cost of calculation of GHG emissions on Member State level, and online system management. As the baseline scenario assumes that the GHG reduction obligation will continue, it is anticipated that the administrative costs will be similar to the current costs.

The evaluation of FQD Art7A has elicited unit values on the administrative burden in the range of 1-2 FTEs per Member State, see section 3.3. Based on labour cost data, this corresponds to an annual cost of about EUR 42,000-83,000 per year, per Member State.[88] These figures represent however, both the cost associated with the GHG reduction obligation as well as the obligations under the RED. During the interviews, stakeholders commonly pointed to an inability to disentangle the administrative cost of both FQD Art.7A and the RED.

Fuel suppliers also incur an administrative burden that consists of annual reports to the national authorities on fuel supplies, monitoring system for tracking various fuels and costs of calculation of GHG emissions. The evaluation has assessed that the administrative burden for fuel suppliers is in the range of 1-2 FTEs per supplier, where the higher figure includes resources on monitoring regulatory trends for FQD Art.7A and RED as an administrative cost. On average, most companies name a figure of 1 FTE for the administrative costs.

In terms of fragmentation of fuel markets, it is predicted that the fragmentation will continue (see Appendix I on fragmentation problem) and could even further increase due to foreseen national initiatives in major biofuel markets (i.e. Germany and Sweden) that target higher reductions in the GHG intensity than are estimated in the baseline.

The wider deployment of innovative low carbon fuels is a prerequisite for the reduction of the transport sector GHG emissions. Based on the current status of the expected evolution of costs of biomass-based biofuels and waste-based low carbon fuels, there is a significant cost gap of between 12 and 128 EUR/MWh (3-36 EUR/GJ) hindering thus the market uptake of such fuels. While the costs of low carbon fuels are an important factor, a broader range of issues also need to be considered like the potential availability of feedstocks and the life cycle GHG emissions and

[87] This is also reflected in RED II.
[88] The estimate assumes a labour cost according to Eurostat data: 37.1 average hours per week, 56 weeks in a year, €20 average hourly labour cost levels (plus taxes minus subsidies) in the EU-27 for administrative and support service activities [lc_lci_lev]

other sustainability criteria associated with particular routes. Large scale deployment will depend on continuing policy support.

The consideration of the FQD targets is not expected to create additional impact to prices given the implementation of RED II, which remains the driving force and places constraints on production of low carbon transport fuels.

Further, the implementation of FQD obligations will lead the involved suppliers to become more flexible and competitive to meet the low carbon needs of the fuel markets globally. The emphasis of FQD Art. 7a on life cycle GHG savings encourages market penetration of RFNBO and RCF, especially in cases they are addressed to the maritime and aviation markets.

Social impacts

An increase in the fuel prices might affect the affordability of road mobility with certain households being affected disproportionally. In the baseline scenario, there could be increase in fuel costs up to about 10% by 2030. For rural households this would mean an increase in transport costs of around 0.7%.

In terms of rural development, the phase-out of crop-based feedstock might lead to reductions in income. The increased demand for 2nd generation biofuels will in turn provide new income opportunities from e.g. wheat straw biofuels. As the overall biofuel consumption is projected to increase until 2030, but the demand for crop-based biofuels to decrease, there is likely to be an overall positive impact on the development in rural areas in the EU.

The baseline scenario is expected to have an impact on employment of administrative authorities in the Member States and on fuel suppliers. The administrative costs for public administrations and fuel suppliers amount to respectively 1-2 FTEs per Member State, except for 15 FTEs in the case of the Netherlands, 2 FTEs in Denmark and France, and 1 FTE in Belgium and one other Member State.[89] On the EU27 level, this amounts to an estimated 43-65 FTEs.[90]

The study has not been able to identify the exact number of fuel suppliers on the European market. The study identified however 46 distinct owners of oil refineries, of which some are co-owned. Assuming this number corresponds to the number of fuel suppliers, a total of 46-92 FTEs is estimated for fuel suppliers.[91, 92]

Summing up the figures for public administrations and fuel suppliers, FQD Art.7A will continue providing employment of 89-157 FTEs[93] on the EU27 level.

According to the EU Renewable Energy Progress Report, the EU biofuels sector is estimated to have entailed 208,000 jobs in 2018, corresponding to being the third largest renewable energy job creator after wind energy and solid biomass.[94] According to a second source, 316,800 jobs are associated with the liquid biofuels and biogas sectors in 2018 (in the EU28); respectively accounting for 248,000 and 68,800 jobs.[95] The EU Petroleum Fitness Check (2015) estimates in turn that 119,000 direct jobs are associated with the EU refinery sector. The employment effect in terms of the administrative requirements is therefore assessed to be small, when compared to the total employment in the sector.

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89 The interviewed stakeholder expressed the wish to remain anonymous

90 Given that the value is expressed as a full-time equivalent, it is independent of time, representing the number of full-time staff per e.g. day, week, or year.

91 McKinsey Refinery Capacity Database (2020), https://www.mckinseyenergyinsights.com/resources/refinery-reference-desk/european-refineries/

92 According to Eurostat, there were 814 enterprises in the refined petroleum manufacturing sector in 2018 (NACE: 'Manufacture of refined petroleum products'). This code includes however according to the EU Petroleum Fitness Check (2015) several manufacturing enterprises that are unrelated to refineries, such as biofuel blenders and manufacturers of hard-coal fuel briquettes, lignite fuel briquettes, peat briquettes, petroleum briquettes and various speciality products such as lubricants, greases, Vaseline, and others.

93 Some of these costs are attributed to reporting and monitoring of public authorities under RED and cannot be disentangled from FQD.

94 COM (2020) 952 final, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf

95 Czako (2020), Employment in the energy sector, https://publications.jrc.ec.europa.eu/repository/handle/JRC120302

4.3.2 *Option 2: Discontinued GHG reduction obligation*

Environmental impacts

In case of FQD Art. 7A's discontinuation, RED II and its provisions (also considering its potential revision) will mainly determine the fuel mix in transport. In that case, the RES-T share in actual energy terms is considered as a generic proxy for the overall reduction of GHG emission in transport and, the relevant direct provisions determining the RES-T levels (through, for instance, setting mandates for specific fuel categories), or indirect ones (through the introduction of multipliers for fuel categories and/or transport modes, promoting thus the use of these fuels), will play the dominant role in the determination of the exact reduction of GHG emissions from transport. Therefore, a potential discontinuation of the Art 7A obligation is not expected to impose a significant change in GHG emissions or GHG intensity of fuels compared to the baseline.

The discontinuation of the obligation will also have limited effects on the actual use of feedstock. As presented in section 4.2.4, the use of biofuels is also governed by the RED II and other national and EU legislation. The discontinuation will therefore not substantially change the demand for different types of biofuels.

Economic impacts

A discontinued GHG reduction obligation does not change the administrative burden for Member States and fuel suppliers compared to the baseline. The reason being that Member State authorities and fuel suppliers still need to use resources on i) the reporting to the EU Commission and ii) the monitoring of life cycle GHG emissions as part of the RED.

A removal of the GHG obligation releases Member States from their duty of ensuring a reduction in the GHG intensity of transport fuels. Therefore, it can be expected that Member States will focus efforts on implementing the RED targets and withdrawing the compliance requirements introduced by Art.7A. Even if the GHG reduction obligation is withdrawn, the market fragmentation might persist. The drivers behind this fragmentation might be reduced, but will not disappear, due to the approach that will be followed in national RED II transpositions.

In terms of innovation, the specific life-cycle approach of the FQD and its relevant targets, are not generally linked with additional effort in innovation of low carbon fuels.

Social impacts

The impact on employment for administrative purposes will remain similar to the baseline, as both Member States and fuel suppliers will continue use resources for RED II obligations. As the feedstock supply will remain similar to the baseline, no change in the affordability of road mobility or displacement of agricultural and other products are expected.

4.3.3 *Option 3: Strengthened GHG reduction obligation*

Environmental impacts

The strengthened approach through the implementation of a mix of policies and 'flanking' measures to promote the deployment of low carbon fuels (see section 4.3.3 on measures proposed under Option 3) will have a positive impact on the deployment and market uptake of fuels with lower individual carbon intensity and therefore will also positively affect the reduction of the overall GHG emissions in transport and the reduction of the overall carbon intensity of fuels in transport compared to the baseline.

This Option will lead to a faster increase of demand for advanced biofuels with low GHG intensity, which results to an increased substitution of crop-based (1st generation) biofuels. This will in return lead to a decrease of land use by an additional 1.1 and 0.5 million ha by 2030 and 2050 respectively, as compared to the baseline. There is also a lower risk of displacement of agricultural and other products compared to the baseline as the strengthened obligation is achieved is achieved by an increased share of advanced biofuels and a further reduction of the crop-based biofuels.

Economic impacts

No changes to the administrative burden for Member States and fuel suppliers are expected compared to the baseline. The substantive costs for fuel suppliers are projected to slightly increase, but the increase is considered negligible, i.e. for gasoline it is 0.037 (10%) EUR/litre and for diesel it is 0.008 (2%) EUR/litre.

Under the strengthened obligation, a number of market policies could significantly facilitate the development, production and trade of low carbon fuels and national initiatives may have to follow a strict timeline of policies supporting the elimination of market fragmentation, strengthening of financing conditions, enhancing innovation and technology development activities. However, the main fragmentation driver of non-harmonized FQD and RED transpositions among Member States will not be affected and most probably similar or less significant fragmentation issues will be experienced, as far as implementation of FQD is concerned.

The implementation of a series of policies that will create an overall positive framework for the deployment of low carbon fuels can also positively contribute to the realization of increased innovation and production cost reductions. Fuel market opening policies, entrance of new low carbon fuels and stricter implementation of GHG emission savings provisions are expected, thus increasing the competition of fuel prices and the interest of fuel suppliers for safeguarding the necessary and cheaper volumes of low carbon fuels. In addition, more ambitious decarbonization policies promoting the use of RCF in the 2030 fuel mix will possibly drive to a tougher competition among renewable fuels and RCF.

Social impacts

Compared to the baseline, the strengthened obligation does not alter the overall demand for biofuels in 2030 but leads to a higher share of 2nd generation biofuels. This could further offset the loss of income in rural areas associated with the reduction in crop-based biofuel demand in the baseline. This option will therefore lead to additional income the agriculture and forestry sectors and thereby provide a contribution to further growth in rural areas and regions.

The impact on employment for administrative purposes will remain similar to the baseline, as both Member States and fuel suppliers will continue to monitor and report GHG emissions. However, a strengthened GHG obligation will further strengthen the demand for low carbon fuels, and consequently it is expected to contribute to more employment in the alternative fuels sector.

A strengthened GHG obligation leads to a stronger mainstreaming of advanced biofuels, so Option 3 will, as compared to the baseline, lead to stronger impacts for third countries. From an environmental perspective, less land use will be associated with biofuel crops. From an economic perspective, the higher demand for advanced biofuels will lead to stronger innovation and cost-savings leading to potentially stronger employment effects in the global biofuel sector.

4.3.4 *Sub-option 3A: Adding gaseous fuels to the scope of the fuel quality requirements under the FQD*

Specific actions to enhance the uptake of gaseous fuels would have a positive impact on the reduction of the overall GHG emissions in transport. Besides the consideration of fossil and biomass-based gaseous fuels, including novel ones such as clean gases[96], within the scope of FQD Art.7A, amendment on the 'technical' part of the FQD is also required to include these fuels. With the current EU policies on sector coupling and on hydrogen[97], it can be assumed that fuel suppliers of natural gas (which is the main gaseous fuel currently in use) will have to gradually move towards the enhancement of the gaseous fuels palette by adding low carbon gaseous fuels that might contribute to a reduction of GHG emissions.

Relevant gaseous fuels in the transport sector (incl. road transport, aviation and maritime) are expected to increase from 3 Mtoe in 2015 to 11 Mtoe in 2030 (almost a four-fold increase). Based on the MIX55 projections, this growth can be particularly attributed to a very high increase of natural gas and high increase of biomethane. The 2030 CTP also reports that gaseous fuels are expected to remain an important contributor to total energy needs.[98] The role of gaseous fuels will therefore further increase in the future, which makes a harmonious technical specification increasingly relevant. The experience of successful and considerable low carbon gaseous fuels implementation in Member States indicates that there is a need for a regulatory framework providing conditions of natural gas grid use and collective effort from farmers and other feedstock producers (Italy and the Biogas Done Right scheme constitutes a Best Practice example). In case

[96] Clean gases are gases produced through a power-to-gas process
[97] Powering a climate-neutral economy: An EU Strategy for Energy System Integration, COM(2020) 299 final, 8.7.2020; and A hydrogen strategy for a climate-neutral Europe, COM(2020) 301 final, 8.7.2020
[98] Section 9.4.2.4 of Annex 2 of the 2030 CTP.

the regulatory frameworks of Member States comply with each other, then market fragmentation could be alleviated for the case of gaseous fuels. However, this fact cannot change market fragmentation conditions in transport fuels in general.

Biomethane is the fuel that drives the development of gaseous biofuels volumes until 2030. Fuel suppliers who provide natural gas, will incur additional costs and be able to justify GHG reduction. The production of green hydrogen and the exploitation of feedstock convenient for biomethane production will relax the competition for eligible feedstock under RED II and probably relax the competition of suppliers to ensure compliance with GHG targets.

The addition of gaseous fuels to the scope of the fuel quality requirements would not entail significant changes to the administrative burden for Member States and fuel suppliers compared to the baseline. However, specific fuel suppliers who currently do not follow the existing EN standards would incur costs to follow the standard but information on the extent of this issue is not available.

4.3.5 *Sub-option 3B: Market-based instrument to trade GHG reduction obligations*

A market-based instrument will provide an incentive for individual fuel suppliers to operate in such a way to ensure as much credits as possible. Depending on the exact annual GHG reduction target, fuel suppliers will act in a way to better fulfil their obligation. Therefore, fuel suppliers will try to provide the market with fuels of lower GHG emissions per supplied MJ in order to achieve a reduced amount of total GHG and be compliant with the market-based instrument. The impact on the GHG emissions reductions will be positive assuming that the market-based instrument will have a strong monitoring and compliance mechanism actually obliging fuel suppliers to meet their GHG reduction targets on an annual basis, potentially offering, at the same time, some room for flexibility in order to allow obligated parties to mitigate part of their risks (e.g. capability for limited banking of credits).

The market-based instrument will have a positive impact on the feedstock demand, as the system rewards higher GHG savings of fuels. Therefore, also more GHG efficient biofuels will be consumed, requiring less land use and less of the associated displacement of agricultural and other products.

The market-based instrument will entail additional administrative costs compared to the baseline. For the public authorities, there will be start-up costs (e.g. technical preparation of the system) and recurrent costs such as annual running costs of the trading platform, administration of participants and enforcement costs. The total administrative costs at EU level are estimated to be around 4-16 million EUR per year (see Appendix K on detailed calculations). This would also have a positive impact on employment in public administration in the order of 3 – 15 FTEs.

For the fuel suppliers, the administrative costs include one-off costs (e.g. understanding the market-based instrument) and recurrent costs (e.g. observing the market price and trading credits). These additional costs are however not substantial compared to the baseline. The trading instrument will partially change the current obligation logistics and therefore generate minor additional administrative costs for fuel suppliers.

On the other hand, the market-based instrument will provide additional flexibility for fuel suppliers and therefore potentially reduces the substantive costs. If the price of credits is lower than the costs of reducing intensity for the supplied fuels, fuel suppliers can buy credits and save on the compliance costs. The findings from the literature and existing trading schemes indicate a reduction in the substantive costs. It is estimated that the savings can be in the order of 20%.

The market-based instrument is designed in such way that fuel suppliers are directly regulated with a harmonious penalty system. The market-based instrument will therefore contribute to reducing the market fragmentation, by establishing uniform market conditions for low carbon fuels.

The market-based instrument can provide additional revenue. This can be crucial for the financial situation of small innovative fuel suppliers who provide low and zero carbon fuels. Although the market-based instrument is not directly related to innovation activity development, it is reasonable to assume that implementation of this sub-option will help in the development of a friendlier investment environment that can potentially enhance innovation activity and the effort to reduce the production cost of low- and zero carbon fuels.[99]

4.3.6 *Sub-option 3C: Regulating directly fuel suppliers with an EU Regulation*

A direct regulation on fuel suppliers will clearly (a) impose a clear GHG intensity reduction obligation and (b) define enforcement and compliance. This will create the conditions for facilitating the development of a seamless market, removing the currently observed fragmentation (see also the findings of the evaluation of FQD Art7A in section 3 and Appendix I). Clarity in targets and the way to achieve them will promote the uptake of fuels that will contribute to the reduction of the GHG emission from transport and the reduction in GHG intensity of carbon fuels.

In terms of the impact on feedstock distribution, this option is similar to the strengthened obligation, as advanced biofuels will represent a higher share in the feedstock distribution of bioethanol and biodiesel, leading to less land use. Compared to the baseline, the impact will therefore be positive.

This sub-option does not alter the administrative processes for Member States authorities as the monitoring and reporting framework towards the Commission does not change. The impact is therefore assessed to be neutral in comparison to the baseline. Similarly, the option does not alter the administrative processes for fuel suppliers as the monitoring and reporting framework does not change. Fuel suppliers will furthermore still have to report to the relevant authorities in their respective Member State.

This sub-option strengthens the GHG intensity reduction and enforces uniform implementation across the EU territory. It thus removes the main identified cause for fuel market fragmentation. Member States with national initiatives will therefore also need to align their transposition policies accordingly, and in some cases, motivations for higher ambition targets at national level to co-exist with EU targets might be launched. This evolution might be combined with exploitation of additional production capacity in EU regions with low cost of low carbon fuels and with smoothening the differences of low carbon fuel prices in the EU. The impact is judged positive compared to the baseline since it relaxes the main reason of market fragmentation.

An EU regulation will increase the level-playing field in Europe because the compliance requirements as well as the level of enforcement is unified on the EU market. This situation might increase competitiveness among suppliers, because opportunities of all suppliers to operate in a larger market will optimize their operational costs. However, competition at feedstock supply level is not expected to change.

[99] The Californian Low Carbon Fuel Standard (LCFS) is for example reported to help boost the market penetration of EVs: the market-based instrument has generated EUR 83 million of additional funding to the electrification of transport in 2016.

5 CONCLUSIONS

The study is structured in two main parts. The first one (Part A) is dedicated to the evaluation of FQD Art7A's effectiveness, efficiency, relevance, coherence, and EU-added value since its inception. The second part (Part B) presents the calculations of the GHG emission intensity of fuels under various fuel mix scenarios and assesses the policy options identified by the Commission to steer the progressive reduction of transport fuels' GHG intensity reduction towards 2030 and 2050.

The main conclusions formulated in the two parts of the study are presented below.

Relevance of FQD Art.7A and of its objectives

- FQD Art.7A and its quantitative goals in terms of reduction of Greenhouse Gas (GHG) emissions intensity of transport fuels are overall **providing a relevant contribution** to EU climate policy and ambitions.
- **Increased competitiveness of fuels with lower GHG emissions intensity** and **fuel technology progress are perceived by stakeholders as the most likely impacts** of FQD Art.7A. However, FQD Art.7A is perceived as **less relevant for improving air quality, human health, vehicle engine efficiency** than other provisions in the FQD.
- Because Art.7A does not provide for a full harmonisation of national fuel markets, consulted stakeholders assert that **it does not enhance the functioning of the European single market for transport fuels and vehicles**.
- Furthermore, the study confirms the **relevance of the quantitative targets** set in FQD Art.7A in terms of reduction of the life cycle GHG emission intensity of transport fuels.
- Last, but not least, the study finds that **stakeholders appreciate particularly the current technology-neutral approach** as it leaves fuel suppliers and producers free of choosing the most appropriate methods to attain the targets.

Effectiveness of FQD Art.7A

- The study **confirms the effectiveness** of FQD Art.7A in creating the conditions for the development of markets for biofuels and other fuels with lower GHG intensity.
- However, in the views of the consulted stakeholders, FQD Art.7A has **not yet contributed to its expected societal and environmental impacts** and **did not give a renewed impetus to technological developments for more efficient engines**.
- **Hampering factors for the attainment of the targets** set in FQD Art.7A include the inconsistency of the regulatory framework (due mostly to inconsistencies with RED) and the low foreseen returns on the investments made by fuel suppliers / producers for curbing GHG intensity. Furthermore, the lack of national, supporting schemes is perceived by stakeholders as another barrier to investments. Other difficulties include the insufficient availability of sustainable feedstocks, and the lack of harmonisation of national transpositions and of blending mandates in the Member States that have opted to introduce them in national legislation. This last aspect lowers both supply of, and demand for, fuels with lower GHG intensity and therefore slows down their uptake and ultimately the attainment of FQD Art.7A's targets.

Efficiency of FQD Art.7A

- The study provides strong evidence that Member States, fuel suppliers and producers cannot disentangle the administrative costs induced by both the FQD and the RED, demonstrating again how intertwined both directives are.
- The measures' costs, amounting to 1-2 FTE (full-time employee), are considered reasonable by stakeholders but highly dependent on the way both directives are transposed in each Member State.
- Also, for both consulted fuel suppliers / producers and national competent authorities, the method to calculate GHG emission intensity of supplied transport fuels is rather easy, even though it could be enhanced by making it provide better guidance as to how UERs should be accounted for.
- The study did not find evidence of major issues regarding the efficiency of the monitoring and reporting systems in place.

- The harmonisation of the penalties structure and of its rationale, as well as a possible policy guidance with long-term objectives would be two components of relevance for both the efficiency and effectiveness of FQD Art.7A as reported in interviews with industry and associations and revealed by the analytical work on the substantive costs and penalties.

Coherence of FQD Art.7A

- The **evidence provided by the study is not conclusive regarding the coherence of the reporting** with national initiatives, with international obligations of the EU, and with other EU initiatives (e.g. inconsistencies and overlap between FQD-REDII).
- On this last aspect, stakeholder consultations confirm **strong concerns among all categories of stakeholders about perceived inconsistencies and possible contradiction between FQD and RED**. Many stakeholders called for a single directive to avoid the current perceived discrepancies and uncertainties slowing down progress towards the attainment of both the targets of FQD Art.7A and of the RED.

EU-added value of FQD Art.7A

- The study confirms the added value of FQD Art.7A in decreasing GHG emission intensity from transport. It remains nonetheless difficult to make assumptions as to whether national initiatives alone would have achieved similar or higher GHG intensity reductions of transport fuels.
- The evidence collected regarding the added value of FQD Art.7A in reducing market fragmentation is also inconclusive. Notably, although fuel suppliers / producers generally declare to appreciate the technology-neutral approach of FQD Art.7A, they criticise the different approaches taken towards national transpositions. The lack of harmonisation across the Member States is perceived to prevent FQD Art.7A to fully ensure the functioning of the single EU market for transport fuels and vehicles.

Policy options for the review of FQD Art.7A

- The GHG reduction obligation in Option 1 enables fuel suppliers to be flexible and competitive to meet the low carbon needs of the fuel markets globally. The emphasis on life cycle GHG savings will encourage market penetration of RFNBOs and RCFs. Simultaneously however, a significant **cost gap for advanced biofuels** is still to be expected. A strengthened obligation (Option 3) would positively contribute to **increased innovation and production cost reductions**.
- Despite an overall increase in the consumption of biofuels by 2030, the transition away from crop-based to residual-/waste-based fuels will lead to **significant reductions in land use for biofuels**. Under the baseline (Option 1), the associated land use by 2030 and 2050 will be reduced by respectively 3.9 and 7.2 million ha. A strengthened GHG obligation (Option 3) will in turn lead to a decrease of land use by an additional 1.1 and 0.5 million ha by 2030 and 2050 respectively.
- The **administrative costs of the GHG reduction obligation will be limited** for both public administrations and fuel suppliers under Options 1 and 3. A discontinuation of the GHG reduction obligation (Option 2) would not eliminate these administrative costs, as neither public administrations nor fuel suppliers are able to disentangle the administrative costs for Art.7A and RED.
- **Differences in the transposition of Art.7A and RED** among Member States are a driver behind the observed low carbon fuel market fragmentation. Asymmetric types and levels of sanctions for Art.7A are identified as the main driver, whereas differences in advanced biofuel policies under RED were not identified as a driver.
- Under the baseline (Option 1), the above fragmentation will continue and possibly further increase due to foreseen national initiatives in major biofuel markets that are more ambitious than the baseline. A **direct regulation of fuel suppliers through an EU Regulation**, such as under Sub-options 3B and 3C, can mitigate the low carbon fuel market fragmentation and enable a seamless low carbon fuel market.
- The **consumption of gaseous fuels in the transport sector in the baseline is predicted to increase substantially**. However, large-scale demand is first expected after 2030. Especially for hydrogen, there will only be notable demand from 2040 onwards. **Adding gaseous fuels to the scope of the FQD** (Sub-option 3A) will remove uptake barriers and enabling a well-functioning single market of gaseous fuels.
- Under the option of a market-based instrument (Sub-option 3B) a small part of the obligation is achieved through credits generated from the provision of electrical energy or from biofuels with low GHG intensity, further driving the transition away from crop-based biofuels. **If the market-based instrument leads to a stronger substitution with**

electrical energy and lower cost low carbon fuels, it is assessed that a positive economic and environmental impact should be expected.

- The market-based instrument (Sub-option 3B) is associated with **additional administrative costs for public administrations** in the order of 4-16 million EUR. **For fuel suppliers however, the additional administrative costs are assessed to be marginal**. In terms of the substantive costs, the market-based instrument can reduce compliance costs for fuel suppliers and provide additional revenue streams for suppliers of (innovative) zero- and low carbon fuels.
- In relation to the options for the GHG reduction obligation, a market-based instrument is therefore only considered relevant for a strengthened obligation. As a market-based instrument requires a symmetric implementation across the EU and a centrally organised operation, **annual targets and penalty levels need to be uniform to ensure a level-playing field for the purchase and sale of reduction achievements**.

APPENDICES

Appendix A Literature consulted

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Appendix B Evaluation Matrix (from approved inception report)

Table 15 Evaluation matrix: Relevance

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
EQ1: To what extent did the target in Article 7a of the FQD still correspond to the ambitions and obligations of the European Union in terms of reduction of GHG emissions?				
› **Are the targets in terms of reduction of the life cycle GHG emission intensity in Art7a of the FQD aligned with the EU policy priorities and objectives?** › **Did the selection of the targets and the encouraged ways to achieve them take into account the challenge of improving human health?**	› The achievement of the goals relative to the life cycle GHG emission intensity will enable the reduction of GHG emissions from transport by 90% and for carbon neutrality by 2050 › The approach to curb the GHG emission intensity of transport fuels is appropriate to increase air quality and ultimately improve human health	› Degree of alignment between the targets in Article 7a of the FQD and the objectives in terms of reduction of GHG emissions from transport and the climate targets › Share of stakeholders who consider that the targets are sufficient to contribute to air quality and human health › Estimates of the contribution of the life cycle GHG emission intensity of transport fuels to human health ›	› Desk research: Mapping of the climate targets; academic and grey literature on the contribution of reduction in GHG of transport fuel/energy to climate targets; link between human health and fuel quality › Interviews with EC officials and CSOs › Workshop › Survey with CSOs	› Desk research: › Policy documents › Academic and grey literature
EQ2: How relevant is the monitoring of supplied fuel and energy to Member States?				
› **What do Member States need to identify the most effective policy intervention(s) to accelerate suppliers' efforts of fuels / energy suppliers to reduce the life cycle GHG emission intensity of transport fuels?** › **Is policymaking at the national level hampered by lack of information relative to the life cycle GHG emission intensity of transport fuels?**	› The monitoring data provide an evidence base for the adoption or adjustments of national initiatives to reduce the life cycle GHG emission intensity of transport fuels	› Share of Member States that have used the monitoring data to decide on initiatives (and their revisions) to reduce the life cycle GHG emission intensity of transport fuels	› Interviews with MS representatives on the use of monitoring data for policymaking	
EQ3: How relevant are the targets in terms of reduction of the life cycle GHG emission intensity of transport fuels?				
› **Can targets defined at the EU level orient effectively the efforts of the energy / fuel suppliers towards the reduction of the life cycle GHG**	› The quantitative goals relative to the life cycle GHG emission intensity foster and steer suppliers' efforts to reduce life cycle GHG emission	› Share of suppliers that consider that the goals were realistic and ambitious enough to steer their efforts	› Survey with fuel / energy suppliers › Interviews with fuel / energy suppliers	

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
emission intensity of transport fuels? › **Are the needs of fuel / energy suppliers different from a country to another and do they require tailored national policy responses?** › **To what extent does the calculation of the life cycle GHG emission intensity of transport fuel at the national level encourage fuel suppliers to contribute to the attainment of the goals set in Article 7a of the FQD?**	intensity of transport fuels › The incentives to reduce the life cycle GHG emission intensity of transport fuels are more effective when decided and implemented at the national level › The accountability of Member States in respect to the reduction of life cycle GHG emission intensity of transport fuels encourages the implementation of the appropriate policy initiatives and does not affect the commitment of fuel suppliers to the goals set in Article 7a.	› Share of suppliers that consider that the Member States are the best placed to decide on and implement the incentives to achieve the targets › Share of suppliers that consider that they should be given the choice of the most effective method to achieve the targets › Share of Member States that effectively encourage the implementation of Article 7a of the FQD by fuel suppliers		

Table 16 Evaluation matrix: Effectiveness

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
EQ4: Does Article 7a of the FQD contribute to reducing the life cycle GHG emission intensity of transport fuels until end of 2020?				
› **To what extent has Article 7a of the FQD contributed to reducing the life cycle GHG emission intensity of supplied fuel and energy?** › **Does the observed reduction of the life cycle GHG emission intensity of transport fuels meet the targets in Article 7a of the FQD?** ›	› The life cycle GHG emission intensity decreased in all EU Member States compared to the fuel baseline standard: › By 2% by 31st December 2014 › By 4% by 31st December 2017 › Estimates that the life cycle GHG emission intensity will decrease by 6% in comparison with the fuel baseline standard by 31st December 2020 › The life cycle GHG emission intensity will decrease by 2% in comparison with the fuel baseline	› Data on life cycle GHG emission intensity ›	› Meta-analysis of MS monitoring reports › Statistical analysis based on data on GHG emissions ›	› Desk research: › MS monitoring report ›

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	standard by 31st December 2020 thanks to: › Uptake of technologies for electric vehicles › Uptake of technologies for environmentally safe › The life cycle GHG emission intensity will decrease by 2% in comparison with the fuel baseline standard by 31st December 2020 through the use of credits purchased via the Clean Development Mechanism			
EQ5: What are the technological, environmental and economic impacts of the implementation of Article 7a of the FQD?				
› **Has Article 7a of the FQD brought any positive changes in terms of engine design, fuel quality and use of alternative fuels?** › **Has Article 7a of the FQD brought any positive changes in terms of air quality and related diseases?** › **Has Article 7a of the FQD brought any positive changes to the competitiveness and market position of EU fuel suppliers?** › **To which extent does Article 7a of the FQD contribute to the better functioning of the single market for transport fuels and vehicles?** › **What are the unintended/ unexpected effects of Article 7a of the FQD?** › **What are the negative impacts of**	› Increase in investments for more efficient engines › Increase in investments in means of production of fuels to reduce their GHG emissions › Accelerated diffusion of more efficient engines › Accelerate diffusion of less emitting fuel production techniques › Higher availability of fuel feedstock and blendstock › Accelerated uptake of sustainable biofuels › Increase in the quality of air quality › Reduction in the number of diseases and deaths attributed to low / bad air quality › Increase in the ratio exports / imports of fuel in EU (coupled with an increase of exportation)	› Amounts and trends of investments in technologies for the production of fuel, and engine technologies › Market penetration of new technologies for the production of fuel, and engines › Share of biofuels compliant with the sustainable criteria › Indicators on air quality › Indicators of / estimates on disease and death related to air quality › Data on fuel trade intra and extra EU › Data on fuel feedstock and blendstock › Trends in ILUC-induced GHG emissions › Effects observed by MS public authorities, suppliers and civil	› Meta-analysis of MS monitoring reports › Desk research – recent trends in investments in, and market penetration, of new technologies; recent trends in air quality and its health impacts, and on the correlation between air quality, human health and GHG emission intensity › Statistical analysis based on data on fuels (collected as part of the compulsory reporting under Article 7a); investments and diffusion; air quality; human health; energy/fuel trade › Survey – with suppliers on their investment and acquisition of new technologies › Interviews – view on civil society organisations on	› Desk research: › MS monitoring reports › Academic and grey literature › Database on: › New technologies › Greenhouse gas emissions

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
Article 7a of the FQD?	› Increase in the intra-EU trade of fuel › Absence of fraudulent claims regarding the origin of feedstock › No increase of ILUC-induced GHG emission caused by Article 7a › No diversion of feedstock with particularly low emissions footprint from other market to achieve the Article 7a target in a country › Article 7a of the FQD has produced unintended and/negative effects ›	society organisations › Evidence of fraudulent claims by fuel suppliers or Member States	the changes that article 7a brought to air quality and human health; view of fuel / energy suppliers on the effects that Art7a of the FQD brought to intra and extra EU trade of fuel and energy; views of suppliers, MS authorities and civil society organisations on unexpected impacts; views of EEA and MS authorities on the quality of the data reported by fuel suppliers and Member States › Workshops – views of suppliers, MS public authorities and civil society organisations on unexpected impacts ›	
EQ6: What factors contribute to or hinder the monitoring and reporting of the life cycle GHG emission intensity of transport fuels?				
› **Are there any uncertainties impeding the consistent calculation and monitoring of the life cycle GHG emission intensity of transport fuels?** › **Are there any mechanisms for enforcing the obligation to report and monitory the life cycle GHG emission intensity of transport fuels?**	› No or low uncertainties regarding the methodologies elaborated by the European Commission to calculate the life cycle GHG emission intensity › All Member States apply the same methodologies (elaborated by the European Commission) – and interpret them in the same ways – to calculate the life cycle GHG emission intensity of transport fuels › The Member States have implemented means to enforce the obligation to	› Degree of perceived clarity of the methodologies for the calculation of the life cycle GHG emission intensity › National and European case laws relative to the interpretation of methods of calculation of the life cycle GHG emission intensity › Information on the national mechanisms for the enforcement of the obligations relative to monitoring and reporting › Views of MS public authorities, and suppliers on the mechanisms for the	› Interviews with MS public authorities and suppliers in charge of monitoring the life cycle GHG emission intensity › Surveys with MS public authorities and suppliers in charge of monitoring the life cycle GHG emissions › Desk research	› Desk research › MS monitoring reports › Reports on the transposition of the FQD by Member States

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	monitor and report the life cycle GHG emission intensity of transport fuels	enforcement of the obligations relative to monitoring and reporting		
› **EQ7: What factors contribute to or hinder the reduction of the life cycle GHG emission intensity of transport fuels?**				
› **Has Art 7a of the FQD encouraged the Member States to implement measures to foster efforts to reduce the life cycle GHG emission intensity of transport fuels?** › **Are there any EU-level enforcement mechanisms to ensure that the Member States comply with their obligation to reduce the life cycle GHG emission intensity and achieve the targets?** › **Do suppliers demonstrate commitment to curbing the life cycle GHG emission intensity of transport fuels?** › **To what extent did the increased supply of alternative fuels including sustainable biofuels contribute to reducing the life cycle GHG emission intensity of supplied fuel and energy?** › **To which extent do the development and uptake of new technologies in fuel production processes contribute to the achievement the targets in Article 7a of the FQD?** › **To what extent the use of credits purchased via the Clean Development Mechanism did**	› The Member States have implemented incentives to encourage the suppliers to reduce the life cycle GHG emission intensity that they must report and monitor › The European Commission or the EEA have (legal) means to enforce the obligations to achieve the target of reduction of the life cycle GHG emission intensity and to take actions against Member States that do not comply with these obligations › The suppliers have invested in the reduction of the life cycle GHG emission intensity of the fuel and energy that they supply	› Information on the mechanisms for the enforcement of the obligation to reduce the life cycle GHG emission intensity › Views of MS public authorities, suppliers and civil society organisations on the mechanisms for the enforcement of the obligation to reduce the life cycle GHG emission intensity › Information on the EU-level enforcement mechanisms › Occurrences of actions against Member States that did not comply with their obligations › Investments in reduction of the life cycle GHG emission intensity of transport fuels › Data or estimates on the contribution of alternative fuels and biofuels to the reduction of the life cycle GHG emission intensity › Data on uptake of new electric vehicles and their share in overall transportation fleet › Estimates of life cycle GHG emission intensity reduction due to new electric vehicles technologies and their uptake › Data on uptake of new CCS	› Desk research - contribution of technological advancement to GHG emissions; contribution of CDM credits to GHG emissions › Interviews with MS public authorities on their mechanisms to enforce the obligation of reducing the life cycle of GHG emission intensity of transport fuels; with civil society organisations on the mechanisms for the enforcement of the obligation to reduce the life cycle GHG emission intensity; with European Commission and EEA officials; with suppliers on their investments in the reduction of the life cycle GHG emission intensity of transport fuels › Survey with MS public authorities on their mechanisms to enforce the obligation of reducing the life cycle GHG emission intensity; with suppliers on their views on the mechanisms of enforcement of the obligation to reduce the life cycle GHG emission intensity and on their investments in the reduction of the life cycle GHG emission intensity	› Desk research › MS monitoring reports › Reports on the transposition of the FQD by Member States › Database: › Investments of fuel suppliers › New technologies › Greenhouse gas emissions

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
contribute to reducing the life cycle GHG emission intensity of supplied fuel and energy?		technologies by power plants › Estimates of life cycle GHG emission intensity reduction due to new CCS technologies and their uptake › Purchase of credits via the Clean Development Mechanism › Estimates of life cycle GHG emission intensity reduction due to the purchase of CDM carbon credits	› Workshop – with suppliers, MS public authorities and civil society organisations on the mechanisms of enforcement of the obligation to reduce the life cycle GHG emission intensity › Statistical analysis – data on investments in GHG-reducing technologies	

Table 17 Evaluation matrix: Efficiency

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
EQ8: Are the reporting and monitoring of the life cycle GHG emission intensity of transport fuels cost-effective?				
› **What were the costs induced by the obligation of monitoring of the life cycle GHG emission intensity?** › **How did these costs compare to the observed benefits?** › **Did the suppliers and MS public authorities have enough resources to comply with their obligation to monitor the life cycle GHG emission intensity of transport fuels?** › **Does the compulsory monitoring of the life cycle GHG emission intensity create higher and critical administrative burdens for some categories of suppliers?**	› The benefits from the reporting and monitoring of the life cycle GHG emission intensity outweigh the costs that they induce › The costs induced by the monitoring and reporting of the life cycle GHG emission intensity of transport fuels are seen as reasonable (views of suppliers) › The costs induced by the quality control and reporting of the life cycle GHG emission intensity of transport fuels are seen as reasonable (views of MS public authorities) › The public resources allocated to the suppliers responsible for monitoring and reporting the life cycle GHG emission intensity of transport fuels are	› Estimates of resource inputs (e.g. in terms of FTE) for the calculation of the life cycle GHG emission intensity - breakdown per type of suppliers › Estimates of resource inputs (e.g. in terms of FTE) for the reporting and monitoring of the life cycle GHG emission intensity - breakdown per type of suppliers › Volume of public resources allocated to the suppliers responsible for the monitoring and reporting › Estimates of resource inputs (e.g. in terms of FTE) for the quality control of the reporting and monitoring of the	› Survey – with suppliers on the benefits and costs induced by the obligation of monitoring the life cycle GHG emission intensity and on whether the costs are justified/reasonable › Interviews – with suppliers on whether the costs are justified / reasonable; with MS public authorities and suppliers on the resources to monitor the life cycle GHG emission intensity › Cost-benefit analysis – based on the data collected on costs and benefits (collected through desk research and survey)	

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	seen as sufficient (views of MS public authorities) › The supplier(s) responsible for reporting and monitoring the life cycle GHG emission intensity of transport fuels have resources to conduct their mission › No obstacle to the monitoring and reporting is due to suppliers' lack of resources and capabilities › Smaller suppliers as well as independent and utility providers does not experience major difficulties in monitoring the life cycle GHG emission intensity of transport fuels in comparison with larger suppliers	life cycle GHG emission intensity › Views of suppliers as to whether the costs induced by the monitoring and reporting are reasonable and justified › Public resources allocated to the suppliers responsible for the monitoring and reporting		
EQ9: Is the obligation to reduce life cycle GHG emission intensity of transport fuels cost effective?				
› **What are the costs induced by the efforts to curb the GHG emission intensity of transport fuels?** › **What are the benefits of the reduction of the GHG emission intensity of transport fuels?** For whom are those benefits? › **How did these costs compare to the observed benefits?**	› For both the suppliers and MS public authorities, the benefits from the efforts to reduce the life cycle GHG emission intensity of transport fuels outweigh the costs that they induce and are seen as reasonable	› Volume of investments in technologies for the production of fuel, and engine technologies › Volume of public support to suppliers' efforts to reduce the life cycle GHG emission intensity of transport fuels › Estimates of suppliers' resources inputs to obtain public support › Benefits for the suppliers from the efforts to reduce life cycle GHG emission › Estimates of the variations in the price of fuel caused by suppliers' efforts to reduce GHG emissions	› Desk research – environmental and societal benefits of reductions in GHG emissions › Survey with MS public authorities on their mechanisms to enforce the obligation of reducing GHG emissions, with suppliers on their investments in the reduction of GHG emissions, the administration costs to obtain dedicated public support, and variations in the final price of fuel/energy › Interview with MS public authorities on their mechanisms to enforce the obligation of reducing GHG	› Desk research: › Academic and grey literature

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
		› Societal benefits from the efforts to reduce life cycle GHG emissions › Views of suppliers and MS public authorities as to whether the costs induced by the obligations to reduce GHG emissions are reasonable and justified	emissions, with suppliers on their investments in the reduction of GHG emissions, the administration costs to obtain dedicated public support, and variations in the final price of fuel/energy › Cost-benefit analysis – based on the data collected on costs and benefits (collected through desk research and survey)	
EQ10: Which factors influence the efficiency of the observed results?				
› **Does the method of calculation create any uncertainties leading to extra costs for suppliers?** › **Do fuel suppliers monitor the life cycle GHG emission intensity of transport fuels for other purposes than those pursued by Art7a of the FQD?**	› There is no uncertainty or existing uncertainties do not induce extra costs for suppliers and MS public authorities in charge of monitoring and reporting the life GHG emission intensity of transport fuels › The suppliers responsible for monitoring and reporting the life cycle GHG emission intensity of transport fuels have already in place mechanisms for calculating and monitoring life cycle GHG emission intensity ›	› Degree of perceived clarity of the methodologies for the calculation of the life cycle GHG emission intensity of transport fuels › Evidence that suppliers have to monitor the life cycle GHG emission intensity of transport fuels for other purposes	› Interviews with MS public authorities and suppliers in charge of monitoring the life cycle GHG emission intensity of transport fuels › Surveys with MS public authorities and suppliers in charge of monitoring the life cycle GHG emission intensity of transport fuels	
› **EQ11: How can the efficiency of Article 7a of the FQD be improved?**				
› **Is there any good practices that could be replicated in other contexts to improve the cost-effectiveness of Art 7a of the FQD?**	› Evidence that changes in the methodologies to calculate the life cycle GHG emission intensity of transport fuels will	› Estimates of resource inputs (e.g. in terms of FTE) that another methodology for calculation could save	› Interview – views on all stakeholders on means to improve the efficiency of Article 7a	

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	save costs induced by the implementation of Article 7a of the FQD › Evidence that other changes in the implementation of Article 7a of the FQD will reduce the costs that it induces	› Stakeholder view on aspects of Article 7a that could be made more efficient	› Workshop – views on all stakeholders on means to improve the efficiency of Article 7a	

Table 18 Evaluation matrix: Coherence

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
EQ12: To what extent is Article 7a of the FQD coherent with other provisions in the FQD?				
› **Is there any contradictions between Article 7a of the FQD and provisions on sustainable biofuels (articles 7b - 7e)?** › **Is there any contradictions between Article 7a of the FQD and provisions on reporting (Article 9)?** › **Is there any contradictions between Article 7a and the documents supposed to facilitate its implementation?**	› No evidence of conflict between Article 7a and the provisions on biofuel sustainability (articles 7b – 7e) › No evidence of conflicts between Article 7a and the provisions on reporting (Article 9) › No evidence of conflicts between the documents produced by the European Commission to provide guidelines for the implementation of Article 7a of the FQD (including the methodologies for the calculation of the life cycle GHG emissions and their baseline)	› Share of suppliers that experience difficulties with complying concurrently with Article 7a and other provisions of the FQD	› Desk research – internal coherence of the FQD › Interview – with MS public authorities and suppliers on the concurrent implementation of several provisions of the FQD › Survey - with MS public authorities and suppliers on the concurrent implementation of several provisions of the FQD	› Desk research: › Academic and grey literature
EQ13: To what extent is Article 7a of the FQD coherent with other EU initiatives?				
› **Is the article 7a of the FQD coherent with other EU initiatives?**	› The objectives and implementation mechanisms of Article 7a of the FQD are aligned with those of: › the Renewable Energy Directive II › the European Green Deal, including its roadmap for achieving climate neutrality by 2050 and the objectives in terms of market	› Case law on conflicts between Article 7a and other EU initiatives › Extent of alignment in terms of objectives between Article 7a of the FQD and the other EU policy initiatives › Extent of alignment in terms of scope between Article 7a of the FQD and the other EU policy initiatives	› Desk research – coherence of Article 7a with other EU policy initiatives, case law › Interview – with suppliers, MS public authorities and civil society organisations on the coherence of Article 7a with other EU policy initiatives › Survey – with suppliers, MS authorities and civil society	› Desk research: › Academic and grey literature

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	penetration of decarbonised transport fuels › European Commission's 2020 Work Programme › Regulation on the governance of the energy union and climate action (EU)2018/199913 › A European Strategy for Low-Emission Mobility (COM(2016) 501 final) › Commission delegated regulation 2016/2071 as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information › Integrating maritime transport emissions in the EU's greenhouse gas reduction policies COM(2013) 479 final & Regulation 2015/757 in the monitoring reporting and verification of carbon dioxide from maritime transport › Regulation 2019/631 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles	› Extent of alignment in terms of methodologies for calculation of life cycle GHG emissions between Article 7a of the FQD and the other EU policy initiatives › Example of synergy effects	organisations on the coherence of Article 7a with other EU policy initiatives	

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	› Regulation 2019/1242 setting CO2 emission performance standards for new heavy-duty vehicles			
EQ14: How coherent is Article 7a of the FQD coherent with national initiatives?				
› **Is there any conflicts between Article 7a of the FQD and national initiatives?** › **How is Article 7a of the FQD positioned in national fuel / climate policy mixes?**	› No evidence of conflicts between Article 7a of the FQD and any national initiatives relative to reductions and monitoring of GHG emissions of transport fuel › Lack of national initiatives pursuing the same objectives and/or relative to the calculation of life cycle GHG emissions of transport fuels	› Case law on conflicts between Article 7a and national initiatives › Example of alignment between Article 7a of the FQD and national initiatives › Share of suppliers that have experienced difficulties with complying concurrently with Article 7a of the FQD and national initiatives › Share of suppliers, MS public authorities and civil society organisations that consider that Article 7a of the FQG meets specific needs that national initiatives do not currently meet	› Desk research - the coherence of Article 7a with national initiatives, case law › Interviews – with suppliers, MS public authorities and civil society organisations on the coherence of Article 7a with national initiatives › Survey – with suppliers, MS public authorities and civil society organisations on the coherence of Article 7a with national initiatives	› Desk research: › Academic and grey literature
› **EQ15: How coherent is Article 7a of the FQD with the relevant international obligations of the European Union?**				
› **Is there any conflicts between Article 7a of the FQD and international initiatives?** › **To what extent the achievement of the targets in Article 7a of the FQD will help the European Union respect its international commitments relative to reduction of GHG emissions?**	› The objectives and implementation mechanisms of Article 7a of the FQD are aligned with those of: › 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 2, Chapter 3: Mobile combustion) › Strategy of the International Maritime Organisation on	› Extent of alignment in terms of objectives between Article 7a of the FQD and the international initiatives › Extent of alignment in terms of scope between Article 7a of the FQD and international initiatives › Extent of alignment in terms of methodologies for calculation of life cycle GHG emissions between	› Desk research – coherence of Article 7a with international initiatives › Interview – with suppliers, MS public authorities and civil society organisations on the coherence of Article 7a with international initiatives › Survey – with suppliers, MS authorities and civil society organisations on	› Desk research: › Academic and grey literature

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
	reduction of GHG emissions from ships (2018) including its related roadmap and follow-up actions towards 2023 › Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)	Article 7a of the FQD and international initiatives › Example of synergy effects	the coherence of Article 7a with international initiatives	

Table 19 Evaluation matrix: EU added value

Sub-questions	Judgement criteria	Indicators	Tools and methodology	Data sources
EQ16: Does the definition of goals at the EU level allow for the achievement of the overarching objectives relative GHG emission?				
› **Does Article 7a of the FQD contribute to enhancing the single market for transport fuels and vehicles?** › **Is an EU-level approach to the reduction of the life cycle GHG emission intensity of transport fuels more effective than national initiatives?**	› Harmonisation across the European Union contributes to building a Single Market for the benefit of all stakeholders and especially EU suppliers and producers of fuel › A Single Market and the attainment of the objectives relative to the reduction of life cycle GHG emissions would not be possible or possible at a higher cost without an EU intervention	› Data on fuel trade intra and extra EU › Share of Member States that have a clear strategy for reducing GHG emission from transport (including those with more ambitious goals) › Share of suppliers and civil society organisations that consider that the Article 7a of the FQG meets specific needs which national initiatives do not currently meet	› Survey with suppliers and civil society organisations on the relevance of an EU-level approach in comparison with a national approach › Interviews with suppliers and civil society organisations on the relevance of an EU-level approach in comparison with a national approach › Desk research – documents on national policy initiatives to reduce GHG emissions › Workshop – with suppliers and civil society organisations on what would be the impact of the replacement	› Desk research: › Policy documents

Appendix C List of stakeholders consulted

Table 20 List of participants registered to the First Workshop (03.09.2020)

Organisation	Country
ABA - Advanced Bioenergy Association	Portugal
Abengoa	Spain
ACEA	Belgium
Advisor Dutch Emissions Authority	Netherlands
APETRO	Portugal
ArcelorMittal	Belgium
Argent Energy	United Kingdom
Belgische Petroleum Federatie	Belgium
BioMCN	Netherlands
Boeing	Spain
BTG Bioliquids	Netherlands
BTG Biomass Technology Group BV	Netherlands
BUNGE	Belgium
Campa Iberia S.A.U.	Spain
CAPREA Sustainable Solutions	Belgium
CEPSA	Spain
Cerulogy	United Kingdom
Clariant	Germany
CRI	Iceland
Danish Energy Agency	Denmark
Direction Générale de l'Energie et du Climat	France
Dutch Emissions Authority (NEa)	Netherlands
EBB - European Biodiesel Board	Belgium
EBV	Germany
EC, DG ENER	EC
Elengy	France
ENGIE	France
Eni Trading and Shipping	Italy
Enviral	Slovakia
Environment Agency Austria	Austria
ePURE	Belgium
Esso Nederland bv	Belgium
EUROMOT	Belgium
EWABA	Belgium
Exergia	Greece
Expur SA	Romania
FuelsEurope	Belgium
German Bioethanol Industry Association	Germany
Ghent University	Belgium

Organisation	Country
Green Biofuels Ireland Ltd	Ireland
Groupe Avril	France
HMRC	United Kingdom
ICCT	Germany
IM Biofuel Italy Srl	Italy
INA-Oil Industry, Plc.	Croatia
Independent	Sweden
Institute of Combustion Technology	Germany
IOGP	Belgium
IPIA	Ireland
IRU	Switzerland
ITM	Hungary
Lantmännen	Sweden
Lantmännen Agroetanol	Sweden
Lantmännen Aspen AB	Sweden
Liquid Gas Europe	Belgium
Malta Resources Authority	Malta
MHPS Europe	Germany
MHPS Europe - EU Liaison Office	Belgium
Mineraloelwirtschaftsverband	Germany
Ministry for Health	Belgium
Ministry for the Ecological Transition	France
Ministry for the Ecological Transition and the Demographic Challenge	Spain
Ministry of Agriculture	Czech Republic
Ministry of Climate	Poland
Ministry of Climate Action	Austria
Ministry of Economics	Latvia
Ministry of Economy and Sustainable development	Croatia
Ministry of Energy, Commerce and Industry	Cyprus
Ministry of Environment	Czech Republic
Ministry of environment and water	Bulgaria
Ministry of the Environment and Energy	Greece
MoE SR	Slovakia
MOL Group	Hungary
Münzer Bioindustrie GmbH	Austria
MVaK e.V.	Germany
Neste Oyj	Finland
Neste Oyj	Finland

Organisation	Country
Netherlands Emissions Authority	Netherlands
Ngva Europe	Belgium
North European Oil Trade Oy	Finland
Novozymes	Denmark
OMV AG	Austria
OMV Slovensko	Slovakia
ORLEN Lietuva	Lithuania
Permanent Representation	Hungary
PFS Public Health - Environment	Belgium
PKN ORLEN S.A.	Poland
Polish Chamber of Biofuels	Poland
Praj Industries Ltd.	India
Representing EUROMOT	Belgium
Repsol	Spain
Self employed	France
SENASA	Spain
Shell	Belgium
SkyNRG	Netherlands
Slovak Association of Petroleum Industry and Trade	Slovakia
SLOVNAFT, a.s.	Slovakia
Sustainable Fuels	Belgium
Swedish Energy Agency	Sweden
Technopolis Group	France
The Swedish Petroleum & Biofuels Institute	Sweden
Transport and environment	Belgium
UPEI	Belgium
UPM Biofuels	Finland
Versalis	Italy
Vierhout	Belgium
ZVVB (Association of the Producers and Use of Biofuels in Slovakia)	Slovakia

Table 21 List of stakeholders interviewed

Interviewee	Organisation	Country
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology	National public administration	Austria
VCÖ- Mobilität (NGO/thinktank)	NGO/think tank	Austria
birdlife	Environmental NGO	Belgium
DG Leefmilieu	National public administration	Belgium
Transport & Environment,	NGO/think tank	Belgium
MOEW Bulgaria	National public administration	Bulgaria
INA	Enterprise, Fuel (including biofuel) supply/production	Croatia
Ministry of the Environment of the Czech Republic (MoE)	National public administration	Czech Republic

DEA – Danish Energy Agency	MS Authority/Publci Administration	Denmark
Green Transition Denmark	Environmental NGO	Denmark
ACEA	Industry association (European Automobile Manufacturers Association)	EU
Association for Emissions Control by Catalyst AECC AISBL	Industry association	EU
EBA	Industry association	EU
EBB	Industry association	EU
ePURE	Fuel (including biofuel) supply/production, First-general bioethanol, Advanced bioethanol, Industry association	Europa
UPM Biofuels	Fuel production	Finland
International Council on Clean Transportation (ICCT)	Research organisation / NGO	Germany
Renewable Energy	National public administration	Germany
SEEPE (Hellenic Petroleum Marketing Companies Association)	Industry association	Greece
	National public administration	Greece
MOL Group Hungary	Fuel (including biofuel) supply/production	Hungary
Permanent Representation of Hungary to the EU	National public administration	Hungary
Unione Energie per la Mobilita	Industry association	Italy
LDTA - Latvian Fuel Traders Association	Industry association	Latvia
Environmental Protection Agency & The Ministry of Environment	National public administration	Lithuania
NEOT Finland	Fuel	NEOT Finland
Apetro	Industry association	Portugal
Enviral	Industry association	Slovakia
Ministry of Environment of the Slovak Republic	National public administration	Slovakia
Drivkraft Sverige	Industry association	Sweden
SE CA, Energimyndigheten	National public administration	Sweden
Swedish 2030-sekretariatet	Environmental NGO	Sweden
Sustainable Fuels	Industry association	
UPEI	Industry association	

Table 22 List of respondents to the online Survey

Organisation/ company
ABA - Advanced Bioenergy Association
Abengoa
Advisor Dutch Emissions Authority
Anders Röj
ArcelorMittal
Association of the German Biofuel Industry (VDB)
Austria's Federal Ministry of Agriculture, Regions and Tourism
Belgium's Federal Ministry for Health
BioMCN
BP
Campa Iberia S.A.U.
CAPREA Sustainable Solutions
CEPSA
Cerulogy
CRI

Organisation/ company
Cyprus' Ministry of Energy, Commerce and Industry
Czech Association of Petroleum Industry and Trade (ČAPPO)
Czechia's Ministry of Environment
EBB - European Biodiesel Board
EBV
ENGIE
Environment Agency Austria
ePURE
European association of national driver associations (FIA Association)
EWABA
France's Ministry of Ecological Transition
FuelsEurope
German Bioethanol Industry Association
Green Biofuels Ireland Ltd
Hellenic Petroleum Marketing Companies Association
Hungary's Ministry of Foreign Affairs
INA-Oil Industry, Plc.
International Council on Clean Transportation (ICCT)
IOGP
Ireland's Department of the Environment, Climate and Communications
IRU
Italy's Ministry of the Environment and the Protection of Land and Sea
Lantmännen Aspen AB
Latvian Fuel Traders Association
Latvia's Ministry of Economics
Lithuania's Ministry of Environment
Luxembourg's Environmental Agency
Malta Resources Authority
Mineraloelwirtschaftsverband
Ministry of Climate
Ministry of climate action
Ministry of the Environment and Energy
MOL Group
MVaK e.V.
Neste Oyj
Netherlands Emissions Authority
Ngva Europe
North European Oil Trade Oy
ORLEN Lietuva
Perspectives Climate Group
PKN ORLEN S.A.
Polish Chamber of Biofuels
Repsol
Self employed
Slovak Association for the Production and Use of Biofuels
Slovak Association of Petroleum Industry and Trade
Slovakia's Ministry of Environment
Slovenia's Government
Slovnaft, a. s.
the Danish Energy Agency
the Netherlands' Ministry of Infrastructure and Water Management
the Swedish Energy Agency
the Swedish Transport Agency
Transport & Environment

Organisation/ company
UK Petroleum Industry association (UKPIA)
UPEI - Union of European Petroleum Independents
UPM
ZVVB (Association of the Producers and Use of Biofuels in Slovakia)

Table 23 List of participants to the Final Workshop (20.04.2021)

Organisation	Country
ABA - Advanced Bioenergy Association	Portugal
Adesso BioProducts	Sweden
Administration de l'environnement	Luxembourg
Adriatica Oli s.r.l.	Italy
AECC (Association for Emissions Control by Catalyst)	Belgium
AGQM Biodiesel e.V.	Germany
AISIN Europe	Belgium
APETRO	Portugal
ArcelorMittal	Belgium
Association of the German Biofuel Industry (VDB)	Germany
Aveiro	Portugal
Belgische Petroleum Federatie	Belgium
BOC Gases Ireland	Ireland
BorgWarner / CLEPA	France
BP	United Kingdom
BP Europa SE	Germany
BTG Bioliquids	Netherlands
BUNEG	Belgium
Bunge SA	France
BZK & Wspólnicy	Poland
CAMPA IBERIA SAU	Spain
CEPSA	Spain
Cerulogy	United Kingdom
Chevron	Belgium
CLEPA	Belgium
Concawe	Belgium
Danish Energy Agency	Denmark
Department of Transport	Ireland
Drivkraft Sverige	Sweden
Dutch Emissions Authority (NEa)	Netherlands
EBB - European Biodiesel Board	Belgium
EC, DG CLIMA	Belgium

Organisation	Country
EEA - European Environment Agency	Denmark
EKO ABEE (HELPE GROUP)	Greece
Energistyrelsen / The Danish Energy Agency	Denmark
Energy Changes	Austria
ENGIE	France
Envien Group	Slovakia
ePURE	Belgium
Equinor ASA	Norway
Esso Nederland BV	Netherlands
Ethanol Energy a.s.	Czech Republic
EUROMOT	United Kingdom
European Waste-to-Advanced Biofuels Association (EWABA)	Belgium
Eurowag	Czech Republic
Eurowag	Belgium
EXERGIA	Greece
Federal Ministry for Climate Action	Austria
Finnish Energy Authority	Finland
FuelsEurope	Belgium
Galp	Portugal
German Bioethanol Association	Germany
Green Biofuels Ireland Ltd	Ireland
Grupa Lotos S.A.	Poland
GSE	Italy
Hydrogen Denmark	Denmark
IM Biofuel Italy	Italy
INA - Oil industry, Plc.	Croatia
Independent	France
Institut für Fahrzeugtechnik Stuttgart	Germany
IOGP	Belgium
Irving Oil	Ireland
ITM	Hungary
KDCP Kancelaria Doradztwa Celnego i Podatkowego Rutkowski i Wspólnicy sp. z o.o.	Poland
KIB - Polish Chamber of Biofuels	Poland
Kreab	Belgium
Lantmännen	Sweden
Latvian Fuel Traders Association	Latvia
Liquid Gas Europe	Belgium
Mabanaft GmbH+Co.KG	Germany
Mayer Brown	Belgium
Ministry	Belgium

Organisation	Country
Ministry for Ecological transition and the demographic challenge	Spain
Ministry for the Ecological Transition	Italy
Ministry for the Ecological Transition	France
Ministry for the Ecological Transition and the Demographic Challenge	Spain
Ministry of Agriculture	Czech Republic
Ministry of Climate and Environment	Poland
Ministry of Commerce, Industry and Tourism	Cyprus
Ministry of Ecology	France
Ministry of Economics	Latvia
Ministry of Energy	Romania
Ministry of Energy	Lithuania
Ministry of Energy, Commerce and Industry	Cyprus
Ministry of Environment	Lithuania
Ministry of Environment	Slovakia
Ministry of Environment and Energy	Greece
Ministry of Environment and Water	Bulgaria
Ministry of Industry and Trade	Czech Republic
Ministry of Infrastructure and Watermanagement	Netherlands
Ministry of the Environment	Sweden
Ministry of the Environment	Poland
Ministy of the Environment	Czech Republic
Mitsubishi Heavy Industries	Belgium
Mitsubishi Hitachi Power Systems Europe GmbH	Belgium
Mittelstandsverband abfallbasierter Kraftstoffe e.V. (MVaK)	Germany
MRA	Malta
Münzer Bioindustrie GmbH	Austria
Nederlandse Emissieautoriteit	Netherlands
Neste	Belgium
Neste Corporation	Finland
Ngva Europe	Belgium
North European Oil Trade Oy	Finland
Novozymes	Denmark
OMV AG	Austria
ORLEN Unipetrol	Czech Republic
Perspectives Climate Group Gmbh	Peru
PKN ORLEN S.A.	Poland
Polish Chamber of Biofuels	Poland
POPiHN - Polish Oil Industry and Trade Organisation	Poland

Organisation	Country
Portuguese Environment Agency	Portugal
PRAJ	India
PRIO	Portugal
Prio Energy	Portugal
Q8Research	Netherlands
Renault	France
Renewable Energy Group	Netherlands
Repsol	Spain
Saipol (Groupe AVRIL)	France
SAPPO/Slovak Association of Petroleum Industry and Trade	Slovakia
Schaeffler Group	Germany
Sekab	Sweden
Shell	United Kingdom
Shell	Netherlands
Shell	Germany
Shell	Belgium
Shell Polska	Poland
SkyNRG	Netherlands
Slovak Hydrometeorological Institute	Slovakia
Slovnaft	Slovakia
STX Commodities	Netherlands
Swedish 2030 Secretariat	Sweden
Swedish Energy Agency	Sweden
T&E	Belgium
The Guild	Belgium
The ICCT	United States
The State Construction Control Bureau / Department of Energy resource control	Latvia
Total	France
UP - Unione Petrolifera	Italy
UPEI - Europe's Independent Fuel Suppliers	Belgium
UPM Biofuels	Finland
VARO Energy Belgium NV	Belgium
VCOE	Austria
Vitesco Technologies	France
W.A.G. payment solutions, a.s.	Czech Republic

Appendix D Survey Report (from approved interim report)

MAY 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS FROM TRANSPORT FUELS

SURVEY REPORT (D4) – **APPENDIX A TO THE INTERIM REPORT**

PREPARED BY TECHNOPOLIS GROUP (LEAD), COWI A/S AND EXERGIA

MAY 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS FROM TRANSPORT FUELS

SURVEY REPORT (D4) – **APPENDIX A TO THE INTERIM REPORT**

PROJECT NO. DOCUMENT NO.

VERSION	DATE OF ISSUE	DESCRIPTION	PREPARED	CHECKED	APPROVED
2	26/05/2021	D4.Survey Report			

CONTENTS

Appendix A Survey report

Table 1 Survey: Answers to "Please indicate the type of the organisation you represent" and "Are you an authority in charge of reporting to the European Commission information and data on transport fuels?"

	Number of respondents	%
Industry associations	20	22%
Intergovernmental organisations	2	2%
National competent authorities	26	29%
Other national public administrations	1	1%
Other enterprises	5	6%
Other	2	2%
Producer / supplier of fuels (including biofuels)	22	25%
Research organisation	3	3%
Think tank or consultancy	8	9%
Total	**89**	**100%**

Table 2 Survey: Answers to "Are you a small or medium-sized enterprise?"

	Number of respondents	%
Yes	5	20%
No	18	72%
I do not know	2	8%
Total	**25**	**100%**

Table 3 Survey: Answers to "In which sector(s), are you the most active?" (only for those who reported to be "Other enterprises")

	Number of respondentss	%
Fuel additive manufacturing	1	25%
Automobile and equipment manufacturing	0	0%
Transport industry	1	25%
Other	2	50%
Total	**4**	**100%**

Table 4 Survey: Answers to "Which type(s) of fuel do you supply and/or produce" (only for those who reported to be "Producer / supplier of fuels (including biofuels)")

	Number of respondentss	%
Diesel	14	63,6%
Petrol	11	50,0%

	Number of respondentss	%
Gasoil	11	50,0%
Liquefied petroleum gas	10	45,5%
Drop-in biofuels	9	40,9%
First-general bioethanol	5	22,7%
First-generation biodiesel (FAME)	5	22,7%
Ethers	6	27,3%
Advanced biodiesel (FAME)	4	18,2%
Other	6	27,3%
Compressed natural gas	2	9,1%
Advanced bioethanol	2	9,1%
RFNBIO, Recycled Carbon Fuels, PtL)	0	0,0%

Table 5 Survey: Answers to "In which sector(s), are your association members the most active?" (only for those who reported to be "Industry association")

	Number of respondentss	%
Biofuel supply/production	13	65%
Fuel supply/production	10	50%
Transport industry	1	5%
Fuel additive manufacturing	0	0%
Automobile and equipment manufacturing	0	0%
Other	0	0%

Table 6 Survey: Answers to "Where are you located (if you are a fuel supplier, indicate the country where you conduct most of your operations)?"

	Number of respondentss	%
Belgium	16	18,0%
Germany	8	9,0%
Slovakia	6	6,7%
Italy	5	5,6%
Sweden	5	5,6%
Czechia	4	4,5%
Finland	4	4,5%
Slovenia	4	4,5%
France	3	3,4%
Cyprus	3	3,4%
Ireland	3	3,4%
Poland	3	3,4%
Spain	3	3,4%
United Kingdom	2	2,2%
Austria	2	2,2%
Croatia	2	2,2%
Latvia	2	2,2%
Netherlands	2	2,2%
Greece	2	2,2%
Hungary	2	2,2%
Lithuania	2	2,2%
Denmark	1	1,1%
Estonia	1	1,1%
Luxembourg	1	1,1%
Malta	1	1,1%
Iceland	1	1,1%
Panama	1	1,1%
TOTAL	**89**	**100,0%**

Table 7 Survey: Answers to "Are you active on other markets?" (only for those who reported to be "Producer / supplier of fuels (including biofuels)" or "Other enterprise")

	Number of respondents	
No	2	9%
Yes	21	91%
TOTAL	**23**	**100%**

Table 8 Survey: Answers to "What are your exporting markets?" (only for those who reported to be "active on other markets")

	Number of respondents	%
Germany	9	43%
Italy	9	43%
Netherlands	6	29%
Sweden	6	29%
Austria	6	29%
Czech Republic	5	24%
France	5	24%
Poland	5	24%
United Kingdom	5	24%
Belgium	4	19%
Spain	4	19%
Slovakia	4	19%
Finland	3	14%
Slovenia	3	14%
Croatia	3	14%
Hungary	3	14%
Denmark	2	10%
Estonia	2	10%
Greece	2	10%
Ireland	2	10%
Latvia	2	10%
Luxembourg	2	10%
Portugal	2	10%
Romania	2	10%
Bosnia-Herzegovina	2	10%
Not specified	2	10%
Bulgaria	1	5%
Cyprus	1	5%
Lithuania	1	5%
Malta	1	5%
United States	1	5%
Norway	1	5%
Serbia	1	5%

Table 9 Survey: Answers to "How familiar are you with the targets set in Article 7a of the FQD?"

	Very familiar	Familiar	Somewhat familiar	Not at all familiar	I do not know	TOTAL
Producer / supplier of fuels (including biofuels)	12	9	1	0	0	**22**
Industry association	16	2	2	0	0	**20**
National competent authority	17	6	1	1	0	**25**
Other	9	6	3	0	2	**20**
Total	**54**	**23**	**7**	**1**	**2**	**87**

Table 10 Survey: Answers to "Do you agree that the targets identified in Article 7a of the FQD can effectively trigger and orient the efforts of fuel suppliers towards the reduction of the life cycle GHG intensity of the supplied fuel?"

	Fully agree	Agree	Neither disagree nor agree	Disagree	Fully disagree	TOTAL
Producer / supplier of fuels (including biofuels)	6	8	6	0	0	**20**
Industry association	11	4	1	3	0	**19**
National competent authority	7	8	7	3	0	**25**
Other	3	11	6	0	0	**20**
Total	**27**	**31**	**20**	**6**	**0**	**84**

Table 11 Survey: Answers to "In your views, what could be reasonably expected from the attainment of the targets in Article 7a of the FQD in terms of reduction of GHG emissions intensity of supplied transport fuels?"

BETTER AIR QUALITY	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	3	6	7	3	0	**19**
Industry association	2	7	3	3	3	**18**
National competent authority	5	8	6	5	0	**24**
Other	2	5	6	3	0	**16**
Total	**12**	**26**	**22**	**14**	**3**	**77**

BETTER HUMAN HEALTH	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	2	6	7	4	0	**19**
Industry association	1	6	4	4	2	**17**
National competent authority	5	7	7	5	0	**24**
Other	2	4	7	3	0	**16**
Total	**10**	**23**	**25**	**16**	**2**	**76**

FUEL TECHNOLOGY PROGRESS	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	4	7	4	2	2	**19**
Industry association	7	9	1	0	2	**19**
National competent authority	6	9	6	3	0	**24**
Other	1	7	5	3	1	**17**
Total	**18**	**32**	**16**	**8**	**5**	**79**

HIGHER FUEL EFFICIENCY	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	2	7	4	3	3	**19**
Industry association	0	8	5	3	2	**18**
National competent authority	2	4	8	8	2	**24**
Other	0	4	7	4	1	**16**
Total	**4**	**23**	**24**	**18**	**8**	**77**

INCREASED COMPETITIVENESS OF RENEWABLE AND LOW-CARBON FUELS	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	6	9	1	2	1	**19**
Industry association	10	6	3	0	0	**19**
National competent authority	7	10	4	3	0	**24**
Other	4	10	4	0	0	**18**
Total	**27**	**35**	**12**	**5**	**1**	**80**

LESS FRAGMENTED MARKET FOR TRANSPORT FUELS AND VEHICLES	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	1	7	4	4	2	**18**
Industry association	0	6	5	5	2	**18**
National competent authority	2	4	8	6	4	**24**
Other	1	2	7	5	1	**16**
Total	**4**	**19**	**24**	**20**	**9**	**76**

BETTER MARKET POSITION OF EU FUEL SUPPLIERS WORLWIDE	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	1	3	6	6	3	**19**
Industry association	0	5	6	3	4	**18**
National competent authority	2	4	6	10	2	**24**
Other	1	3	5	4	3	**16**
Total	**4**	**15**	**23**	**23**	**12**	**77**

OTHER	Extremely likely	Likely	Neither unlikely nor likely	Unlikely	Extremely unlikely	Total
Producer / supplier of fuels (including biofuels)	1	0	1	0	0	**2**
Industry association	0	0	0	0	1	**1**
National competent authority	2	1	1	1	0	**5**
Other	0	0	3	0	0	**3**
Total	**3**	**1**	**5**	**1**	**1**	**11**

Table 12 Survey: Answers to "What does your company do to comply with the compulsory reduction of greenhouse gas emission intensity of transport fuels in Article 7a of the FQD?" (only to those who responded to be "Producer / supplier of fuels (including biofuels)")

	Number of respondents	% of respondents
No action taken	0	0%
Purchase and blending of biofuels and/or other types of renewable and low-carbon fuels	11	61%
Investing in biofuel and other types of renewable and low-carbon fuel production facilities	11	61%
Investing in new R&D projects on other types of renewable and low-carbon fuels	10	56%
Other	5	28%

Other, Please specify:
sell (advanced) biomethanol to obligated parties. depending on the hight of a FQD target, possibly invest in renewable and low carbon production. We have applied for a low carbon methanol but this process was put on hold due to uncertainty on FQD prolongation after 2030.
Purchasing UER certificates
Upstream Emission Reduction
Associate with other companies that have surplus in GHG.
UER's. As part of the compliance mechanisms, Total, through its Exploration-Production Branch, is also active in developing projects to reduce upstream emissions (e.g Nigeria)

Table 13 Survey: Answers to "What are the most frequent actions undertaken by your association members to comply with the compulsory reduction of greenhouse gas emission intensity of transport fuels in Article 7a of the FQD?" (only to those who responded to be "Industry association")

	Number of respondents	% of respondents
No action taken	0	0%
Purchase and blending of biofuels and/or other types of renewable and low-carbon fuels	12	63%
Investing in biofuel and other types of renewable and low-carbon fuel production facilities	12	63%
Investing in new R&D projects on other types of renewable and low-carbon fuels	0	0%
Other	4	21%

Other, Please specify:
UERs
optimizations in production processes
Upstream Emission Reduction
Improvement of GHG performance of biofuels

Table 14 Survey: Answers to "What mechanisms/tools does your country deploy to enforce the obligation of reducing GHG emission intensity of fuel in compliance with Article 7a of the FQD?" (only to those who responded to be "National Competent Authority")

	Number of respondents	% of the respondents
No incentive	2	9%
Mandatory targets for all fuel suppliers	19	86%
Biofuel and other types of renewable and low-carbon fuel blend requirement	16	73%
Financial penalties for not fulfilling obligation	21	95%
Support to the demand for/consumption of biofuels and other types of renewable and low-carbon fuels	6	27%
Financial support to private investments in biofuel and other types of renewable and low-carbon fuel production facilities	4	18%
Promoting electric mobility	15	68%
Other	0	0%

Table 15 Survey: Answers to "In your views, what are the most effective incentives to encourage fuel suppliers to enforce the obligation of reducing GHG emission intensity of fuel in compliance with Article 7a of the FQD?" (only to those who did not respond to be "National Competent Authority")

	Number of respondents	% of respondents
Financial penalties for not fulfilling obligation	35	66%
Mandatory targets for all fuel suppliers	35	66%
Financial support to private investments in biofuel and other types of renewable and low-carbon fuel production facilities	35	66%
Support to the demand for/consumption of biofuels and other types of renewable and low-carbon fuels	33	62%
Biofuel and other types of renewable and low-carbon fuel blend requirement	28	53%
Other	9	17%
Promoting electric mobility	7	13%
No incentive	1	2%

Other, Please specify:
a revision of the energy taxation directive based on a C02 price
Contracts for difference schemes to support emerging advanced alternative fuel technologies such as cellulosic biofuels
Create a market for the low GHG intensity fuels by reducing tax rate, whilst penalising fossil fuels with a higher tax
Develop a credit mechanism for EVs
Increase consumer awareness regarding the benefits of renewable and low carbon fuels
Introduction of biofuel blends at national or EU level, such as the initiatives that several countries have taken to roll out E10
the coherence of the objectives and the instruments available for their implementation in the field of air quality improvement resulting from other EU legislation
The national GHG quota obligation is much more ambitious than art 7a so if the national quota is fulfilled also art 7a will be fulfilled. Art 7a has no or very little impact when tha national system is more ambitous
There should also be a penalty for MS not complying. next, Promoting electricity has the effect that emissions are emitted/calculated elsewhere and should be left out of the options to comply with art. 7a. Focus should be on reducing (emissions from) fossil fuels

Table 16 Survey: Answers to "In your views, should fuel suppliers be given additional choices with respect to the most effective method(s) to reduce life cycle GHG emission from their fuels?"

	Fully agree	Agree	Neither disagree nor agree	Disagree	Fully disagree	Total
Producer / supplier of fuels (including biofuels)	7	4	5	2	1	**19**
Industry association	6	5	6	1	0	**18**
National competent authority	3	10	9	2	0	**24**
Other	3	6	9	0	0	**18**
Total	**19**	**25**	**29**	**5**	**1**	**79**

Table 17 Survey: Answers to "Have you faced any difficulties or challenges in achieving the objectives of Article 7a of the FQD?" and "What difficulties or challenges have you encountered?" (only to those who responded to be "Producer / supplier of fuels (including biofuels)")

	Number of respondents	% of respondents
Low trade of renewable and low-carbon fuels between demand and supply sites	1	9%
Low deployment of electromobility	2	10%
Too ambitious / not achievable targets	3	15%
Lack of demand for renewable and low-carbon fuels (also considering the availability of related fleet)	4	20%
Lack of blending mandate for renewable and low-carbon fuels	4	20%
I do not know	4	20%
Lack of technical specifications to support higher blending of renewable and low-carbon fuels	5	25%
Other difficulties	5	25%
Lack of incentives/penalties	5	25%
Incentives/penalties not adapted to the needs of local fuel suppliers	5	25%
Lack of production volumes for renewable and low-carbon fuels	5	25%
No foreseen return on investments for reducing GHG emissions	6	30%
Lack of EU harmonised mechanisms	8	40%
No difficulties	5	25%

Other, Please specify
Lack of mandate of using renewable and low carbon fuels by end users.
Lack of the scope of art.7a with different interpretations within EU members.
Low consumer awareness for renewable, low carbon fuels
Misalignment between national policies towards RED and FQD targets. If MS focuses more on RED rather than FQD attainment, fuel suppliers follow suit. LT case - minimum E10 and B7 volumetric blending requirements in each liter, which favor national food/feed crop biofuel industry and does not incentivizes use of more expensive Annex IX biofuels with better GHG savings.
One of the major hurdles, is the discrepancy in implementing article FQD7a (and RED for that matter) between Member States. The way MS implement sustainability criteria, specifically the addition of sustainability criteria (e.g ILUC) for some feedstocks create a market distortion between MS

Table 18 Survey: Answers to "In your opinion, what are the main obstacles to attain the compulsory target of reducing by 6% the GHG emission intensity of supplied transport fuels by 2020?" (only to those who did not respond to be "Producer / supplier of fuels (including biofuels)")

	Industry association	National competent authority	Other	Total
Too ambitious / not achievable targets	5	9	3	**17**
Lack of incentives/penalties	8	4	8	**20**
Incentives/penalties not adapted to the needs of local fuel suppliers	3	1	2	**6**
Lack of production volumes for renewable and low-carbon fuels	5	14	5	**24**
Lack of demand for renewable and low-carbon fuels (also considering the availability of related fleet)	7	6	3	**16**
Low trading of renewable and low-carbon fuels between demand and supply sites	1	5	1	**7**
Lack of EU harmonised mechanisms	10	10	7	**27**
Lack of blending mandate for renewable and low-carbon fuels	8	3	3	**14**
Lack of technical specifications to support higher blending of renewable and low-carbon fuels	11	12	3	**26**
Low deployment of electromobility	2	16	3	**21**
No foreseen return on investments for reducing GHG emissions	10	10	5	**25**
Low awareness of climate issues among fuel suppliers	1	3	2	**6**
Other	6	7	5	**18**

Table 19 Survey: Answers to "In your views, should fuel suppliers (instead of Member States) be held responsible for failures to attain the targets in Article 7a?"

	Fully agree	Agree	Neither disagree nor agree	Disagree	Fully disagree	Total
Producer / supplier of fuels (including biofuels)	3	3	5	4	3	18
Industry association	3	5	3	2	5	18
National competent authority	5	11	5	4	0	25
Other	6	5	4	0	3	18
Total	17	24	17	10	11	79

Table 20 Survey: Answers to "How familiar are you with the method used to calculate reduction of greenhouse gas emission intensity of transport fuels in the FQD?"

	Very familiar	Familiar	Somewhat familiar	Not at all familiar	I do not know	Total
Producer / supplier of fuels (including biofuels)	12	5	3	0	0	20
Industry association	12	5	2	0	0	19
National competent authority	12	11	1	1	0	25
Other	6	6	2	2	2	18
Total	42	27	8	3	2	82

Table 21 Survey: Answers to "In your view, does the method of calculation proposed under the FQD allow for an accurate monitoring of life cycle GHG emissions from transport fuels?" (only to those who responded to be at least somewhat familiar with the method used to calculate reduction of greenhouse gas emission intensity of transport fuels in the FQD)

Row Labels	Producer / supplier of fuels (including biofuels)	Industry association	National competent authority	Other	Total
I do not know	4	4	5	3	16
Yes	12	10	12	7	41
Default values for the GHG emission intensity of each fuel pathway	2	4	5	2	13
Sustainability criteria for biofuels	2	1	2	1	6
Fossil fuel comparator	0	4	1	1	6
Other	1	3	4	4	12

Other, Please specify:
Lack of some sort of ILUC factor on 1. generation biofuels. - Missing a possibilty for using actual GHG intensities for renewable fuels of nonbiological origin. - The possibility of using UER-credits
Accounting of the UER, aggregated CO2 intensity of fossil fuels and the unaccounted ILUC effects of biofuels prevent the accurate measurements of GHG reduction potential.
Accuracy and traceability of GHG data by suppliers.
artificial support of electro mobility which does not lead to real emission savings
Default values tend to largely underestimate actual GHG savings for certain biofuel pathways. In 2019 renewable ethanol from EU producers was certified to be, on average, 72.5% less emitting than an 83.8 g CO2eq/MJ fossil fuel comparator. Additionally, upstream emission reductions (UER) prevent a further reduction of the GHG intensity of transport fuels used since UER projects are completely decoupled from EU's oil/fuels supply chain.
Existence of a 40% bonus for electromob., which comes on top of several other incentives in every policy, e.g. RED II multipliers, CO2 standards sales quota. Overall reliance on RED I default values and on this system which as a whole tends to largely underestimate actual certified GHG savings for certain fuel pathways. Renewable ethanol produced by ePURE members in 2019 was certified to be on average 72.5% less emitting than the fossil fuel comparator. This comparator should also be regularly updated.
In addition to answer c) the fossil fuel comparator should be reviewed and updated regularly.
Lack of a harmonised, legally-binding European classification of feedstock for biofuels as waste, residue or product

Other, Please specify:
Lack of consideration of important indirect emissions
Lack of ILUC emissions accounting and unavoidable uncertainty in ILUC emissions estimation
missing or non reliable information on import crude oil from 3rd countries.
Where to begin with the biofuel methodology? Possibly its worst problem is methodological inconsistency

Table 22 Survey: Answers to "Have you faced any difficulties or challenges in calculating, monitoring and reporting greenhouse gas emissions from transport fuels?" (only to those who responded to be producer / supplier of fuels (including biofuels) or national competent authorities, and at least somewhat familiar with the method used to calculate reduction of greenhouse gas emission intensity of transport fuels in the FQD)

Row Labels	I do not know	No	Yes	Total
Producer / supplier of fuels (including biofuels)	1	3	0	**4**
National competent authority	1	0	4	**5**
Total	**2**	**3**	**4**	**9**

Table 23 Survey: Answers to "In your opinion, what have been the positive impacts of Article 7a of the FQD until now?"

	Producer / supplier of fuels (including biofuels)	Industry association	National competent authority	Other	Total
Reduction of GHG emissions intensity from transport fuel	15	13	17	9	54
Better air quality	4	3	7	3	17
Better human health	1	1	4	3	9
Increased supply of renewable and low-carbon fuels and fuels with lower greenhouse gas emissions intensity	12	12	14	8	46
Increased demand for renewable and low-carbon fuels and fuels with lower greenhouse gas emissions intensity	12	10	15	6	43
Information on transport fuels harmonised across the EU	3	7	4	1	15
Trading of transport fuels harmonised across the EU	1	0	1	1	3
Better information on feedstock and biofuel production pathways	7	9	8	2	26
Increased use of electric vehicles	2	0	4	1	7
Increased use of carbon credits (e.g. through Clean Development Mechanisms)	1	1	0	0	2
Increased use of carbon capture and storage technologies	3	0	1	3	7
Fuel technology progress	5	10	10	5	30
Higher fuel efficiency of vehicles	3	1	1	3	8
Increased competitiveness of	5	10	8	4	27

	Producer / supplier of fuels (including biofuels)	Industry association	National competent authority	Other	Total
renewable and low-carbon fuels					
Increased synergies and cooperation between oil-based fuel suppliers and producers of renewable and low-carbon fuels	7	10	5	1	23
Less fragmented markets for transport fuels and vehicles	2	0	0	2	4
Better market position of EU fuel suppliers worldwide	1	1	0	0	2
Other, please specify	2	1	2	3	8

Table 24 Survey: Answers to "Has Article 7a of the FQD had any negative impacts?"

	I do not know	No	Yes	Total
Producer / supplier of fuels (including biofuels)	4	8	7	19
Industry association	0	11	8	19
National competent authority	4	6	12	22
Other	8	5	5	18
Total	**16**	**30**	**32**	**78**

Other, Please specify
Administratively difficult to implement alongside RED. There is a misalignment in relation to the fuels to be counted towards the different targets .
An extra system which is an extra administrative burden. The requirement in the national system is enough. RED II will also put an obligation on member states to implement an obligation to reach the target in art 25 in RED II. There is no need for multiple systems to achieve the same thing.
Biofuels with high GHG savings are exported to countries with GHG mitigation targets before 2020
Due to Article 7a, biofuels having low GHG emissions have become highly sought after. Unfortunately, there is no harmonised, legally-binding European classification of feedstock for biofuels as waste, residue or product. This situation is leaving room for interpretation, fragmenting the European market and increasing ILUC emissions. This is

causing pressure on the regulators that can easily be avoided by a harmonised European feedstock classification system.
Due to existing targets in other member states e.g. Germany, biofuel produced in Austria with high GHG savings are exported due to better prices there
Europe competitiveness decreasing
FQD supports fossil fuels (some of them have higher life cycle emission than base fuels - LNG), in reality we do not reduce any domestic GHG emissions by buying UER from 3rd countries.
FQD7a obligation does not prevent the use of high ILUC biofuels. This choice can be with serious consequences, particularly for MS where measures are in place to prevent their use. -Some MS are facing a leak of the most virtuous biofuels to MS where penalties are high due to a lack of a harmonized system. FQD7a obligation is inequitable for fuels suppliers and results in unfair competition throughout the UE, because the effort required is more important in MS where diesel consumption is predominant. This is due to the fact that the fuel baseline standard of 94.1 gC02/MJ is based on the 2010 average EU mix of fossil fuels (diesel and non-road gasoil 66.4% (J/J) / petrol 31.4% / LPG 1.8% / CNG 0.4% with respective GHG intensities of 95.1 (g CO2eq/MJ) / 93.3 / 73.6 / 69.3). This mix is non-representative of the ones of some MS where diesel consumption accounts for about 80% of transport fuels. This not-fairness will probably lead to different losses of purchasing power for consumers across the EU when penalties are applied, since they are ultimately going to pay (at least partially, or even in its entirety).
Fragmentation of the market due to different national approaches to implementation. In some countries, incorrect identification of the obligated party. Potentially penalties to pay harming small businesses in particular. Unfair competition: More limited possibilities for independent fuel suppliers (importers) to reach the target compared with integrated oil companies (e.g. which can more easily reduce upstream emissions e.g. with co-hydration). Too intense competition for renewable fuels with "high CO2 saving capacity". Administrative burden for fuel suppliers, although reporting costs are manageable in most countries. Very high burden and costs out of proportion for small fuel supplying companies who are not capable of exploiting all the possibilities to reach the target (e.g. UER projects, hard to get "high savers", …)
Fuels aim to used in NRMM gasoline has no technical flexibility to fulfil the article 7a.
High targets but lack of high GHG products on the market.
In Estonia it is possible to buy gasoline with bioethanol as well as bioethanol free gasoline. A lot of consumers have chosen to use bioethanol free gasoline as they think it is better for their car, because there are rumours that bioethanol can impair the engine work. This degrades to achieve the goal set by article 7a.
Increased cost of fuels
increased cost of supplied fuels, administrative burden, lack of tools for achieving the 6% reduction
increased demand for fossil fuels - LPG, increased energy costs for society,
Inefficiencies due to overlapping with RED-T for provisions related to transport.
Lack of biofuels to achieve target of Article 7a distorts competition between fuel traders higher fuel prices with negative impact to economy and citizens level of life
Lack of competition with non-EU market Overlap with other directive (RED) Regulations for fuel supplier and OEM are uncoupled
Overlapping legislation with RED and inconsistencies with RED-T
Overlap with RED for the transport sector
Overlapping legislation with RED and inconsistencies with RED-T
Raw materials (crop) are intended for biofuels

So-called 'ultra low emission' biocomponents propelled development of hardly verifiable carbon offset schemes.
the lack of an EU UER register may generate fraud related to the use of UERs to achieve the goal
The reported GHG reduction may not be realistic due to many reasons like the consideration of UER, and aggregated GHG intensity of fossil fuels, etc. 1) it allows unsustainable biofuels with high ILUC risk 2) It allows emissions offsetting through UER, which might be unrealistic, while the EU initiatives are moving away from international offsetting 3) Disaggregated GHG intensity of fossil fuels sources should have been considered. It shall exclude fossil fuels and count only renewables and electricity for GHG reduction target 4) Counting electricity is an option, but that shall be a mandate through credit mechanisms and multipliers.
The use of UER's which might be money spend on nothing, which could have been used for actual CO2-reductions. - The fact that ILUC is not included in any way, might cause GHG emission increase world-wide and it would once more be money used, that could have been used for actual CO2-reductions.
To high targets, lack of BIO fuels
Too much privileges for bio-fuels, based on a bad method of LCA. Too stringent regulation for e-fuels and Recycled Carbon Fuels makes market entry impossible
Undue administrative burden overlapping regulations between FQD 7a and RED lack of harmonised EU mechanism for UER management

Table 25 Survey: Answers to "In your views, which objective(s) would not be achieved if article 7a of the FQD were replaced with national initiatives?"

	Producer / supplier of fuels (including biofuels)	Industry association	National competent authority	Other	Total
Decreased GHG emission from transport	10	9	10	9	38
Increased air quality	1	1	4	4	10
Better human health	0	0	2	3	5
Technological progress for fuel blending	5	4	9	5	23
Higher fuel efficiency of vehicles	4	3	3	3	13
Less fragmented market for transport fuels and vehicles	13	11	5	5	34
Better market position of EU fuel suppliers worldwide	5	4	3	5	17
Other	3	4	9	3	19

Other, Please specify
A decrease of full consumption
All objective could be achieved through either national initiatives or through other EU legislation, namely RED2.
All of the above could be achieved with national initiatives
Article 7a has a limited impact on GHG emission reduction in transport.
Clear regulations on the generation/use of UERs
development of the use of natural gas in transport
Having the same national system with GHG quota means that art 7a could be discontinued. More efficient with one system to achieve the climate target.
In our views, FQD 7a does not contribute achieving these goals.
Internationally article 7a might have an effect, however many things could be changed to have a better world-wide CO2-reduction effect.
Not possible to answer
Nothing would happen. The leading drivers are NCEP, REDII and Green Deal.

Reaching a common market (and value) of low carbon biofuels among EU countries
Sort of a daft question isn't it? The point is that it might *not* be replaced with national initiatives.
The first lever to be considered is a decrease in fuel consumption, which is not taken into account in FQD7a obligation
the same objectives could be achieved with national initiatives
there would have been some countries with highest targets then others and specific products available ONLY in the most challenging countries
we do not know whether there would have been a material difference if FQD7a was replaced by national schemes.
would depend on the sort of the national initiatives,

Table 26 Survey: Answers to "In your views, to what extent do you agree with the following statements?" (only to those who responded to be "Producer / supplier of fuels (including biofuels)")

	Fully agree	Agree	Neither disagree nor agree	Disagree	Fully disagree	Total
The costs of the monitoring and reporting system introduced by Article 7a of the FQD are excessively high in comparison with the benefits	1	2	9	4	3	19
The costs of reduction of greenhouse gas emission intensity of transport fuels introduced by Article 7a of the FQD are excessively high in comparison with the benefits	1	2	9	4	3	19
The benefits of the monitoring and reporting system introduced by Article 7a of the FQD outweigh the associated costs	1	2	9	4	3	19
The benefits of reduction of greenhouse gas emission intensity of transport fuels introduced by Article 7a of the FQD outweigh the associated costs	1	2	9	4	3	19

Table 27 Survey: Answers to "How does the implementation of Article 7a of the FQD influence the enforcement of the following rules?"

THE COUNCIL DIRECTIVE (2015/652) LAYING DOWN THE CALCULATION METHODS AND REPORTING REQUIREMENTS RELATIVE TO ARTICLE 7A OF THE FQD	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal .	I do not know	Total
Producer / supplier of fuels (including biofuels)	5	6	4	0	2	17
Industry association	5	10	2	0	1	18
National competent authority	4	8	3	1	5	21
Other	3	6	0	2	4	15
Total	17	30	9	3	12	71

Please elaborate
I do not understand what is meant by these
Initially it was supposed to include disaggregated GHG for fossil fuels, no UER, etc. However, as mentioned in the previous questions this method allows aggregated GHG intensity and UER of fossil fuels. This undermines the effectiveness of FQD to achieve any net GHG reduction globally.
LCA for bio-fuels is much more favorable then the stringent LCA for RNFBIO or RCF
On one hand the provisions of the Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to the FQD which adjust the efficiency factor of the battery and hydrogen electric powertrains are acceptable. On the other hand the EC should consider assessing the interaction of different bonus' for battery electric vehicles such as multiple counting in the RED II or the sales quotas for so-called zero and low-emission vehicles in the CO2 standard.
provides a framework for article 7a
Regular updates on emission factors for novel fossil fuels (carbon capture) and RFNBO's are required
Since its purpose is to implement the Directive
We question the provisions of the Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to the FQD which adjust the efficiency factor of the battery and hydrogen electric powertrains. While we do recognise the better efficiency of these powertrains, the EC should carefully assess how this bonus interacts with all the benefits already given to these technologies such as the multiple counting in the RED II or the sales quotas for so-called Zero and Low-Emissions Vehicles in the CO2 standards.

PROVISIONS RELATIVE TO THE SUSTAINABILITY CRITERIA IN THE FQD	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal framework	I do not know	Total
Producer / supplier of fuels (including biofuels)	2	9	6	1	0	18
Industry association	6	6	1	4	0	17
National competent authority	3	4	1	6	6	20
Other	1	7	0	2	4	14
Total	12	26	8	13	10	69

Please elaborate
different sets of criteria in FQD and RED
however, mass balance is not harmonized across member states. This leads to (EU recognized) certified biofuels being rejected in certain countries (NL) although sustainability criteria are met.
No enough provisions. Please refer the response on point 6.
should be left to one directive and RED II is better placed for that than FQD.
The comment on the combined effect of Article 7a making biofuel with low GHG emissions highly sought after and the lack of classification of feedstock for biofuels explained earlier refers.
they clash with REDII

REPORTING PROVISIONS IN THE FQD	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal framework	I do not know	Total
Producer / supplier of fuels (including biofuels)	2	7	6	0	2	17
Industry association	6	4	3	2	3	18
National competent authority	2	5	4	2	7	20
Other	3	6	1	1	4	15
Total	13	22	14	5	16	70

Please elaborate
Which reporting provisions? There is no major clash with the reporting provisions dealing with fuel quality. Reporting on place of purchase and origin of the fuels is no longer required, due to the fact that it was technically impossible to meet this requirement.

OTHER PROVISIONS IN THE FQD	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal framework	I do not know	Total
Producer / supplier of fuels (including biofuels)	1	3	7	3	3	17
Industry association	1	1	4	3	7	16
National competent authority	0	2	6	2	9	19
Other	0	3	4	0	7	14
Total	2	9	21	8	26	66

Please elaborate
FQD states that any fuel meeting the minimum quality requirements should be allowed in any EU market. While in reality that is completely different and level of fragmentation even in geographically close markets can be significant.
The current limits set by the fuel requirements of the FQD on the level of oxygen and ethanol represent a barrier to the incorporation of more bio-components in fuels and thus to the achievement of the targets in Art. 7a. Any introduction or standardisation of a petrol grade with more than 10% ethanol in volume or 3.7% oxygen in mass is 'illegal' despite unlocking higher GHG savings, better engine efficiency and reducing reliance on imported fossil fuels. Upper limits are not enough to fully incentivise the incorporation of oxygenates and renewables in petrol. For example, the EU average level of ethanol blending in petrol have stagnated around 5% in volume despite the limit being placed at 10%. By introducing minimum requirements for oxygen and ethanol, the FQD could address the variation of blends and consequent market fragmentation while also defining a credible driver to meet the Art. 7a target.
The incorporation of more than 10 % ethanol in volume to petrol is limited by the fuel requirements of the FQD on the level of oxygen. It means that any introduction and even standardisation of a petrol grade with more than 10 % ethanol in volume or 3.7 % oxygen in mass is not possible. This barrier limits the incorporation of more bio-components to petrol fuels which would lead to higher GHG savings, better engine efficiency and a reduced reliance on imported fossil fuels. To ensure higher ethanol blends in petrol fuels article 3 sections 3 and 4 as well as recital no. 32 should be amended accordingly. Furthermore, due to the current European car fleet there is no need for E5 as a protection grade, accordingly recital 30 should be amended.

METHODOLOGY FOR THE CALCULATION OF THE LIFE CYCLE GREENHOUSE GAS EMISSIONS FROM RENEWABLE AND LOW-CARBON FUELS	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal framework	I do not know	Total
Producer / supplier of fuels (including biofuels)	3	7	4	2	1	17
Industry association	8	2	2	4	2	18
National competent authority	2	4	4	3	7	20
Other	5	5	0	0	4	14
Total	18	18	10	9	14	69

Please elaborate
definitions should be in line with REDII
GHG savings are completely dependent on the robustness of voluntary sustainability schemes. Without unified level of control of compliance with the sustainability criteria and the GHG reduction levels - substantial risk for fraud exists and the FQD 7a targets as well as the methodology creates incentives for that.
Regular updates on emission factors for novel fossil fuels (carbon capture) and RFNBO's are required
The comment on the combined effect of Article 7a making biofuel with low GHG emissions highly sought after and the lack of classification of feedstock for biofuels explained earlier refers.

INCUMBENT TRANSPOSITION OF THE RECAST RENEWABLE ENERGY DIRECTIVE (REDII)	Synergies allowing better / faster achievement of all pursued objectives	Complementarities allowing the achievement of all pursued objectives	No mutual influence	Overlaps negatively affecting the overall clarity of the legal framework	I do not know	Total
Producer / supplier of fuels (including biofuels)	0	5	5	7	0	17
Industry association	0	3	3	12	0	18
National competent authority	1	2	2	9	5	19
Other	1	6	1	1	5	14
Total	2	16	11	29	10	68

Please elaborate
Different sustainability criteria
do not overlap and negatively affect the overall clarity of the legal framework
High levels of food/feed crop biofuel is OK for FQD 7a targets, while it is clearly limited towards REDII. The control of compliance with sustainability criteria and the GHG reduction targets has to be improved and unified. It should not be possible for the same product to be waste/residue in some member states and not - in others. The harmonization of feedstock list is crucial and there should not be such major differences in the biofuel-pool depending on whether FQD 7a or RED (REDII) influences the national policies most
In Finnish national legislation the RED/RED II and FQD mandates overlap, RED/RED II targets being significantly higher compared to the FQD target. Thus, FQD mandate is fulfilled automatically if the RED/RED II targets are fulfilled.
Raising energy mandates in REDII are not aligned anymore with the 6% FQD target, as the GHG target will in any case be filled by concentrating on volumes. Raising GHG target of FQD would be needed to continue supporting fuels with highest GHG saving performance.
Recast of FQD needed
Sustainability criteria
the 6% target is a main driver for next gen biofuel demand
The FQD and the RED II should have harmonised targets that are calculated on the same basis and reward equally all types of low-carbon/renewable energy. The blending of crop-based ethanol is today the main factor contributing to the reduction of GHG intensity of petrol fuel yet its contribution, alongside other crop-based biofuels, is limited by the cap set by the ILUC Directive and amended under RED II. Now that the Commission Delegated Regulation on High-ILUC risk biofuels proved that ILUC was not an issue for domestic feedstock used in biofuels production, this cap should be reassessed and revised upwards to enable the achievement of the RED and FQD targets.

Please elaborate
The methodologies and threshold for GHG emissions set in FQD are not in line with those set in RED2 creating inconsistencies between the two sets of regulations. In addition there is no correlation between the objectives set in FQD and RED2 while being, mostly, dealing with the same scope of transport fuel concerned.
There are significant inconsistencies
To completely unlock the effect of EU regulations, they should have harmonised targets calculated on the same basis and reward equally all types of low-carbon/renewable energy. It should be mentioned as well that with the Delegated Regulation on High-ILUC risk, which proved that ILUC was not an issue for domestic feedstock used in biofuels production, the limitation of crop-based biofuels set by the ILUC Directive and amended under RED II should be reassessed.
We think RED II should be strengthened first to fully exclude unsustainable and high ILUC biofuels. For the 2030 framework, a 65 % GHG savings threshold for biofuels as in RED II shall be adapted. More concerning is also the fact that the FQD has no cap on 1st generation biofuels, which is a very significant discrepancy from the current RED II. The FQD should also include a dedicated limit on crop based biofuels and we recommend the complete phase out of crop-based biofuels by 2030 i.e. they should not be accounted for any climate target compliance in FQD or any other EU framework.

Table 28 Survey: Answers to "Are there any difficulties with complying with Article 7a of the FQD while abiding by"

OTHER EU POLICY MEASURES AND RULES	I do not know	No	Yes	Total
Producer / supplier of fuels (including biofuels)	6	3	8	17
Industry association	2	3	12	17
National competent authority	2	6	12	20
Other	7	5	4	16
Total	**17**	**17**	**36**	**70**

Please elaborate
a) and c) differences between national RED reporting and FQD reporting added extra difficulties on calculating the level of compliance: for example, RED does not include non-road fuels while FQD does. Also double counting rules differ (no double-counting in FQD)
Besides the elements stressed regarding the REDII, we would like to add the following points: To incentivise a better uptake of low-emission fuels a consistent well-to-wheel approach in all EU legal framework should be adopted (CO_2 standards vs. FQD Art. 7a). Furthermore, taxation should account for the fossil carbon intensity of energy products instead of the volume-based approach. CO_2 pricing should not apply to sustainable biofuels and biomass. In contrast to fossil CO2, CO2 from the use of biofuels does not increase GHG concentration in the atmosphere since the CO2 emitted was captured from the air by the biomass used as feedstock ('carbon cycle').
Blending wall for FAME biodiesel at 7% and bioethanol at 10%
Blending wall of biofuels into fuels specifications
Blending walls
Both FQD7a and Red (2) are aiming at the same overall objective of reducing GHG emissions from the transport sectors but through different mechanisms and calculation methodologies. So far, compliance to the FQD is mostly based on blending biofuels in a similar way to the achievement to the RED objectives. The fact that FQD had no intermediate binding objectives before 2020 led to RED being the predominant regulation in most Member States.
Considering the historic development of the FQD, it mainly aimed to create an internal market for fuels and introduce environmental standards by preserving internal market. The introduction of the GHG emissions reduction target added a new dimension to the FQD, which has also been addressed by other regulation. With adding 'climate action' objectives to the scope of FQD, the FQD framework started to overlap with other European policy frameworks, especially with the Renewable Energy Directive. 1 https://ec.europa.eu/clima/policies/transport/fuel_en Maintaining emission reduction targets beyond 2020 would – especially in the light of the revised renewable energy directive – lead to an even stronger overregulation in the field of sustainable biofuels as it already was. While REDII – which was revised under the European Commission's proposal to address decarbonisation of transport fuels after 2020 – already stimulates the development of sustainable biofuels and other renewable transport energy, an overregulation resulting out of additional obligations set out in FQD, would not necessarily enhance the development of sustainable bio- and alternative fuels. In fact, contrarily it could lead to an unsettlement of investors and therefore ultimately slow down the development of sustainable fuels.
consistency between RED mandates and FQD carbon intensity reduction target

DG Climate (ETS) and DG Energy (RED) are not aligned
Green Deal and rising ambition in GHG savings
I am not aware of any such difficulties.
In addition to the elements stressed regarding the RED II: CO_2 standards: The way current CO_2 standards accounts fuels emissions on the sole tailpipe approach is restrictive and inconsistent with the targets set in Art. 7a which reward fuels on a full Well-to-Wheel basis and distinguish fossil from biogenic CO_2. Adopting a consistent WTW approach in all off the EU legal framework would incentivise the uptake of better fuels with lower GHG footprint. ETD: Taxation should move away from the volume-based approach and instead account for the fossil carbon intensity of energy products. CO_2 pricing should not apply to sustainable biofuels and biomass. Rationale here is that, contrary to fossil CO2, CO2 from the use of biofuels does not increase GHG concentration in the atmosphere since the CO2 emitted was captured from the air by the biomass used as feedstock ('carbon cycle')
In addition to the elements stressed regarding the RED II: CO_2 standards: The way current CO_2 standards accounts fuels emissions on the sole tailpipe approach is restrictive and inconsistent with the targets set in Art. 7a which reward fuels on a full Well-to-Wheel basis and distinguish fossil from biogenic CO_2. Adopting a consistent WTW approach in all off the EU legal framework would incentivise the uptake of better fuels with lower GHG footprint. ETD: Taxation should move away from the volume-based approach and instead account for the fossil carbon intensity of energy products. CO_2 pricing should not apply to sustainable biofuels and biomass. Rationale here is that, contrary to fossil CO2, CO2 from the use of biofuels does not increase GHG concentration in the atmosphere since the CO2 emitted was captured from the air by the biomass used as feedstock ('carbon cycle')
In addition to the elements stressed regarding the RED II: CO_2 standards: The way current CO_2 standards accounts fuels emissions on the sole tailpipe approach is restrictive and inconsistent with the targets set in Art. 7a which reward fuels on a full Well-to-Wheel basis and distinguish fossil from biogenic CO_2. Adopting a consistent WTW approach in all off the EU legal framework would incentivise the uptake of better fuels with lower GHG footprint. ETD: Taxation should move away from the volume-based approach and instead account for the carbon intensity of energy products. CO_2 pricing should not apply to sustainable biofuels and biomass.
Overlaps with RED transport
RED II
RED II and FQD are not yet aligned.
RED limits use of food/feed crop based biofuels while FQD does not. Thus what could be a way of meeting the FQD target means incompliance with the RED rules.
RED overlap
REDII
The scope of article 7a is not clear. Does NRMM included or is it only for transport sector?
We refer to the overlapping regulation with RED/RED2.
Yes, due to major inconsistencies with REDII, the ETD in particular

INTERNATIONAL TREATIES AND OTHER INTERNATIONAL OBLIGATIONS OF THE EU AND/OR THE COUNTRY IN WHICH YOU ARE LOCATED	I do not know	No	Yes	Total
Producer / supplier of fuels (including biofuels)	9	5	2	16
Industry association	7	6	1	14
National competent authority	6	10	3	19
Other	6	6	2	14
Total	**28**	**27**	**8**	**63**

Please elaborate
CDM projects after 2020
EU directives are only guidelines, always leave room for interpretation.
I am not aware of any such difficulties.
Technical standard for alkylate gasoline.
the lack of single registry for UERs made it difficult its application due to potential overlaps with CMD
UER options: Abolishment of CDM-mechanism post 2020

NATIONAL POLICY MEASURES AND RULES	I do not know	No	Yes	Total
Producer / supplier of fuels (including biofuels)	6	3	8	17
Industry association	3	9	3	15
National competent authority	3	6	9	18
Other	4	7	3	14
Total	**16**	**25**	**23**	**64**

Please elaborate
a) and c) differences between national RED reporting and FQD reporting added extra difficulties on calculating the level of compliance: for example, RED does not include non-road fuels while FQD does. Also double counting rules differ (no double counting in FQD)
Air pollution legislative
At national level, implementation of opt-in for marine shipping
EU member states can decide to accept/refuse some types of low GHG Intensity fuels
FQD and RED targets are overlapping in Finland
Fragmented market
I am not aware of any such difficulties.
NL, has stricter rules on mass balance. Thus not allowing for example of co-production of biofuels.
same comment regarding RED and FQD transpositions in Member States regulations
Technical standard for alkylate gasoline.
the law of reduction for gasoline and diesel have some differences in definitions.
Yes, due to diverging and unclear implementing legislation

Table 29 Survey: Answers to "Do you believe that targeted reduction of life cycle greenhouse gas emission intensity of transport fuels by 6% in Article 7a of the FQD should be increased?"

	It should be removed	No, it should not be increased	Yes, above 10%	Yes, up to 8-10%	Total
Producer / supplier of fuels (including biofuels)	3	3	8	3	17
Industry association	5	1	8	0	14
National competent authority	7	4	3	4	18
Other	1	3	7	4	15
Total	16	11	26	11	64

Please elaborate
A target can only be given if a market is created for new technologies. So the target should depend upon the possible market access of the new types of fuels.
49We support an increase in ambition for 2030 in support of the Green Deal. The ambition should be set at the EU level with a common trajectory, as it is the case today. The rules should equally be applied at the EU level to minimize the risks of market fragmentation due to different implementation rules. Should the article 7a being continued with an increased ambition, this can only be achieved by removing overlapping regulations such as RED2
A continuation of the FQD emission reduction target beyond the year 2020 would lead to unnecessary burdens for fuel producers and suppliers, biofuel producers and national administrations. Furthermore, it would increase the overregulation on EU-level and together with different national policies and regulations it will ultimately lead to internal market distortions. Therefore, we are in a view that the Renewable Energy Directive is properly addressing the decarbonisation of transport fuels after 2020.
As long as RED-T is in force, the FQD/7a is overlapping with the objectives of the RED for transport and therefor it should be removed.
Before increasing the reduction obligation, two improvements in the methodology are needed. ILUC emissions should be included in the 6% reduction obligation. This should be coupled with a harmonised, legally-binding European classification system of feedstocks for biofuels to make sure that all the lifecycle GHG emissions are included in the same way across all Member States. (It should be pointed out that the classification of a feedstock as waste reduces considerably the GHG emissions of the resulting biofuel, increasing its price, provided that the classification of the feedstock as waste is accepted by a national regulator.) Once, these two improvements are implemented, the increase of the reduction obligation beyond 6% could be considered.
By 2030
Current 6% gives too small impact of overall GHG reduction.
Depends on the timeline. If for 2030 it should be above 10%
Equivalent to the eventual increase of the transport subtarget in the REDII revision to be proposed in June 2021
even 6% is not achievable with the present methods

FQD should be the determinative legislation for GHG reductions instead of RED II
Germany implemented the GHG-reduction quota in 2015 (https://www.gesetze-im-internet.de/bimschg/). The stepwise increase of the quota up to 6 % over the past years showed numerous effects on the fuel market as e.g. an increased reduction of GHG emission intensities from transport fuels (see answers in question 17-19). An increase of the target of the GHG intensity of transport fuels would strengthen and expand the positive impacts. A negative impact of the GHG quota due to lacking implementation in all EU member states was a market distortion. The obligation to implement the GHG-quota in all EU-member states since 2020 will counteract the fragmented market of transport fuels and deploy the full effect of this instrument. Therefore and regarding the 2030 Climate Target Plan, it would be important to evolve this efficient driver for low GHG/renewable fuels blending.
GHG decrease of more than 10% is needed in order to achieve ESR targets
GHG targets is not in line with renewable target stipulated in REDII. From our point of view GHG savings can be achieved by renewable targets (REDII).
Gradual increase may be needed during the period of 2020-2030
If the member state must fulfil 14% RES target in transport it is necessary increase FQD target
In line with the renewable energy share in transport to be proposed within the revision of the RED II due June 2021
In order to achieve Green Deal Goals and faster decarbonisation of transport sector increase above 10% is very much needed
In order to promote the use of fuels with high GHG savings, the targeted reduction of life cycle greenhouse gas emission intensity of transport fuels should be increased in a similar proportion than REDII mandates are increased.
In theory, we support the principle of increasing the target, but, practically, the sustainability safeguards and real GHG reduction potential of the alternative fuels should be ensured before revising the GHG target.
It is enough the FER -T target
It is not possible to reach even 6% by blending biofuels.
It was generally understood, prior to October 2019, that the 6% carbon intensity reduction target of the FQD was applicable in 2020 only. Accordingly, most Member States, including Ireland, put in place a legislative framework for supporting increased renewable fuels in transport using the biofuel blending mechanism of the RED (and RED II). While the 6% target was transposed into Irish law, it was not the driver for increased renewable fuel penetration in transport, because it was believed to cease after 2020.
More ambition needed in terms of the role of renewable fuels.
Most of the policy objectives of FQD 7a are within the scope of other EU regulations (RED/RED2/Aviation ETS). Continuing 7a would maintain the overlapping regulation, would not contribute achieving Green Deal objective and cause unnecessary administrative burden for the industry and member states as well.
necessary to meet longterm target to decarbonise transport sector
Need to be implemented a blending mandate only. Article 7/A is an overlap of the current blending mandate
Our industry is fully committed in reducing its carbon footprint: already in November 2018 we have adopted the IRU vision for decarbonisation up to 2050 This vision is based on our five pillars, one of which is the wider use of alternative fuels.
Our modelling has shown that a GHG reduction target of 8-10% would be achievable and would greatly increase GHG savings, the share of renewable energy in the transport

sector, and would be more cost efficient in terms of Euros spent per tCO2e abated than an equivalent renewable energy mandate.
Overlap with other EU directive an only mandate for both fuel supplier and OEMs should be considered
Please be specify that the requirement is only for transport fuels where it contributes most benefit.
purpose of art. 7a FQD will be achieved by REDII
RED should be the only tool for GHG reduction and RES penetration
The 6% target set in the current FQD is not achieved. This is particularly challenging for independent fuel suppliers for the following reasons: - they do not necessarily have blending facilities, and therefore the purchase of fuel that is already blended (no power to decide the type of blend purchased nor to further blend without the facility needed). - in some countries, they are not allowed to blend by law (e.g. at terminals) - they do not have access to other possibilities such as UER's, renewable electricity in transport,… - they do not always have access to timely information on the content of fuels they purchase and related renewable certificates - there is not enough advanced biofuels (lignocellulose origin, waste, HVO..) available on the market, especially not for smaller companies (with blending possibilities) - it is highly difficult to purchase fuels blended with advanced biofuels. The big oil companies retain such products for sale through their retail networks. The FQD is a suitable tool to decarbonise fuels as it is based on a WTW technology neutral approach, and it could deliver more post-2020 provided that incentives are in place and that barriers are removed. In particular, the FQD prevents the roll-out of higher biofuel blends such as B10 or E10+, even though they significantly contribute to the objective of reducing the GHG intensity of fuels included in Article 7.a.
The 6%-target should be increased to be equivalent with the RED-targets
The affordability of cars that can use fuels with a higher percentage of biofuel is crucial.
the Article 7a target of FQD contradicts with Green Deal and RED2 target as Article 7a target can be achieved by promoting fossil fuels and it doesn't differentiate 1st generation and advances biofuels
The focus should be on making the goal more sustainable with actual GHG-reductions e.g. a CO2-reduction could be given if the biofuel is 2. generation or some amount of CO2 is added due to the fuels being 1. generation. Better methodology should be made for using renewable fuels of non-biological origin. Furthermore UER's are not beneficial.
The FQD7a obligation is redundant with the RED2 obligation, and less effective, for instance because of its failure to consider the negative ILUC effect of high ILUC risk biofuels. The obligation should match RED2 more precisely.
The requirement in RED II for MS to put an obligation on fuel suppliers is enough and there should not be multiple systems for the same targets.
The target for fuels GHG intensity reduction represents one of the most efficient driver for low GHG/renewable fuels blending. It should be significantly increased post-2020 in line with the higher ambitions set out in the 2030 Climate Target Plan.
There should be alternative fuel framework or GHG reduction framework (RED II or Article 7a), not both.
This is one the most effective tools how to achieve the climate neutrality with direct influence in real life.
This response is conditional. FQD 7a mechanism should be the major tool for decarbonising the transport sector, not REDII. Thus any increase in the target, should also be accompanied with major changes in the legislative framework. FQD 7a allows for maximum flexibility and incentivizes use of the truly low-carbon fuels. This is an objective criterion policy wise as well. REDII policies have other goals apart form decarbonization of the transport sector and might not be best-suited for this specific goal.

To get to 6% is a big challenge right now due to the low availability of next gen biofuels.
To get to Net 0 in 30 years, we must set targets that get us there. I refer you to the 2017 SGAB recommendations for RED II targets. If they alone had been implemented, what could the GHG intensity have declined to? A carbon border tax could help and, at the same time, play a major role to right the wrongs of the FFC.
transport decarbonization must increase and the success of LCFS in California in terms of fuels carbon intensity reduction proves the concept is valid
Transport sector lacks behind in achieving EU GHG reduction targets. If an absolute cap on (road) transport emissions is not introduced ,than a high reduction target should be put in place.
We believe that provisions in RED II for transport create duplication with the current FQD 7a and suggest FQD 7a to be removed. Moreover we highlight that MS still should be able to decide on their own how to meet national emission reduction target (including by determining the obligated parties).
We do not believe that it is necessary to have two directives incentivizing renewable energy into the European fuel pool. Experience to date has shown that implementation of both the FQD article 7a and RED have led to a confusing landscape and less efficient markets. We therefore think that there is no need to maintain both directives and would prefer the Greenhouse Gas accounting elements of the Article 7a integrated into the RED II, which should remain the primary legislation driving renewable energy into European fuels.
We have sent you our opinion in written.
We need ambitious targets to reduce emissions in transport sector.
will be necessary to reach the longterm targets to decarbonise the transport sector

Table 30 Survey: Answers to "To what extent do you agree to the following statement" (only to those who responded to be "Producer / supplier of fuels (including biofuels)")

	Fully agree	Agree	Neither disagree nor agree	Disagree	Fully disagree	Total
The obligation to reduce GHG emissions intensity from transport fuels beyond 2020 should be continued (similar to 2020)	1	6	5	0	3	15
The obligation to reduce GHG emissions intensity from transport fuels beyond 2020 should be strengthened (higher target)	6	4	1	2	3	16
The obligation to reduce GHG emissions intensity from transport fuels beyond 2020 should be discontinued post 2020	2	0	3	5	6	16
The scope of FQD should be extended to include other fuels, e.g. gaseous fuels	4	3	9	0	0	16
The obligation to reduce GHG emissions intensity should be placed on the Member States	1	4	5	4	2	16
The obligation to reduce GHG emissions intensity should be placed on the fuel suppliers	1	3	4	3	5	16

Table 31 Survey: Answers to "Do you want to add any comments regarding potential changes to the obligations to reduce greenhouse gas emission intensity?"

A concern would also be a reconsideration of the crediting of UERs to the GHG-reduction quota as UER measurements are not affecting directly, if at all, the GHG intensity of fossil fuels consumed in the EU. GHG-savings, coming from oil extraction and occurring in third countries, shouldn't be promoted by an instrument aiming to reduce emissions in the EU. Therefore, it should be considered to ensure that any contribution of UER comes on top of the GHG-quota. In addition to question 10g: Counting e-mobility against GHG targets for fossil fuels will result in less pressure on fuel suppliers to blend low CO2 fuels In addition to question 12g: Lack of EU harmonized mechanisms is given by inconsistency between FQD and RED
A GHG reduction target would likely be much more effective if implemented as a regulation instead of as a directive.

An increase of the reduction target to 10% or higher would make sense if blending walls were removed or if there was a possibility to use a wider range of GHG credits compared to the use of only the very specific UERs
Article 7a of the FQD should be continued after 2020 and aligned with RED II and contnued use of UERs should be enabled
Define regulations with an open mind, rather seen from the 2050 world configuration, .. and not with the narrow current mindset
GHG system is good but there is no need to have more paralell systems for this, which is the case in Sweden
ILUC emissions should be included in the 6% reduction obligation. This should be coupled with a harmonised, legally-binding European classification system of feedstocks for biofuels to make sure that all the lifecycle GHG emissions are included in the same way across all Member States.
ILUC should be counted. Only biofuels that reduce in reality GHG emissions should be allowed to use, not any statistical reductions.
In case of other emission reduction solutions than biofuels are supported (e.g. UERs), their life cycle emission calculation methodology should be in line with methodologies for biofuels. Additionally, verification of these emission reductions should be brought to the level of those in biofuels - in practise, using voluntary scheme certifications. This is the only way to secure a level playing field.
It should be either FQD 7a, or REDII incorporation targets. It appears that FQD 7a is a much better tool to decarbonize the transport sector than REDII.
It would be better just to allow the recast Renewable Energy Directive (REDII) to be the only driver of GHG reduction in the transport sector. The provisions for the transport sector in REDII are already complex enough without the added complexity of Art 7a. REDII already has comprehensive sustainability criteria (incl. GHG reductions) built in.
Make incentives to make the fuels more sustainable.
Please note that our response to Q50 means that we recommend that the obligation to reduce GHG intensity of transport fuel should be continued AND strengthened. The obligation should be kept, and its ambitions should align with those of the 2030 Climate Target Plan. The EC should also evaluate how UERs are accounted, to ensure any contribution comes on top of other necessary efforts. UERs do not effect directly, if at all, the GHG intensity of fossil fuels consumed in the EU. Article 7a of the FQD seems therefore not a reasonable instrument to promote GHG savings in oil extraction.
Please note that our response to Q50 sent by email to M. Chicot means that we recommend that the obligation to reduce GHG intensity of transport fuel should be continued AND strengthened. The obligation should be kept, and its ambitions should align with those of the 2030 Climate Target Plan. The EC should also evaluate how UERs are accounted, to ensure any contribution comes on top of other necessary efforts. UERs do not effect directly, if at all, the GHG intensity of fossil fuels consumed in the EU. Article 7a of the FQD seems therefore not a reasonable instrument to promote GHG savings in oil extraction.
The FQD target should be decreasing GHG emissions from transport instead of decreasing the emission intensity of fuels.
The FQD7a obligation is good in its spirit. Unfortunately, its implementation is not helpful in its current version, and it is not coherent with other pieces of European legislation.
The level of penalties is very different from one Member State to the other, and in some case are not correlated to sale volumes, hence disproportionally affecting small suppliers. Who is defined as obligated party according to national laws is not necessarily in a position to meet the FQD GHG reduction target due to administrative or technical restrictions. Indeed, developing blending capacities or deploying alternative fuels can be difficult for independent suppliers from both a cost and technical perspective.

Generally, independent suppliers are found at competitive disadvantage compared with oil companies in the situations described above. These risks hampering the business diversification in the fuel supply market, and reinforcing monopolistic situations and market concentration.
The RED mandate and the FQD one should be considered in a synergic way in a single provision
The target should incorporate all transport fuels (intra and extra EU).
To increase the greenhouse gas emission intensity reduction of fuels, a system of credits, to be used by car industry also, need to be introduced.
We have sent you our opinion in written.
While maintaining art. 7a FQD should: 1) create a European register of UER, 2) make art. 7a FQD with the REDII directive, 3) enable individual determination of GHG emissivity for electricity generated from renewable energy sources.

Appendix E Cost Benefit Assessment Report (from approved interim report)

JUNE 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS FROM TRANSPORT FUELS

COST BENEFIT ANALYSIS REPORT (D5) – **APPENDIX B TO THE INTERIM REPORT**

PREPARED BY TECHNOPOLIS GROUP (LEAD), COWI A/S AND EXERGIA

JUNE 2021
EUROPEAN COMMISSION, DG CLIMA

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6	09/06/2021	D5.CBA report	PM, MLG, SG	LLP	

CONTENTS

1 Cost-Benefit Analysis report

This document is deliverable D5, corresponding to the Cost-Benefit Analysis (CBA). A CBA has been carried out under this study to assess the following aspects related to the efficiency of art.7a of the FQD:

- The cost-efficiency of the reporting and monitoring of life cycle GHG emissions. In particular, the analysis focused on the costs induced by the obligation of reporting and monitoring the life-cycle GHG emissions from transport fuels, on the administrative burden created by the Art 7a of the FQD on fuel / energy suppliers, looking if this administrative burden is higher for SMEs, and how these costs compare to the observed benefits.

- The cost-efficiency of the obligation to reduce the life-cycle GHG emissions. Notably, the analysis aimed at establishing the costs induced by the efforts to curb GHG emissions, identifying the benefits (and beneficiaries) of the reduction of GHG emissions, and how these costs compare to the observed benefits.

1.1 Cost Assessment – fuel suppliers

1.1.1 Approach – what has been feasible

The approach for the estimation of costs attributable to art 7a of the FQD has been designed via consultations with industry stakeholders. The major difficulties to overcome were:

- Difficulty in conceptually attributing costs solely to art 7a of the FQD

- Difficulty of respondents to provide numerical data on cost (both as a matter of definition, and availability)

To overcome those difficulties and provide meaningful insights for the evaluation and in particular the effectiveness criterion, the solution proposed is the creation of two archetypes accounting for the practice in national transposition:

- Whether a national transposition system is led by RED, FQD, or a mix of the two

- Whether a system has set a target similar to the EU target or significantly higher

The following tables summarise the archetypes:

Archetypes for administrative costs
Archetype A: Countries that transposed the legislation with FQD 7a target as leading target
Archetype B: Countries that transposed the legislation with RED target as leading target
Archetype C: Countries that transposed the legislation with both RED and FQD 7a

Target level archetypes
Archetype 1: Countries implementing the minimum 6% greenhouse gas intensity reduction
Archetype 2: Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets (Finland, Sweden)

To operationalise the approach and validate the outcomes a series of consultations with stakeholders have been performed:

(1) interviews for the mapping of costs
(2) follow up interviews using cost templates partially pre-filled
(3) survey to collect raw cost estimates
(4) interview with *FuelsEurope*
(5) survey with members of Fuels Europe using cost templates partially pre-filled
(6) validation workshop

At the moment we are awaiting further inputs for validation via the survey with members of Fuels Europe (5) before we can proceed with the final validation workshop (6).

1.1.2 Summary of findings from the Survey

Findings from the survey show that overall, costs attributable to art. 7a of the FQD are limited. In the case of administrative cost, the range vary from 0,5 to 2,5 FTE/month. It is unclear if the transposition mode makes a difference. Regarding substantive cost, respondents provided few answers, and no consensus seemed to appear. A few numbers were given, which will need to be compared to other sources of information. The highest estimates provided were an increase of 5% in fuel cost, and an increase of 130 Euros per tonnage gasoline. The results of the survey tend to confirm that the main cost is related to purchasing and blending biofuels, and that suppliers of different Member States might not be equal in their capacity to purchase the needed quantities (the main hurdle identified being lack of harmonised EU rules).

When it comes to testing the country archetypes for either administrative cost (legislation transposition) or substantive cost (emission reduction target), no significant difference was found in the way they affect suppliers, apart from the need to blend more biofuels in countries with higher targets.

Finally, stakeholders' comments confirm that it is difficult to disentangle RED and FQD related costs.

Survey respondents: 24 suppliers contributed to the survey. They came from 15 Member states and Iceland and were generally active in other Member States. 13 suppliers provided a variety of fuels, while two provided only Synthetic fuels, two only biodiesel, two only bioethanol and one only drop-in biofuels. While some questions were directly aimed at estimating costs, others offered for a more qualitative assessment on the nature of their costs.

Administrative costs: In the survey, respondents were asked to provide cost estimates for: Outsourcing monitoring and reporting activities; Equipment, software, databases to support monitoring and reporting. However, no supplier provided any estimate.

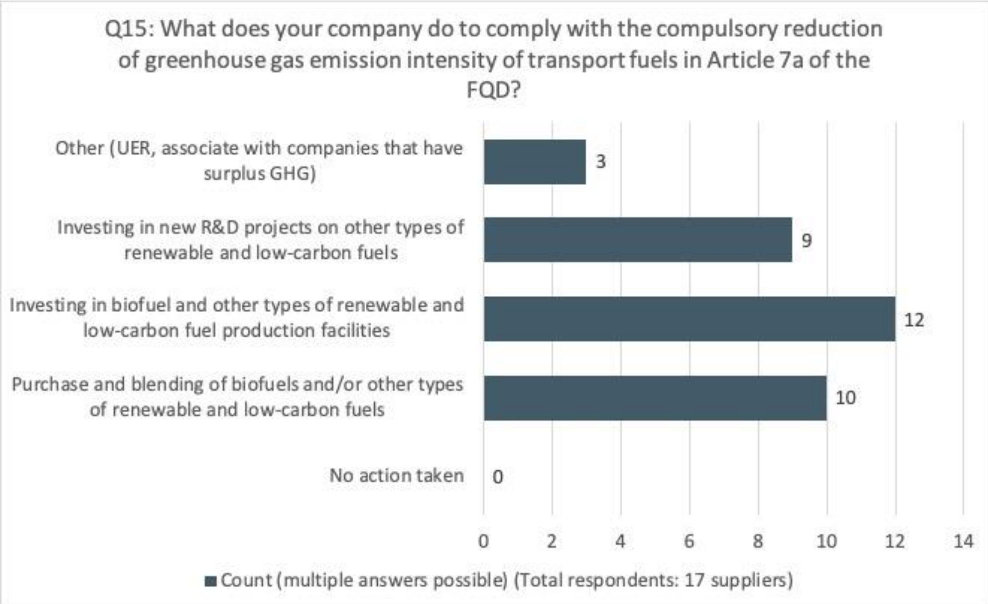
Suppliers were also asked to comment on personnel costs. We received answers from nine respondents:

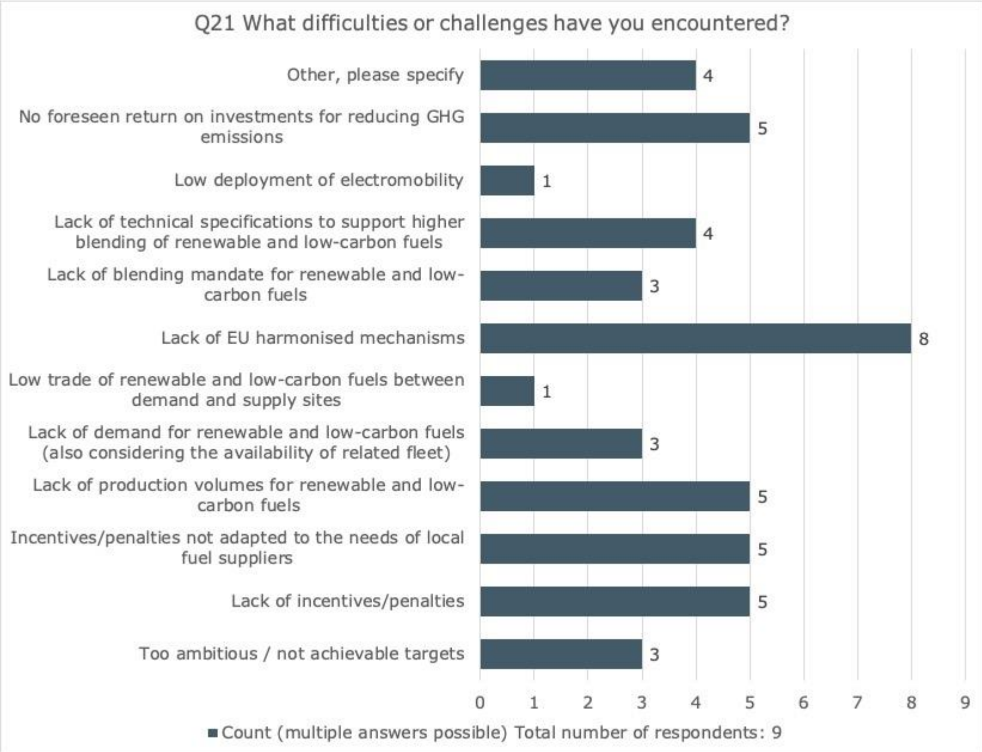
- one respondent from a country which transposed the legislation with Art. 7a of the FQD target as leading target (Archetype A) indicated 1 FTE per month.
- five respondents from countries that transposed the legislation with RED target as leading target (Archetype B) countries indicated 0,5 FTE (n=1) and one FTE (n=3). One respondent that answered with one FTE commented that it is difficult to separate from sustainability criteria compliance work (link to RED), but that their figure includes GHG emission management, accounting, reporting and verification. In Estonia, monthly reporting is required, which is considered time consuming (no estimate provided).
- three respondents from countries that transposed the legislation with both RED and art. 7a of the FQD (Archetype C) indicated: three days/month, one FTE and 2,5 FTE.

Substantive costs: Survey respondents were asked to comment on the increase of the commodity cost due to higher renewables blending resulting from Article 7a of the FQD. In archetype 1 countries' (where the target is close to the EU target of 6%), answers varied between 0% (n=2, one Italian respondent indicated that operators are not matching the obligation due to the negligible value of the fine in the country; the other did not observe an increase of net fuels costs), 2% (n=1), 3% (n=1) or 5% (n=1). Another respondent indicated that while fuel prices became significantly higher, this is attributable to RED rather than art. 7a of the FQD.

In Archetype 2 countries (where the target is significantly higher than 6%), only two answers were received. One indicated approximatively €130 increase per tonnage gasoline, and the other indicated that this increase cannot be separated from cost induced by RED blending obligation.

Regarding indirect costs, questions 15 and 21 provided indications. Responses presented in the graphs below only account for suppliers' answers.





1.1.3 Summary of findings from interviews

A total of six interviews, with four large companies and one association of fuel suppliers were conducted. Company 1 and 2 are predominantly active on their national or regional market (respectively Greece and Finland/Sweden), while Company 3 and 4 are multinationals. Company 1 is a "large" SME (about 220 employees in fuel supply market) with an annual turnover of 2 billion euros. Company 2 is a smaller player but is the fuel procurement subsidiary of a larger player. Their annual turnover is around 5,5 billion euros, and while the company itself has 50 employees, the mother company employs about 780.

General remarks:

Company size: There is no need to distinguish companies by size, as all of them can be considered large due to their turnover or balance sheet. Small companies are normally not bound by obligations set in Art. 7a of the FQD, unlike the fuel supplier/-s they buy from.

Measurement unit: Turnover is typically used to provide cost estimates in relative terms, namely because it is public information companies report on. However, in the case of the energy sector costs should not be expressed as a share of turnover, as most of the turnover comes from collecting and paying excise duties. The alternative of using net profit with data collected directly from companies is not a viable option either. The current measurement used is to measure the cost per million ton produced.

Economic costs: The cost of the regulation and thus also the penalties imposed on companies due to non-compliance is expected to be entirely passed on to the consumers.

Relevance of archetypes: The question of disentangling costs from Art. 7a of the FQD and RED was recurring throughout the interviews. Fuel suppliers were reluctant to provide costs attributable to the Art. 7a of the FQD only, as it would lead to wrong conclusions considering, for instance, the countries leading national transposition with RED that would attribute a zero cost to the Art. 7a of the FQD. To address this complexity, and as costs relate to national transpositions, it was decided to set up archetypes to differentiate two variations in transposition:

- Whether a country had implemented a system led by RED, FQD, or a mix of the two
- Whether a country had set a target similar to the EU target or significantly higher

The above archetypes formed the basis for discussion with fuel suppliers.

In Table 1, Table 2 and Table 3 we summarise the findings per cost category.

Table 1 Administrative costs

Company profile	Main observations
Company 1 Archetype: C	All companies in the country have outsourced monitoring and reporting to consultants. In their case, it amounts to 5000€ per year. To this, they add an overall of 1 day of work per month.
Company 2 Archetype: A and B	The monitoring system in place to answer to FQD requirements would have been put in place without the legislation.
Company 3 Multinational Archetype: interviewee was not country-based and thus archetype specific	A total of 2 FTE per country of operation are attributable to FQD and RED, broken down between 1 FTE to gather data and submit reports, and 1 FTE to understand the country’s legislation. From an administrative perspective, whether the national transposition corresponds to one archetype or another does not make any difference: the administrative cost is common for both FQD and RED, and in a world where RED exists, having FQD or not makes no difference to their costs.
Company 4 Multinational Archetype: interviewee was not country-based and thus archetype specific	The fourth company did not discuss administrative costs.
Association	In 2017 administrative costs have been substantial, as most of the data on fuel origin was impossible to gather. But for the 2018 reporting period, as the requirements changed,

Company profile	Main observations
	administrative costs are now minimal. This can be fully attributed to the revised reporting requirements.

Table 2 Substantive costs

Company profile	Main observations
Company 1 Archetype: C	Reported no substantive costs as there has been no increase in the use of renewables, a result of the local market conditions (namely the quotas for biodiesel with very high prices, a result of limited number of producers i.e. 10-12 producers in total which means fuel suppliers have access to only expensive biodiesel). The result of this is that the company will need to pay a penalty.
Company 2 Archetype: A and B	Reported no CAPEX, and considered this question irrelevant with regards to the legislation's objective. They also considered that the lack of implementation, apart from countries like Sweden with a high target, resulted in no substantive costs for suppliers.
Company 3 Multinational Archetype: interviewee was not country-based and thus archetype specific	Indicated that the main cost driver, overall, is the cost of blending renewables in fuel. This cost is in direct correlation with the target of the country. Indeed, the only way to reduce emissions over the period has been to blend additional amounts of renewables. However, once again, the existence of RED makes the attribution of the cost of blending to the Art. 7a of the FQD questionable. Whether the country transposed in a system led by one or the other makes no difference, but if the FQD was to be repealed, while RED was kept, blending would still exist, and the cost would not disappear. Finally, as prior to the FQD and RED there was no blending in Europe, the substantive cost of national transposition is fairly easy to assess, and corresponds to the cost of blending.
Company 4 Multinational Archetype: interviewee was not country-based and thus archetype specific	*The fourth company* did not discuss substantive costs.
Association	Confirmed the indication of Company 3: the cost of renewable is the key variable. As a result, availability of biofuels is also a key factor.

Table 3 Penalties

Company profile	Main observations
Company 1 Archetype: C	*Company 1* indicated that as they are materially incapable of increasing the level of blending in their supply, they expect to miss their national target, and to be fined up to 10% of their profit.
Company 2 Archetype: A and B	*Company 2* does not expect to miss the national target.
Company 3 Multinational Archetype: interviewee was not country-based and thus archetype specific	*Company 3* discussed the different systems in place in different countries, which lead to different incentives. For example, the Austrian system, and some Central and Eastern European countries are considered particularly permissive, where companies are better off paying the fine than meeting the target. In other countries, such as Belgium or the Netherlands, high fines sometimes combined with criminal charges incentivise compliance.
Company 4 Multinational Archetype: interviewee was not country-based and thus archetype specific	*Company 4* discussed different penalties in their countries of operation. They claim to always aim at reaching the target, regardless of the incentive. They discussed the case of France which had a high target at the time (10%), which was complicated for the industry but also triggered a transformation.
Association	*The supplier association* indicated that non-compliance will likely be the biggest cost of the legislation. According to their internal analysis, they expected to reach 4% of GHG emissions reduction by 2020, prior to the COVID-19 pandemic. The two missing percent would have represented 600 billion euro in penalties, at EU level.

Mechanisms to support companies

Upstream Emission Reduction (UER), traded values and double-counting were discussed, but considered negligeable, as while helpful, they are rarely available.

Table 4 Indirect costs

Company profile	Main observations
Company 1 Archetype: C	*Company 1:* There are limits to the quantities they can blend, due to the legal requirement to constitute safety stocks, and the lack of availability of high sustainability biodiesel. The quota system in place to protect producers hinders competition but it is necessary to maintain local production. The lack of infrastructure is also an issue. Prices have also increased due to heightened competition between Member states, and especially from member states that apply double counting, where suppliers can

Company profile	Main observations
	pay a higher price, forcing suppliers from other countries to buy on other producers than those of their own country.
Company 2 Archetype: A and B	Company 2 confirmed the remarks of company 1 regarding competition between member states. As suppliers in a country with a very high target and corresponding penalties, they have a strong incentive to buy at a higher price, than suppliers from countries with a lower target.
Company 3 Multinational Archetype: interviewee was not country-based and thus archetype specific	According to Company 3, the penalty system will drive where sustainable fuels will be bought.
Company 4 Multinational Archetype: interviewee was not country-based and thus archetype specific	The impact of differing transposition was also pinpointed by Company 4, which indicated that it is very hard to assess costs of FQD for a specific country due to interference of neighbours.
Association	Not discussed.

1.1.4 Results of the substantive costs calculation

Substantive costs are associated to the increased use of renewables. For substantive costs there is a clear link between the national stringency of countries' legal framework and the use of renewables by suppliers i.e., the countries with additional targets under other legislations which render the 6% target obsolete (e.g., Finland and Sweden). For instance, in Sweden a national GHG quota is implemented: Petrol quota for 2020 is 4,2% and diesel quota is 21%. The two archetypes are described below. By design, the archetypes were proposed as the industry was explicit that no attribution of the costs to the Article 7a of the FQD is possible but rather its transposition to national law. To better reflect this point this distinction between countries based on national transposition has been retained in the calculations.

Table 19 Archetypes typologies

Target level archetypes
<u>Archetype 1</u>: Countries implementing the minimum 6% greenhouse gas intensity reduction **<u>Archetype 2</u>: Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets (Finland, Sweden)**

The baseline for the calculations is the year 2010, which is also the baseline for the emission reduction target. With the latter baseline in mind, the increase of the cost per thousand ton between 2010 and 2019 is estimated as follows:

- In countries implementing the minimum 6% greenhouse gas intensity reduction:
  - €0,20 per thousand litre of blended petrol
  - €1,30 per thousand litre of blended diesel
- In countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets. These estimates correspond to costs attributable to practices motivated by a a higher than 6% greenhouse gas intensity reduction target:
  - €7,10 per thousand litre of blended petrol
  - €19,0 per thousand litre of blended diesel

The assumptions on blending shares are based on Eurostat national reporting, and fuel prices are based on desk research (see Table 20).

The reason for using this distinction between

Assumptions:

(1) Assumptions had to be made on the cost of fuel. A distinction was originally made between the theoretical cost which corresponds to quoted prices that are publicly available and the actual cost which depends on companies' strategies. To simplify the latter the study assumes the average purchase price of term contracts during the period 2017-2019 to correspond to the term contract price.

Table 20 Fuel prices

Theoretical price: quoted price/term contract price (without taxes) in EUR	
Measurement	Period 2017-2019 (3-year average)
Source	Desk research[1]
Petrol price per 1000 lt[2] of fuel	€537
Diesel price per 1000 lt of fuel	€574
Biodiesel price per 1000 lt of fuel	€717
Bioethanol price per 1000 lt of fuel	€733

(2) Blending assumptions before and after FQD have been made using Eurostat data for the period 2017-2019 and validated via interviews with industry. A distinction is made according to the target level archetypes described in Table 19. This distinction is necessary as it is impossible for companies to hypothesize what they would have done for FQD in the absence of the more

[1] See: https://ec.europa.eu/energy/data-analysis/weekly-oil-bulletin_en; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0951; https://www.indexmundi.com/commodities

[2] 1,000lt equals 1,119t.

stringent targets set nationally. The baseline before FQD is set as 2010 and uses the EU average of renewables shares.[3]

Table 21 Blending shares

Blending assumptions	Baseline before FQD/RED (2010)	Countries implementing the minimum 6% greenhouse gas intensity reduction (2017-2019)	Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets (2017-2019)
Share of petrol	0.953	0.952	0.917
Share of diesel	0.944	0.945	0.836
Share of biodiesel	0.056	0.057	0.169
Share of bioethanol	0.047	0.048	0.083

The additional substantive cost for fuel suppliers operating in countries implementing the minimum 6% greenhouse gas intensity reduction is low (estimated at € 0,20 per thousand litre of blended petrol and € 1,30 per thousand litre of blended diesel). This is not surprising as their average uptake of renewables between 2010 and the period 2017-2019 has only increased marginally remaining at the level of 5-6%. None of these countries meet the target of 6% lower than the 2010 levels which shows that the uptake of 5-6% of renewables is insufficient. The total cost hence for those countries will account for the penalties imposed which are still unknown.

[3] ***Based on the following Eurostat dataset:*** Supply, transformation and consumption of oil and petroleum products [nrg_cb_oil], Final Consumption Transport Sector Road.
Data used:
Petrol: "Motor gasoline"
Diesel: main dataset "Road diesel", and "Gas oil and diesel oil" for Bulgaria (years 2017-2018-2019. Explanation: for these years the road diesel dataset reports 0, and for previous years it reports the same data as this second dataset. We assume the coverage is the same)
Bioethanol: Combination of "motor gasoline" and "Motor gasoline (excluding biofuel portion)" Biodiesel: "Blended biodiesels".
Baseline: EU average, 2010.
Archetype - Countries implementing the minimum 6% greenhouse gas intensity reduction: Average of all MS but Finland and Sweden, Three-year average (2017-2019).
Archetype - Countries implementing additional related targets under other legislations which imply higher than 6% greenhouse gas intensity reduction targets: Average of Sweden and Finland, Three-year average (2017-2019).

Figure 1-1 Substantive costs calculation

Million Tons attributable to FQD	2,5

	Theoretical price : quoted price
Measurement	period 2018-2020 in million euro (3 year average, see source below)
Source	desk research
Petrol price per thousand lt of fuel	537
Diesel price per thousand lt of fuel	574
Bioedieselprice per thousand lt of fuel	717
Bioethanol price per thousand lt of fuel	733

			Baseline before FQD/RED (2010)		Archetype: X National targets match/are very close to EU min targets		Archetype Y: National targets far exceed EU min targets	
		variables	theoretical cost	term contract cost	theoretical cost	term contract cost	theoretical cost	term contract cost
Substantive obligations as a result of 'obligations' included in FQD	•Cost of low carbon fuel •Cost of blending	**Cost per thousan lt of fuel (blended petrol)**	546,212	0	546,408	0	553,268	0
		Cost per thousand lt of fuel (blended diesel)	582,008	0	583,299	0	601,037	0
		Blending						
		Share of petrol	0,953		0,952		0,917	
		Share of diesel	0,944		0,945		0,836	
		Share of biodiesel	0,056		0,057		0,169	
		Share of bioethanol	0,047		0,048		0,083	

			Δ Archetype X		Δ Archetype Y		Δ Cost Archetype X		Δ Cost Archetype Y	
		variables	theoretical cost	term contract cost	theoretical cost	term contract cost	theoretical cost	term contract cost	theoretical cost	term contract cost
Substantive obligations as a result of 'obligations' included in FQD	•Cost of low carbon fuel •Cost of blending	**Cost per thousan lt of fuel (blended petrol)**	0,2	0	7,1	0	0,49	0	17,64	0
		Cost per thousand lt of fuel (blended diesel)	1,3		19,0		3,2275		47,6	
		Share of petrol								
		Share of diesel								
		Share of biodiesel								
		Share of bioethanol								

1.1.5 Penalties/Compensation

Penalty systems vary across Member States, and so does the possibility to quantify expected penalty levels for 2020. We have combined indications provided by stakeholders and documentation on transposition:

- Conformity Checking of measures of Member States to transpose Council Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC (2019)
- Information provided by a fuel supplier and by *FuelsEurope*

Results remain partial as the Conformity checking does not necessarily differentiate penalties for failing to meet the Art. 7a of the FQD target, and penalties linked to fraud or failure to comply with reporting obligations. Our own assessment only focuses on the former, but in case of uncertainty, sanctions reported in the Conformity checking have been included in our mapping. Information provided by the industry was sometimes outdated, and incomplete. When two sources of information seem to contradict each other, this is indicated. Nonetheless, a typology of the different systems is possible:

Type 1: A number of Member States and the UK have defined distinct and easily quantifiable penalties for failure to meet the target, based on a penalty per each excess ton of CO_2 equivalent released in 2020. Penalty levels and a provisional estimation of total penalty cost at Member States level is described in the table below.

Table 22 Penalty regimes type 1

Country		charge / t cO2 eq		Excess tCO2eq expected in 2020 (kt)[4]	Estimated Penalty/ Compensation[5]	Additional penalty
	<6% GHG	<4% GHG	<2%/2,7% GHG			
Austria	15	15	15	786	11.785.519€	Fine up to 5000€ (or imprisonment)
Czechia	400	400	400	500	200.140.717€	Fine up to 1935€
Finland	1000	1000	1000	None		Option of a daily fine for each day during which the offence persists
Germany	470	470	470	5234	2.459.977.650€	administrative fines range from EUR 5 to EUR 1000 and the sanction shall exceed the economic advantage which the person had from the administrative infringement. When the maximum amount is not sufficient to reach this result, it may be exceeded.
Greece	2	10	100	589	5.891.100€	Fine 1000-5000€, further sanctions for relapse or recurrence
Hungary	30	300	300	626	187.902.131€	Fines of 313€ to 313.479€
Luxembourg	720	720	720	231	166.208.843€	Fines 251€-20k€. Additional prison up to 6 months

[4] Estimated 2020 data based on 2017 and 2018 reporting (source: EEA and EIONET). Estimation based on: target completion in 2017 and in 2018, emission levels in 2018. In countries where emissions increased in 2017, or where there was a decrease in reduction in 2018 compared to 2017, or where no data was reported in 2017, it was estimated that target completion would remain the same in 2019 and 2020 as it was in 2018.
[5] When several levels of charges exist, we used the charge according to country level target completion. E.g. in Greece, it is estimated that in 2019, they will have reached 3% reduction, so we applied a penalty of 10€/tCO2eq.

Slovakia	15	185	370	231	42.643.610	
Sweden	386 / 482	386 / 482	386 / 482	None		
UK	83	83	83	4472	357.765.939€	Fine: 1/ twice the value of the GHG credits which the account holder has gained or attempted to gain; or 2/ 10% of turnover; and 3/ in any other case 56.600€ or the amount equal to 10% of turnover, whichever is the lesser.

Type 2: Some Member States have opted for **other forms of penalties directly related with the Art. 7a of the FQD target**.

Table 23 Penalty regimes type 2

Country	Excess tCO2eq expected in 2020 data (kt)[6]	Penalty regime
Italy	2390	4-6%: 300k-500k (at country level, expected reduction >4%) 2-4%: 500k-800k 0-2%: 800k-1000k And fines of 15k€-150k€
Lithuania	288	Industry: The latest draft foresees penalties of up to 3000€ for incompliance with the 6% reduction target Conformity check: fines 500€-1000€
Poland	1297	Industry: ETS EUA price * energy intensity per extra ton of CO2 equivalent Conformity check: fines up to 1000€

Finally, in many Member States, **other types of penalty** apply. They are summarised below. Several remarks apply to these:

- In most cases, it is unclear if the penalty applies to failure to meeting the target or only to failure to monitor and report.
- In Belgium and in the Netherlands, the application of other (more general) regulations for penalties has been chosen.
- In RED-led countries, while there might not be an Art. 7a of the FQD target related penalty, the penalties related to the failure of meeting RED targets will apply. These penalties are not reported. Some RED-led countries nonetheless adopted Art. 7a of the FQD sanctions (Hungary, Finland).

Overall, we can distinguish some Member states where failure to meet the Art. 7a of the FQD target will lead to high cost for suppliers, and some Member states where the penalty is considered as a disincentive to comply.

- Suppliers face imprisonment or criminal charges in Austria, Luxembourg, Belgium, Cyprus, Denmark, Malta.
- Suppliers face a withdrawal of licence in Bulgaria, Cyprus, the Netherlands (including confiscation of property), and Spain.
- Particularly high fines are expected in Hungary, UK, Belgium, Denmark, Estonia, Ireland, the Netherlands.
- Sanctions are considered insufficient in Austria (despite the possibility for prison sentences), Poland, Czech Republic, Germany.

[6] Estimated 2020 data based on 2017 and 2018 reporting (source: EEA and EIONET). Estimation based on: target completion in 2017 and in 2018, emission levels in 2018. In countries where emissions increased in 2017, or where there was a decrease in reduction in 2018 compared to 2017, or where no data was reported in 2017, it was estimated that target completion would remain the same in 2019 and 2020 as it was in 2018.

Table 24 Other penalty regimes

Country	Excess tCO2eq expected in 2020 data (kt)[7]	Penalty regime
Belgium	1,071	According to industry: Penalty up to 3 years prison and max 32 M€ fine. Administrative fine up to 1.6 M€ According to Conformity checking (2019): fine 52-120k€ and up to 1 year imprisonment
Bulgaria	244	Licence withdrawal and fines of 512€-5112€ for natural persons, double for legal persons
Croatia	528	Fine 3,000-9,000€ for natural persons; 4,000-15,000€ for legal persons.
Cyprus	131	Fine up to 87,200€, up to 5 years imprisonment, licence withdrawal. Further sanctions if failure to comply with first sanctions.
Denmark	512	A court decides the size of the penalty (there is no upper limited). Criminal charges are possible
Estonia	108	According to industry: Penalty up to 400k (might be reviewed, up to 10M) According to Conformity checking (2019): Fine up to 1,200€ for natural persons, and up to 128k€ for legal persons
France	3,444	Fine 300-3,000€. Option of a daily fine for each day during which the offence persists
Ireland	494	Fine of up to 250,000€
Latvia	103	Industry: 0.01% of the fuel supplier's net turnover in the last financial year, including supply and trade. Conformity check: Fines 200€-10,400€
Malta	11	Option of a daily fine for each day during which the offence persists Prison
Netherlands	None	Administration fines up to 10% of annual sales value, high reputational damage risk. Additionally, provisions to require the complete or partial cessation of the convicted person's enterprise, confiscation of property, community service and cessation of the convicted person's rights in relation to the enterprise.
Portugal	694	Fines of 1,000€ - 3,700€ for natural persons. 2,000 – 44,500€ for legal persons
Romania	906	Fines 4,200€ - 14,000€
Slovenia	49	Fines 2,000€ - 100k€
Spain	2,999	Fine 600k€ - 30M€, licence withdrawal

[7] Estimated 2020 data based on 2017 and 2018 reporting (source: EEA and EIONET). Estimation based on: target completion in 2017 and in 2018, emission levels in 2018. In countries where emissions increased in 2017, or where there was a decrease in reduction in 2018 compared to 2017, or where no data was reported in 2017, it was estimated that target completion would remain the same in 2019 and 2020 as it was in 2018.

1.2 Cost assessment for Member States

1.2.1 Summary of findings on Costs interviews with Member States

Nine Member State authorities answered questions related to efficiency during interviews. They cover Austria, Belgium, Czech Republic, Denmark, Germany, Greece, Lithuania, Slovakia, Sweden. The reporting below focuses on answers to Efficiency Q8.

How has Art 7a of the FQD been transposed in your country?

- Transposition leading with FQD target: Czechia (yet with a limited blending mandate)
- Transposition leading with both RED and FQD targets:
  - Austria
  - Belgium (includes a high RED blending mandate, and art. 7a of the FQD target of 6%)
  - Greece (with no double counting)
  - Denmark
  - Sweden (they include high-blend biofuels into their reporting, contrary to other countries. They disagree with the idea of having an exceptionally high target and mention high engagement from companies instead)

Lithuania transposed all disposition of art. 7a of the FQD in national law, but it is unclear if it is combined with RED or not.

What were the types of costs induced by the obligation of monitoring of life cycle GHG emission introduced by article 7A of the FQD?

Four countries were unable to determine costs. Difficulties to disentangle from RED cost was mentioned by one of them. Two countries reported costs, indicating that they are not attributable to FQD as they correspond to existing costs when only RED was there. Costs reported vary from:

- No additional cost for authorities. Suppliers pay 1,500-2,000 euros per report, done by the independent verifier (LT)
- one FTE (BE)
- two FTE for both RED and FQD (DK)

How does the national penalty system work? Provide when available the information on euro per ton of CO_2 equivalent (€/t CO2 eq.) What are the benefits of the reduction of GHG emission intensity of transport fuels?

Some countries have adopted specific FQD sanctions (SE, CZ, AT) while others have opted for sanctions included in more general laws on public standards or environmental law (BE). Some sanctions are fixed (e.g. a certain penalty per extra ton of CO_2 equivalent), while others are up to court decision. An overview of the current system is provided in Section 1.1.1 Approach above.

On the capacity of suppliers to reach the target or face penalties, not all companies are equal. For example, in Slovakia, the interviewee reported that while refineries are likely to either meet their target or pay the penalty, smaller operators such as reseller will have to find ways to meet the target, or face bankruptcy. They expect some value chain "solidarity" (with refineries selling some of their savings to their direct customers), which will inherently benefit bigger players.

How do the costs compare to the observed benefits?

To this question, one respondent answered that considering that most of the burden to suppliers already pre-exist with RED, the additional cost to suppliers is "not that high". Another authority indicated that the penalties being two to three time higher than the cost of implementing the legislation, suppliers are better off reaching the target.

Does the compulsory monitoring of life cycle greenhouse gas emissions increase administrative burdens for some categories of fuel suppliers?

Answers to this question were mixed. Three authorities indicated that this burden exists but should be limited, as RED reporting already exists and FQD reporting is not much more. Belgium indicated that if a company needs to buy a certificate, then this is likely to drive further costs. Two other authorities indicated a perceived high burden from the side of the companies. While Lithuania considers that the reporting cost is important to ensure accurate statistics and is therefore proportionate, Greece called it "disproportionate" as several instruments add up.

How would the cost of reporting and monitoring change if the scope of the FQD is extended to include other types of fuels?

Four respondents indicated that this is unlikely to cause additional cost if the reporting remains similar, and that a broad range of fuels is already included.

How would the costs induced by the efforts to curb GHG emissions of transport fuels change if the obligation is strengthened post 2020?

Three interviewees responded to this question, agreeing on the likelihood of a proportionate increase between a higher obligation and costs, and one indicated that this cost would be transferred to customers.

1.2.2 Cost Assessment MS representatives

The assessment is based on six interviews with EU MS representatives.

Table 25 - FQD Costs Assessment – Member states

Country	Administrative cost	Enforcement cost	Other	Estimate
Denmark	2 FTE for both FQD and RED	n.a.	n.a.	83,104
Belgium	1 FTE	n.a.	n.a.	41,552
Lithuania	-	n.a.	n.a.	-
Netherlands	15 FTE working on RED and FQD (including inspectors)	x	n.a.	623,280
France	2 FTE for both FQD and RED (among which one FTE in ICT)	x	n.a.	84,672
Bulgaria	1 FTE, for both FQD and other tasks	n.a.	n.a.	41,552

Notes:

(1) Four out of seven authorities consulted were not able to determine their cost. Of the three who did provide an estimate for administrative cost, the attribution to the Art. 7a of the FQD is hard to separate from RED cost.

(2) Estimates assume a labour cost according to Eurostat data: 37.1 average hours per week, 56 weeks in a year, €20 average hourly labour cost levels (plus taxes minus subsidies) in the EU-27 for administrative and support service activities [lc_lci_lev].

(3) The 2017 REFIT of the FQD study indicates that the costs ranges can only be considered indicative, given that data was only provided by six Member States.

Appendix F Report on calculation of GHG emissions for various fuel mix scenarios (from approved interim report)

MAY 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS FROM TRANSPORT FUELS

REPORT ON CALCULATION OF GHG EMISSIONS FOR VARIOUS FUEL MIX SCENARIOS (D7) –
APPENDIX C TO THE INTERIM REPORT

PREPARED BY TECHNOPOLIS GROUP (LEAD), COWI A/S AND EXERGIA

MAY 2021
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CONTENTS

1 Report on calculation of GHG emission intensity of the transport fuel mix of the MIX55 scenario of the 2030CTP

1.1 Introduction

The present section presents the methodology and the details of the calculation of GHG emission intensity of the transport fuel mix using the MIX55 scenario of the 2030 Climate Target Plan (2030CTP). It essentially reports on the activities performed under Task 2 of the project.

The aim of Task 2 is to calculate the GHG emission intensity (GHGi) of the transport fuel mix in 2030 and to determine reductions compared to the 2010 baseline set in the FQD/RED II (i.e. 94 grCO2e/MJ).

The GHG emission intensity calculations are based on:

(a) the fuel mix of the transport sector as it is reported in the MIX55 climate ambition scenario of the 2030CTP, accounting for COVID-19 impact and considering the EU27 without the UK,

(b) the life cycle approach of the FQD, and

(c) the provisions of RED II with respect to transport fuels.

The objectives of the analysis to be performed are to

(a) support the analysis of the Policy Options for the future of FQD Article 7a, discussed in Task 3 of the project,

(b) identify the estimated contribution of the different fuels in the overall GHG emissions, and

(c) identify potential gaps between the projected results for low carbon fuels utilization and the relevant policies and supporting effort required.

For reasons of completeness of the presentation of the analysis within this section, it is noted that the MIX55 scenario anticipates 55% GHG reductions in 2030 considering expansion of carbon pricing to the transport and buildings sectors and a moderate increase of the ambition of policies related to deployment of renewable fuels in the transport sector. Further details on the policies considered in the MIX55 scenario have been presented in the Task 2 section of this report while the reader is referenced to the original publication for full information[1].

1.2 GHG intensity calculations

For the calculation of the GHG intensity of the 2030 transport fuel mix, the following three steps have been employed:

- **Step 1:** Identification of the available quantities of fuels or energy carriers (expressed in ktoe) in the transport fuel mix of the MIX55 scenario of the 2030CTP.

- **Step 2:** Determination of the greenhouse gas intensity (GHGi, expressed in terms of grCO2e/MJ) for each identified fuel or energy carrier of Step 1, following the life cycle approach of the FQD Art. 7a.

- **Step 3:** Performance of calculations for the overall GHG intensity of the assumed transport fuel mix in 2030 and parametric analysis (to the extent it is needed) to support the assessment of policy Options in Task 3 (Impact Assessment of Policy Options).

The sections below will expand on each of the above three Steps.

1.2.1 Step 1: Identification of the available quantities of fuels or energy carriers in the transport fuel mix of the Mix55 scenario of the 2030CTP

The fuels and energy carriers reported in the 2030CTP for the MIX55 scenario have been considered. The relevant data have been provided by DG CLIMA (PRIMES-TREMOVE extracts).

Under Step 1, the following actions are undertaken:

- Analysis for the correspondence of:

  (a) the fuels or energy carriers reported in the 2030CTP (referred to as "**2030CTP fuels**"),

  (b) the fuels or energy carriers considered by the FQD and RED II (referred to as "**FQD Fuels**"). This analysis is of particular importance for the case

[1] Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people. SWD(2020) 176 final, 17.9.2020.

of non-fossil fuels and carriers; the recent studies of JRC v1d, (2019)[2]; and the JEC v5, (2020)[3] are considered for feedstocks for non-fossil fuels.

› Identification of the quantities reported for each fuel or energy carrier in the 2030CTP results that fall within the scope of the FQD 7a, namely, the consumption sectors of Road Transport, Rail and Inland Navigation.

Looking at the results of the CTP, there is a misalignment between the level of detail of the composition of the fuel slate considered and reported therein, and the fuel options available within the scope of the FQD 7a; FQD (and also RED II) consider a more extensive list of fuels and energy carriers that are eligible for the GHG intensity reduction target of the FQD 7a.

Furthermore, a point that has to be mentioned, is that the present work primarily considers the fuel mix of 2030. Calculations are extended to 2050 on the basis of the available data on the quantities of fuels provided in the MIX55 scenario of the CTP, however, the corresponding results are only considered here so as to provide an indication on the trends[4].

Based on the above, a number of reasonable assumptions are made as follows:

› Bio-gasoline considered to be blended with fossil gasoline fuel is considered to be 2nd Generation Ethanol[5].

› Bio-diesel considered to be blended with fossil diesel fuel is assumed as a mix of HVO and biodiesel. In particular, based on the recent work conducted by RICARDO[6], an allocation of 55% HVO and 45% biodiesel is considered for 2030.

› Hydrogen for Fuel Cell Vehicles is considered as compressed hydrogen in a Fuel Cell, in line with the provisions of Annex I, Part 2(5) of the FQD reporting and calculation methodology Directive (2015).

› Electricity used in transport: the EU average electricity generation mix, as it is reported in the MIX55 scenario of the CTP, is considered.

› Natural gas used in transport: Based on the WTT study of JEC (2020), the expected distribution of the pipeline natural gas in 2030 is considered.

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[2] https://ec.europa.eu/jrc/en/publication/definition-input-data-assess-ghg-default-emissions-biofuels-eu-legislation
[3] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/jec-well-wheels-report-v5
[4] The extension of the carbon intensity calculations to 2050 requires assumptions on the feedstock availability for advanced biofuels as well as the evolution of the relevant conversion technologies, which is a task that goes beyond the scope of the present work. However, it is mentioned that in cases where the relevant information was available (e.g. the evolution of the electricity mix in Europe) has been considered.
[5] Communication with the 2030CTP authors
[6] https://ee.ricardo.com/downloads/transport/europe%E2%80%99s-clean-mobility-outlook-scenarios-for-the

Further, it is also considered that the natural gas filling stations for transport applications will provide the relevant vehicles with Compressed Natural Gas (CNG) that is supplied from the grid. In addition, natural gas blends with hydrogen and biogas is assumed as per the projections of the 2030CTP.

The above assumptions are held through the 2030 – 2050 time range.

Based on the above assumptions, the following fuels are considered as the constituents of the overall transport fuel mix: Fossil Gasoline, Bioethanol, Fossil Diesel, Biodiesel, DME, B100, Natural Gas, Biomethane, Biogas, Green Hydrogen, Liquefied Petroleum Gas (LPG), Electricity.

1.2.2 Step 2: Determination of the Greenhouse Gas emission intensity (GHGi) of fuels or energy carriers determined in Step 1

Within Step 2 of the present methodology, the GHGi of all fuels identified Step 1 is determined. The basis for the determination of the GHGi is the "correspondence" between:

(a) The 2030CTP fuels, as those were identified in Step 1, and

(b) the FQD fuels, as those are considered by the FQD and RED II to contribute to the GHG intensity reduction target of the FQD 7a, and the uptake of renewables in the fuel mix respectively.

This Step is of particular importance for assessing the role of biofuels, including those characterized as "advanced" (or 2nd generation biofuels).

Mix of feedstock used to produce biofuels

For the determination of the relevant contribution of each pathway to the total production of each biofuel, the 2025+ biofuels mix reported in the JEC v5 work is considered. In particular, the JEC v5 WtW report provides a 2025+ scenario for the estimation of the mix of feedstock that is expected to be used for biofuels consumed in the EU, taking also into account the provisions of RED II; the sub-target of 3,5% for advanced biofuels by 2030, and the 1,7% cap for feedstocks listed in Annex IX Part B. Therefore, the relevant contribution of feedstocks in the production of the bioethanol, biodiesel and HVO considered in this work are presented in Table 1 and Table 2.

The share of individual feedstocks in the total bio-gas and bio-methane mix of 2030, have been also elaborated on the analysis presented in the WTT report of the JEC work, see Table 3.

Table 1 Share of feedstock in EU bioethanol production in 2030

Feedstock	Share of ethanol production in 2030
Wheat	26%
Maize	34%
Sugars	21%
other cereals	6%
lignocellulosic material or other feedstocks listed in Annex IX-A RED II	13%

Table 2 Share of feedstock in in EU biodiesel and HVO production in 2030

Feedstock	Share of biodiesel production in 2030	Share of HVO production in 2030
rapeseed oil	47%	16%
used cooking oil (UCO)	15%	25%
palm oil (all sustainable)	20%	42%
animal fats	5%	11%
soybean oil	5%	2%
sunflower oil	6%	0.4%
Other residual oils	2%	5%

Table 3 Share of feedstock in the biogas and biomethane mix of 2030

Feedstock	Share to the 2030 mix
Liquid manure	14.8%
Energy crops	38.6%
Organic waste	42.0%
Sludge	3.4%

The feedstock listed above can be used within the frame of various processes for biofuels production. The assignment of GHGi values to the individual process pathways of feedstock towards production of the FQD fuels is made on the basis of the JRC v1d study, because this is the most recent and relevant work to the FQD 7a and RED II, Annex V provisions.

The JRC v1d report determined input data to assess GHG default emissions from biofuels in RED II Annex V and actually provides the carbon intensity in terms of CO2eq/MJ for a number of biofuels produced from various feedstocks and application of various processes.

The details of the determination of the GHGi value of each pathway for the feedstock considered are presented in the following sections.

Greenhouse Gas emission intensity (GHGi) of bioethanol

For each feedstock that is considered to contribute to the bioethanol mix in 2030, the JEC 2025+ scenario also provides the relevant production pathways. As it is originally reported in the JEC v5 report, more weight was assigned to the sub-pathways that are able to save more GHG emissions on the basis of the assumption that new investments will be made aiming at saving higher amount of GHG emissions.

Table 4 provides the pathways considered for the assumed 2025+ ethanol mix, along with the respective carbon intensity and savings against the relevant fossil fuel comparator, as those are reported in the JRC v1d study.

Table 4 Pathways for bioethanol production considered for 2030 and their corresponding GHG intensity (grCO2eq/MJ) and savings (%) against the baseline

Pathway Code (JRC terminology)	Description	Relative contribution of the pathway to total production of feedstock	GHG Intensity (grCO2eq/MJ)	Savings (%)
Wheat				
Average GHG intensity and savings – Wheat			**44,63**	**52,5%**
WTET2	Ethanol from wheat, NG CHP	70%	50,3	45,6%
WTET4	Ethanol from wheat, forest residues CHP	30%	31,4	66,6%
Maize				
Average GHG intensity and savings – Maize			**48,50**	**48,4%**
CET2	Ethanol from maize, NG CHP	100%	48,5	48,4%
Sugars				
Average GHG intensity and savings – Sugars			**29,24**	**68,9%**
SBET1a	sugar beet, (no biogas from slop), NG boiler	27%	38,2	59,4%
SBET1b	sugar beet, (with biogas from slop), NG boiler	63%	25,5	72,9%
SCET	sugar cane	10%	28,6	69,6%
Other cereals				
Average GHG intensity and savings – Other Cereals			**50,30**	**46,0%**
BET2	Ethanol from barley, NG CHP	50%	50,5	46,27%
RYET2	Ethanol from rye, NG CHP	50%	50,1	46,7%
Lignocellulosic material				
Average GHG intensity and savings – Lignocellulosic material			**15,70**	**83,3%**
STET	Ethanol from straw SSCF (not including carbon debt)	100%	15,70	83,3%

Average GHG intensity and savings – Bioethanol (shares of Table 1)	**39,3**	**58,2%**

Conventional bioethanol features an overall GHGi of 42,8 grCO2eq/MJ, offering 58% emission savings as compared to fossil fuel comparator (fossil gasoline with 93,3 grCO2eq/MJ). On the other hand, lignocellulosic material can lead to advanced bioethanol (RED II Annex IX Part A eligible fuel) with approximately 90% savings compared to fossil gasoline, but according to Table 1, this latter contributes to only 13% of total ethanol feedstock mix in 2030.

Therefore, the overall average GHG intensity of the assumed bioethanol mix in 2030 is 39,3 grCO2eq/MJ, achieving 58% savings as compared to the baseline of 94 grCO2eq/MJ.

It is noted that the implementation of policies supporting the deployment of 2nd generation bioethanol, assuming that the required feedstock will be available, and that the number of new production plants will increase, would result to a further enhancement of the achieved savings. For instance, doubling the contribution of lignocellulosic ethanol at the expense of 1st generation bioethanol (application of a proportional reduction to each pathway), leads to an overall GHG intensity for the bioethanol mix of 35,7 grCO2eq/MJ, achieving 62% savings as compared to the baseline.

Greenhouse Gas emission intensity (GHGi) of biodiesel

Table 5 provides the pathways considered for the assumed 2025+ biodiesel mix (JEC v5 reports), along with the respective GHG intensity and savings against the baseline (JRC v1d report).

Table 5 Pathways for biodiesel production considered for 2030 and their corresponding GHG intensity (grCO2eq/MJ) and savings (%) against the baseline

Pathway Code (JRC terminology)	Description	Relative contribution of the pathway to total production of feedstock	GHG Intensity (grCO2eq/MJ)	Savings (%)
Rapeseed oil				
Average GHG intensity and savings – rapeseed oil			**50,10**	**46,7%**
ROFA	FAME from rapeseed	100%	50,10	46,7%
Used cooking oil (UCO)				
Average GHG intensity and savings – used cooking oil (UCO)			**14,90**	**84,1%**
WOFAs	Waste cooking oil to FAME biodiesel	100%	14,90	84,1%
Palm oil (all sustainable)				
Average GHG intensity and savings – palm oil (all sustainable)			**38,50**	**59%**
POPP2	Pure plant oil from palm oil, methane collected from effluent	100%	38,50	59%
Animal fats				

Average GHG intensity and savings – Animal fats			**20,80**	**77,9%**
AWFA	FAME from produced animal fats from rendering plant	100%	20,80	77,9%
Soybean oil				
Average GHG intensity and savings – soybean oil			47,00	50,0%
SYFA	FAME from soybean	100%	47,00	50,0%
Sunflower oil				
Average GHG intensity and savings – sunflower oil			**44,70**	**59,3%**
SOFA	FAME from sunflower seed	100%	44,70	52,4%
Average GHG intensity and savings – Bio-diesel (shares of Table 2)			**40,4**	**57,9%**

The mix of conventional biodiesel pathways, i.e. FAME from soybean, sunflower seed and rapeseed (that are able however to deliver a higher than 50% GHGi reduction as per Art. 29(10)) results to an overall value of 49,3 grCO2eq/MJ offering 48% emission savings, as compared to the respective fossil fuel comparator (fossil diesel with 95,1 grCO2eq/MJ).

POME[7] biodiesel, which is eligible under Annex IX Part A of RED II, offers 59% emission savings as compared to fossil fuel comparator. On the other hand, waste-based biodiesel eligible under Annex IX Part B of RED II (i.e. biodiesel from UCOs and animal fats) offers significant emission savings of 83%, as compared to fossil fuel comparator, achieving a weighted average GHGi value of 16,3 grCO2eq/MJ.

Considering the above, an overall GHGi value for the biodiesel mix of 2030 is calculated at 40,4 grCO2eq/MJ, achieving 58% savings as compared to the baseline of 94 grCO2eq/MJ.

It is, however, noted that the potential of the waste-based pathways to further reduce the GHGi of the biodiesel mix is significant. Table 2 assumes a contribution of 22% of these fuels to the 1,7% cap on the basis of the Annex IX Part B. Nonetheless, there are indications that some Member States[8] are oriented to extend this (soft) cap to higher percentages. However even by assuming an increased penetration by 50% of such fuels into the overall biodiesel mix (at the expense of the other pathways in a proportional manner), the resulting GHGi of the overall biodiesel mix would be 40,0 grCO2eq/MJ.

Therefore, it is confirmed that policies to support the widespread promotion of waste-based biodiesel would directly contribute to the reduction of the overall GHGi in transport.

[7] Palm Oil Mill Effluent biodiesel
[8] E.g. Netherlands: https://platformduurzamebiobrandstoffen.nl/draft-ordinance-energy-in-transport-open-for-consultation-main-elements/ and Germany: https://www.iscc-system.org/wp-content/uploads/2021/02/Daniel_Oliveira_Implementation-of-the-RED-II-in-Germany.pdf

Greenhouse Gas emission intensity (GHGi) of HVO

Table 6 provides the pathways considered for the assumed 2025+ HVO mix (JEC v5 reports), along with the respective GHG intensity and savings against the baseline (JRC v1d report).

HVO can be classified as being produced from food-based biofuel, advanced biofuel (Annex IX Part A) and waste-based biofuel (Annex IX Part B). The distribution of the contribution of each pathway to the total HVO mix of JEC, assumes an approximate split of 18% – 42% – 40% respectively. Under such assumptions, the respective GHGi values of each category are calculated as conventional:

- HVO biofuel: 53,6 grCO2eq/MJ (savings of 44% cf. the fossil fuel comparator);
- biofuel from HVO eligible under Annex IX-A: 42,2 grCO2eq/MJ (savings of 55% cf. the fossil fuel comparator); and
- biofuel from HVO eligible under Annex IX-B 18,2 grCO2eq/MJ (savings of 81% cf. the fossil fuel comparator).

Table 6 Pathways for HVO production considered for 2030 and their corresponding GHG Intensity (grCO2eq/MJ) and savings (%) against the baseline

Pathway Code (JRC terminology)	Description	Relative contribution of the pathway to total production of feedstock	GHG Intensity (grCO2/MJ)	Savings (%)
Rapeseed oil				
Average GHG intensity and savings – rapeseed oil			**50,10**	**46,7%**
ROHY	HVO from rapeseed	100%	50,10	46,7%
Used cooking oil (UCO)				
Average GHG intensity and savings – used cooking oil (UCO)			**16,00**	**83,0%**
WOHY	Waste cooking oil to HVO	100%	16,00	83,0%
Palm oil (all sustainable)				
Average GHG intensity and savings – palm oil (all sustainable)			**42,20**	**55,0%**
POHY1b	CH4 captured at oil mill	100%	42,20	55,0%
Animal fats				
Average GHG intensity and savings – animal fats			**21,80**	**76,8%**
AWHY	HVO from animal fats	100%	21,80	76,8%
Soybean oil				
Average GHG intensity and savings – soybean oil			**46,50**	**50,3%**
SYHY	HVO from soybean	100%	46,50	50,3%
Sunflower oil				
Average GHG intensity and savings – sunflower oil			**43,60**	**53,6%**

SOHY	HVO from sunflower seed	100%	43,60	53,6%
Other residual oils				
Average GHG intensity and savings – Other residual oils			**16,00**	**83,0%**
WOHY	Waste cooking oil to HVO	100%	16	83,0%
Average GHG intensity and savings – HVO (shares of Table 2)			**34,04**	**63,8%**

The overall HVO mix features a value of 34 grCO2eq/MJ, achieving 64% savings as compared to the baseline of 94 grCO2eq/MJ.

Greenhouse Gas emission intensity (GHGi) of biomethane

Table 7 provides the pathways considered for the assumed 2025+ biomethane mix (JEC v5 reports), along with the respective GHG intensity and savings against the baseline (RED II Annex VI values).

Table 7 Pathways for biomethane production considered for 2030 and their corresponding GHG Intensity (grCO2eq/MJ) and savings (%) against the baseline.

Pathway (as per RED II Annex VI)[9]	Relative contribution of the pathway to total production of feedstock	GHG Intensity (grCO2/MJ)	Savings (%)
Liquid manure			
Average GHG intensity and savings - Liquid manure		**-95,88**	**202%**
Wet manure, closed digestate, off-gas	100%	-95,88	202%
Energy crops			
Average GHG intensity and savings - Energy crops		**34,78**	**63%**
Maize whole plant, close digestate, off-gas	100%	34,78	63%
Organic waste			
Average GHG intensity and savings - Organic waste		**18,8**	**80%**
Biowaste, close digestate, off-gas	100%	18,8	80%
Average GHG intensity and savings – Biomethane (shares of Table 3)		**7,4**	**92,1%**

The assumed contribution of each pathway to the biomethane mix, 60% of the produced final fuel can be considered as Annex IX Part A fuel, while the rest 40% is under the Food-based biofuels category. The relevant GHGi values of each category are -6,1 and 34,8 grCO2eq/MJ, offering savings of 106% and 63% against the baseline, respectively.

[9] The pathways considered refer to the following codes reported in the JEC report: (a) OWLG21 for wet manure, (b) OWCG4 for energy crops, and (c) OWLG1 for organic waste.

Overall, the average biomethane mix features a value of 7,4 grCO2eq/MJ, achieving 92,1% savings as compared to the baseline of 94 grCO2eq/MJ.

Greenhouse Gas emission intensity (GHGi) of biogas

Biogas is assumed as injected into the Natural Gas grid, therefore reducing the GHG intensity of the pipeline NG, which is then used in transport as CNG.

Table 8 provides the pathways considered for the assumed 2025+ biogas mix (JEC v5 reports), along with the respective GHG intensity and savings against the baseline, as those have been calculated following the RED II methodology and are reported in Appendix 1 of the JEC v5 report.

Table 8 Pathways for biogas production considered for 2030 and their corresponding GHG Intensity (grCO2eq/MJ) and savings (%) against the baseline.

Pathway (as per JEC)	Relative contribution of the pathway to total production of feedstock	GHG Intensity (grCO2eq/MJ)	Savings (%)
Liquid manure - Biogas			
Average GHG intensity and savings - Liquid manure		**-95,7**	**202%**
Upgraded biogas from wet manure as compressed methane gas (CBM). Digestate storage closed (21)	100%	-95,7	202%
Energy crops - Biogas			
Average GHG intensity and savings - Energy crops		**34,5**	**63%**
Upgraded biogas from maize (whole plant) as compressed methane gas (CBM) closed digestate storage	100%	34,5	63%
Organic waste - Biogas			
Average GHG intensity and savings - Organic waste		**18,6**	**80%**
Upgraded biogas from municipal organic waste as compressed methane gas (CBM) closed digestate storage	100%	18,6	80%
Average GHG intensity and savings – Biogas (shares of Table 3)		**7,3**	**92,3%**

Overall, the average biomethane mix features a value of 7,3 grCO2eq/MJ, achieving 92,3% savings as compared to the baseline of 94 grCO2eq/MJ.

Greenhouse Gas emission intensity (GHGi) of hydrogen

Hydrogen constitutes a very versatile energy carrier as it can be produced via several individual pathways, involving virtually any primary energy source, largely either via a chemical transformation process (decarbonization of a hydrocarbon or organic feedstock) or via water electrolysis using also renewable electricity.

The 2030CTP assumes fuel cells vehicle within the stock of equipment for road transport. Although the penetration of such vehicles is not significant in 2030, it approximately reaches 18% and 27% of the total fleet of passenger cars and heavy-duty vehicles respectively in 2050 (numbers refer to the MIX scenario).

Fuel cells are assumed to be fed by compressed hydrogen, which in turn would have been produced via electrolysis. For the scope of the present work, and on the basis of the provisions of the FQD Implementing Act (2015), Annex I, Part 2(5), the carbon intensity of the pathway "Electrolysis fully powered by non-biological renewable energy" for production of "Compressed Hydrogen in a Fuel Cell" is considered, with an average reported lifecycle GHG intensity of 9.1 grCO2eq/MJ.

Greenhouse Gas emission intensity (GHGi) of electricity

Electricity will be the power source for Electric Vehicles (EV) and also for Plug-in Hybrid Electric Vehicles (PHEV). Considering that the majority of the electric vehicles fleet will consist of passenger cars, it is reasonable to assume that charging of these vehicles will take place at low voltage. Therefore, the EU average electricity mix at low voltage (LV) is considered.

Prediction of the EU-mix electricity in 2030 poses some difficulties, because it requires a knowledge of what generating capacity and efficiency gains per technology will be in place at the future date.

The JEC version 5 work has considered the IEA New Policies Scenario[10] as a reference for the 2030 electricity mix. JEC WTT Version 5 calculations on the EU electric energy mix used at low voltage include all energy losses and GHG emissions incurred at the different stages of its production, transmission and distribution. The analysis concludes that, overall, a 45% contribution of renewables in the LV electricity mix will take place in 2030, resulting eventually to a Carbon Intensity of 74.5 g CO2eq/MJ of final fuel.

When compared to other studies, the abovementioned picture on the 2030 electricity mix seems rather conservative in terms of penetration of RES into the electricity systems.

[10] IEA World Energy Outlook 2017

The 2030 Climate Target Plan in the MIX55 scenario, assumes an almost 68% contribution of RES. Such differences in the assumptions for the electricity mix have a significant impact on the related electricity GHGi value.

Table 9 presents the contribution of electricity sources to the electricity mix in 2030 and 2050 as those are reported under the MIX55 scenario, while it also shows the individual GHGi value expressed as grCO2eq/MJ, calculated on the basis of the information reported in JEC v5 reports.

It is noted that for the estimation of the GHGi value of fossil fuels, an assumption on the relevant contribution of the different fossil fuels had to be made. Therefore, and since CTP does not provide the internal contribution of each fossil fuel under the generic "fossil fuels" category, the information reported in JEC was used, as it is reported in *Table 12*.

Table 9 Contribution of electricity sources to the electricity mix in 2030 and 2050 and their corresponding GHG Intensity (grCO2eq/MJ)

Electricity source (CTP-MIX55)	2030	2050	Individual GHGi (grCO2eq/MJ)
Wind onshore	27,3%	32,9%	0,0
Wind offshore	7,4%	16,8%	0,0
Solar	13,8%	17,4%	0,0
Other renewables	19,3%	14,3%	0,0
Nuclear	15,0%	9,7%	3,9
Fossil fuels	17,2%	2,6%	173,3
Fossil fuel (CCS)	0,0%	4,1%	42,6
BECCS[11]	0,0%	2,2%	-

Table 10 Relevant contribution of fossil fuel electricity production pathways to the fossil-based electricity mix in 2030 and their corresponding GHG Intensity (grCO2eq/MJ)

Fossil fuel source	Fossil-based electricity (%)	GHGi (grCO2eq/MJ)	Assumptions
Coal	36%	251	Utilization in IGCC (without CCS)
Oil	2%	95,1	Assumed as Diesel oil
Natural Gas	62%	130,75	Utilization in CCGTs; Natural gas mix comprising 50% imports from Russia and 50% LNG

[11] An individual GHGi value for BECCS technologies was not assigned due to lack of data that would be consistent with the rest set of assumptions of the study. The relevant contribution has been excluded and the percentages of the rest pathways have adjusted accordingly in the weighted average calculation of the electricity mix GHGi.

Consideration of the information reported in *Table 9* and *Table 10* results into the calculation of the electricity mix in 2030 and 2050. Then, through linear interpolation the respective values for the years in-between are estimated, as shown in *Table 11*.

Table 11 Relevant contribution of fossil fuel electricity production pathways to the fossil-based electricity mix in 2030 and their corresponding GHG Intensity (grCO2eq/MJ)

Year	GHGi of the electricity mix (grCO2eq/MJ)	Savings
2030	30,5	68%
2035	24,6	74%
2040	18,6	80%
2045	12,70	86%
2050	6,7	93%

Greenhouse Gas emission intensity (GHGi) of Natural Gas

The JEC v5 WTT study provides an analysis of the expected future Natural Gas mix in 2030 as shown in *Table 12*. For the calculation of the GHG intensity of the Natural Gas mixture in 2030, *Table 12* also provides the GHGi values of each of the individual components of the considered mix.

It is assumed that the pipeline natural gas and the LNG will feature the average EU CNG and average EU LNG GHGi values respectively, as these are reported in the FQD 7a Implementing Act (2015)[12]. The GHGi of the assumed biogas mix in 2030 has been calculated above in *Table 8* and is therefore considered herein as well.

Overall, the assumed natural gas mix in Europe in 2030 exhibits a GHGi value of 67,9 grCO2eq/MJ and achieves a 27,8% GHG emissions intensity savings as compared to the baseline.

Table 12 GHG intensity of Natural Gas

Fuel	Contribution to 2030 mix	GHGi (grCO2eq/MJ)	Savings (%)	Assumptions
Pipeline NG	77,7%	69,3	26%	Assumed CNG, Annex 1, Part 2(5), FQD Implementing Act (2015)
LNG	18,9%	73,6	21%	Assumed LNG, Annex 1, Part 2(5), FQD Implementing Act (2015)
Biogas	3,4%	3,79	96%	See Table 8 above on the basis of the relevant

[12] More recent values for CNG and LNG are reported in the JEC v5 report. However, the JEC v5 report is based on the marginal approach for the determination of the WtW carbon intensity values and therefore it was preferred to use the original values of the FQD, which have been calculated following the average approach.

				analysis in JEC v5 WTT report.
Overall figures		**67,9**	**27,8%**	

Greenhouse Gas emission intensity (GHGi) of DME

DME has some attractive characteristics as a fuel for diesel engines and it has been considered as a fuel option for Heavy Duty Vehicles. However, according to the 2030CTP is expected to have a very marginal contribution to the 2030 fuel mix.

According to Annex V of RED II and the JRC v1d study[13] of 2019 there are three pathways for DME:

- DME from forest residue chips in free-standing plant (not including carbon debt): 13,5 grCO2eq/MJ and 85,6% savings;
- DME from short rotation forestry wood in free-standing plant: 16,2 grCO2eq/MJ and 82,8% savings;
- DME from black liquor: 10,3 grCO2eq/MJ and 89% savings.

For the purposes of this study, an equal mix of the above three pathways is considered, resulting to a DME GHG intensity value of 13,9 grCO2eq/MJ and 85,2% savings.

Greenhouse Gas emissions intensity (GHGi) of Synthetic fuels

The MIX55 scenario of the CTP also considers some contribution of Synthetic (P2X) Gasoline and diesel, as well as of clean gases, in the overall transport fuel mix.

The JEC v5 work considers two PtX pathways for synthetic diesel in the 2030 perspective:

- Syndiesel as a result of the path "Renewable electricity to Syndiesel via methanol (CO2 from flue gases)[14]". The WtW value of this stream has been calculated as: 0,9 grCO2eq/MJ.
- Syndiesel as a result of the path "Renewable electricity to Syndiesel high temperature (HT) electrolysis based on SOEC and FT route (CO2 from

[13] DME from forest residue chips code in the JRC v1d study: WWDM; DME from short rotation forestry wood code in the JRC v1d study: WFDM
[14] Path named as RESD1 in the JEC work

flue gases, biogas upgrading, and direct air capture)[15]". The WtW value of this stream has been calculated as: 0,8 grCO2eq/MJ.

As the TRL of the former path is already 9, it can be assumed that this pathway will be the dominant one at the 2030 time horizon and therefore the GHGi value of synthetic diesel in this work is considered as 0,9 grCO2eq/MJ.

Due to lack of detailed information for the production pathways of synthetic gasoline and clean gases, the above GHGi value of 0,9 grCO2eq/MJ has been considered for all synthetic fuels.

1.2.3 Step 3: calculations for the overall GHG intensity of the assumed transport fuel mix in 2030

Overview of individual GHGi values

Following the previous two steps, the calculation of the overall GHG intensity of the assumed transport fuel mix in 2030 can be performed following the CI input data presented in *Table 13*.

Table 13 Overview of input data for the calculation of the overall GHG intensity of the assumed transport fuel mix in 2030

Fuel in CTP2030	GHG intensity (grCO2eq/MJ)	Assumptions
Gasoline	93,3	Original FQD values
Bio-Gasoline	15,7	Bio-gasoline assumed as 2nd generation Ethanol, see *Table 4*
Bio ethanol	39,3	Bio-ethanol mix at 2025+ of JEC, values of JRC v1d, *Table 4*
Synthetic (P2X) Gasoline	0,9	Assumed same GHGi as for synthetic diesel
Diesel	95,1	Original FQD values
Bio Diesel	35,6	55% HVO + 45% Biodiesel, HVO and biodiesel mixes at 2025+ JEC, values of JRC, see *Table 5* and *Table 6*
Synthetic (P2X) Diesel	0,9	Syndiesel from PtX via (a) methanol and (b) SOEC and FT
DME	13,9	mix of the DME paths in RED II Annex V
B100	40,4	Biodiesel mix at 2025+ of JEC, values of JRC, see *Table 5*
Residual Fuel Oil	95,1	Assumed fossil diesel fuel
Bio-heavy	40,4	Assumed bio-diesel (B100)
Natural Gas	67,9	Natural gas gid mix based on analysis of JEC; GHGi values from RED II Annex V, *Table 12*

[15] Path named as RESD2x in the JEC work, where x denotes CO2 from flue gases, biogas upgrading, or direct air capture

Biomethane	7,4	Biomethane; feedstock mix from JEC, GHGi values from RED II Annex V, see *Table 7*
clean gas	0,9	Assumed same GHGi as for synthetic diesel
Biogas	7,3	Biogas for grid injection; feedstock mix from JEC, GHGi values from RED II Annex V, see *Table 8*
Green Hydrogen	9,1	FQD Implem. Act (2015), Annex I, Part 2(5): Electrolysis powered by non-biolog. renewable energy, Compressed Hydrogen in Fuel Cell
Liquefied Petroleum Gas	73,6	RED II Annex V
Electricity	See *Table 11*	

Fuel mix as reported in the MIX55 scenario

Table 14 presents the final fuel consumption in ktoe by transport mean falling within the scope of FQD Article 7a and by fuel for the EU27 under the Green Deal 55% carbon taxation COVID scenario (MIX55 scenario) of the 2030CTP.

Table 14 Final fuel consumption in ktoe by transport mean falling within the scope of FQD 7a and by fuel for the EU27 under the Green Deal 55% carbon taxation COVID scenario (MIX55 scenario of the 2030CTP)

Final Energy Demand	**226316**	**189276**	**145194**	**117476**	**103633**
By transport mean					
Road transport	**215285**	**178055**	**133711**	**105903**	**92231**
Rail	**6508**	**6765**	**6936**	**7059**	**7199**
Inland navigation	**4523**	**4457**	**4548**	**4514**	**4203**
By Fuel					
Liquid Fuels	**194817**	**143092**	**82254**	**40980**	**18592**
Gasoline blend	47577	32318	15993	6242	1549
Gasoline	43876	26288	10000	3254	202
Bio Gasoline	3700	4440	3409	1753	525
Synthetic (P2X) Gasoline	1	1590	2585	1235	821
Ethanol	1002	916	502	196	40
Diesel blend	145324	109034	65126	34129	16795
Diesel	130971	84662	36695	15042	932
Bio Diesel	14344	19008	17933	12410	7062
Synthetic (P2X) Diesel	9	5364	10497	6678	8800
DME	2	3	3	2	0
B100	242	282	211	114	24
Residual fuel oil blend	671	541	419	297	185
Residual fuel oil	575	428	291	181	101
Bio Heavy	96	112	128	116	84
Gaseous Fuels	**18674**	**20946**	**16212**	**10455**	**6489**
Natural Gas with H2 blend	9541	12019	9807	4134	2512
Natural Gas	9541	11896	8284	792	272

Hydrogen Blended	0	63	640	928	738
Clean Gas	0	60	883	2414	1502
Natural Gas with Biogas blend	603	641	1004	2930	2440
Natural Gas	489	320	202	0	0
Biogas	114	318	711	1219	981
Clean Gas	0	3	90	1711	1459
Methane from Biogas	1482	1646	1368	1211	816
Liquefied Petroleum Gas	7048	6641	4034	2179	721
Hydrogen for Fuel Cell Vehicles	703	3466	11440	22293	32651
Electricity	12122	21772	35288	43748	45901
Total Oil products	182469	118020	51020	20656	1956
Total Natural Gas	10030	12215	8486	792	272
Total Biomass	20982	26723	24265	17021	9533
Total Liquid Synthetic	10	6954	13082	7912	9621
Total Gaseous Synthetic (Clean Gas)	0	63	973	4126	2961
Total Hydrogen	703	3529	12080	23221	33389

GHGi for the overall transport fuel mix

Considering the reported fuel quantities for the MIX scenario of the 2030CTP (see *Table 14*), the assumed 2030 transport fuel mix is calculated to feature an **overall GHG intensity of 83,2 grCO2e/MJ, resulting thus in a reduction of 11,5% as compared to the baseline**.

Fossil liquid fuels confirm their dominance in the formation of the overall GHGi, having a GHGi value of 88,4grCO2e/MJ (or, +4% as compared to the overall average value of 83,2).

Gaseous fuels moderately contribute to the reduction of the overall GHGi, despite the significantly lower individual GHGi value of 64,9 grCO2e/MJ (or, -24% as compared to the overall average value of 83,2).

Calculation of GHGi of the overall transport fuel mix up to 2050

As discussed above in this Appendix, the main purpose of this exercise is to calculate the overall GHGi value of the 2030 fuel mix. Nonetheless, calculation of the GHGi value of the fuel mix in the period 2030 – 2050 is possible on the basis of the quantities of fuels provided in the MIX55 scenario of the CTP. Extension of the calculations to 2050 requires the consideration of the evolution of the individual fuels GHG intensity values.

In order to determine the time evolution of the individual fuels GHG intensity values, further analysis on several key issues is required, such as:

- feedstock availability for advanced biofuels (also considering potential limits imposed by legislation);

- evolution of the efficiency of the relevant conversion technologies (including the effects stemming from the enhanced RES share in the electricity mix moving towards 2050).

Albeit analysis on the above issues is not within the scope of this work, a rough calculation of the GHGi of the overall transport fuel mix up to 2050 could be carried out. This exercise is only possible under the assumption that the GHGi of all, except electricity, individual fuels will remain constant for the 2030 – 2050 period. For electricity, the evolution of its GHGi is estimated by considering the evolution of the electricity mix in the respective period, as this is reported in the 2030CTP and has already been analysed before.

Overall, even with the limitations explained above, the obtained results can be considered to provide a first indication of the expected evolution of the GHGi of the transport fuel mix on the basis of the expected picture in 2030 and considering the currently available information.

The 2030CTP results indicate the substantial reduction of the overall GHGi after 2030 due to the progressive decline of the contribution of fossil fuels in favour of the increase of the consumption of hydrogen and electricity. In particular, and as it is shown in *Table 15*, the overall GHG emission intensity of the expected transport fuel mix in 2050 is estimated at 10,6 grCO2eq/MJ, achieving thus a reduction of almost 88% as compared to the currently applied baseline of 94 grCO2eq/MJ.

Focusing on the eventual year 2050, a significant increase in the contribution of Hydrogen (32%) and electricity (44%) in the total transport fuel consumption is noted. Internal Combustion Engines are largely fuelled by synthetic fuels (9%) and advanced biofuels (8%), whereas fossil diesel and gasoline only contribute marginally (1%). Further, the GHGi of both categories of liquid and gaseous fuels degreases substantially, by 75%, due to:

- for liquid fuels, synthetic fuels and advanced biofuels account for ca. 60% of the total liquid fuels consumption;

- for gaseous fuels, deployment of clean gases and hydrogen blending into the natural gas grid are the main driving factors for decarbonization

Table 15 Calculated GHGi for the overall fuel transport mix for the period 2030 – 2050

	2030	**2035**	**2040**	**2045**	**2050**
GHG intensity (grCO2eq/MJ)	83,2	70,1	47,3	27,8	10,6
Reduction	-11,5%	-25,4%	-49,7%	-70,5%	-88,7%

Appendix G Initial Workshop Report (from approved interim report)

JUNE 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GHG EMISSIONS FROM TRANSPORT

FRAMEWORK CONTRACT CLIMA.A4/FRA/2019/0011

FIRST WORKSHOP REPORT (D10) – **APPENDIX E TO THE INTERIM REPORT**

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EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GHG EMISSIONS FROM TRANSPORT

Workshop I Report (D10) – **Appendix E TO THE INTERIM REPORT**

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CONTENTS

1 Objectives of the workshop

On Thursday 3rd September 2020, the first workshop under the support study to evaluate Article 7a of the Fuel Quality Directive (FQD) and to assess approaches to reduce greenhouse gas (GHG) from transport fuel was held. It had a two-fold objective:

- Introduce the study and the methodological approaches for the evaluation and impact assessment. The feedback of the workshop participants will serve the refinement of the stakeholder consultation methodologies.
- Collect insights into the implementation of Article 7a and views on relevant approaches to further reduce GHG emissions from transport fuels.

2 Workshop participants

The workshop targeted experts and relevant stakeholders involved in the implementation of Article 7a. A preliminary list of potential participants included representatives of industry and industry associations (with a focus on the fuel industry and the transport sector), national competent authorities involved in the monitoring and reporting of life cycle GHG emission intensity of transport fuels, research organisations, consultancy and think tanks, individual experts, and representatives of the European Commission, EEA, JRC, and other international organisations.

The invitation to the workshop was sent to the organisation in the list on 29th July 2020. Registration was done through the EventBrite platform[1]. The consortium partner, Exergia, and individual experts disseminated the invitation in their respective networks and promoted participation.

On 31st August, a total of 121 people had registered (see Annex A), of which around 77% were representatives of industry (including industry associations). They represented 24 of the EU Member States and 28% reported to be in Belgium.

Two days before the workshop they all received a file introducing the study, the objectives and the agenda of the workshop, and instructions on how to connect to the online platform and on the meeting rules.

All direct communication with them was carried out using a dedicated functional email address which will be used for all follow-up activities: 7a.fqd.consultation@technopolis-group.com.

[1] https://www.eventbrite.com/e/workshop-to-support-evaluation-of-article-7a-of-the-fuel-quality-directive-registration-115020790280

Figure 1 Breakdown of registered participants per type of stakeholder (31st Aug.)

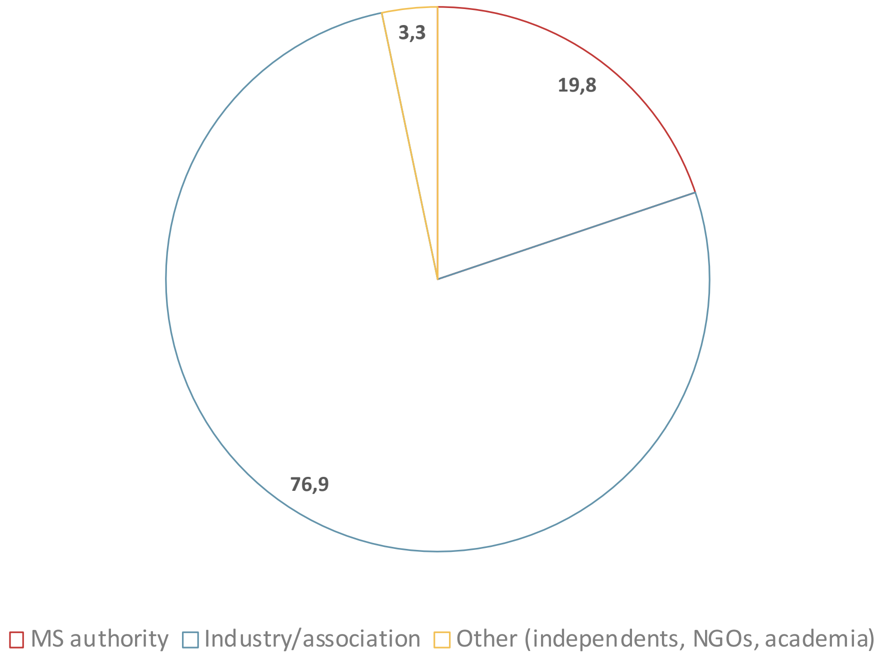
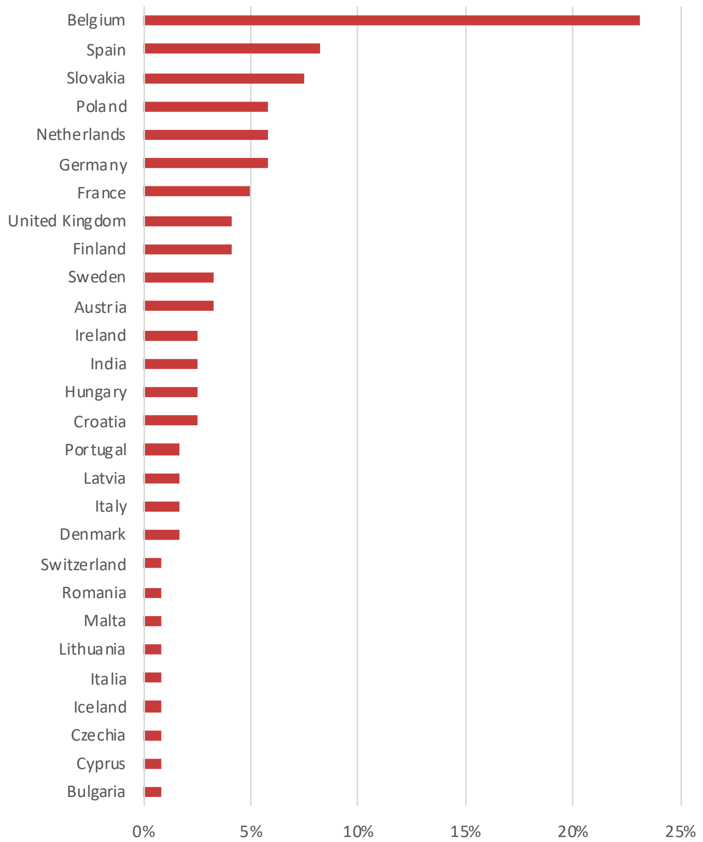


Figure 2 Geographical distribution of registered participants (31st Aug.)



3 Organisation and agenda of the workshop

The workshop was held on the WebEx platform, which offers all functionalities for the organisations of such webinars. To facilitate interactions, we used *MentiMeter*, a tool allowing for the organisations of polls and the automatic display of their results.

Except for the first sessions aimed at welcoming the participants and at introducing the study and the agenda of the workshop, the other sessions were designed to be as interactive as possible. Participants were invited to react orally, in writing through the chat room, or through *MentiMeter* polls. Additionally, two questions and answers sessions were scheduled. Finally, the participants were invited several times to share their views and any relevant documents with the Study Team after the workshop by using the project functional email address above.

The week before the workshop, the Study Team agreed with the European Commission on the following agenda:

9:45 – 10:00	Opening of the online workshop platform Allowing participants to connect, test their connection, be introduced to the rules to follow and interact at the workshop (speaker: Luigi Lo Piparo, Technopolis)
Opening session	
10:00 – 10:05	Welcome by the moderator and presentation of the team (speaker: Luigi Lo Piparo, Technopolis)
10:05 – 10:15	Opening words by the DG CLIMA: Background to the study (speaker: Laura Lonza, European Commission)
10:15 – 10:30	General presentation of the approach, methodology and timeline of the study, COVID-19 (speaker: Luigi Lo Piparo, Technopolis)
10:30 – 10:40	Q&A session (moderator: Luigi Lo Piparo, Technopolis)
Discussion session	
Part I - Specific aspects under evaluation	
10:40 – 10:45	Explanation on the flow of the session, use of the online tool for interactive discussion (speaker: Luigi Lo Piparo, Technopolis)
10:45 – 11:30	Interactive session on the goals of the Fuel Quality Directive in terms of reduction of life cycle GHG emissions from transport fuels, in alignment with other EU legislative initiatives (moderator: Julien Chicot, Technopolis)
11:30 – 12:00	Interactive session on the mechanisms to monitor life cycle GHG emissions from transport fuels (moderator: Julien Chicot, Technopolis)
12:00 – 12:30	Costs resulting from article 7a of the Fuel Quality Directive (moderator: Paresa Markianidou, Technopolis)
12:30-13:45 Lunch break	

Part II - Future perspectives	
13:45 – 14:30	Challenges to reduce GHG emissions from transport fuels (moderator: Ole Kveiborg, COWI)
14:30 – 15:00	Policy options to accelerate the reduction of GHG emissions from transport fuels (moderator: Ole Kveiborg, COWI)
15:00 – 15:30	Q&A session (moderator: Ole Kveiborg, COWI)
Closing session	
15:30 – 15:45	Summary of the discussion and next steps (moderator: Luigi Lo Piparo, Technopolis)

Also, Susanna Gionfra (Technopolis) provided logistical support, and Loan Hemery (Technopolis), Margaux Le Gallou (Technopolis) and Julija Skolina (COWI) helped with the minutes.

4 Workshop Participants

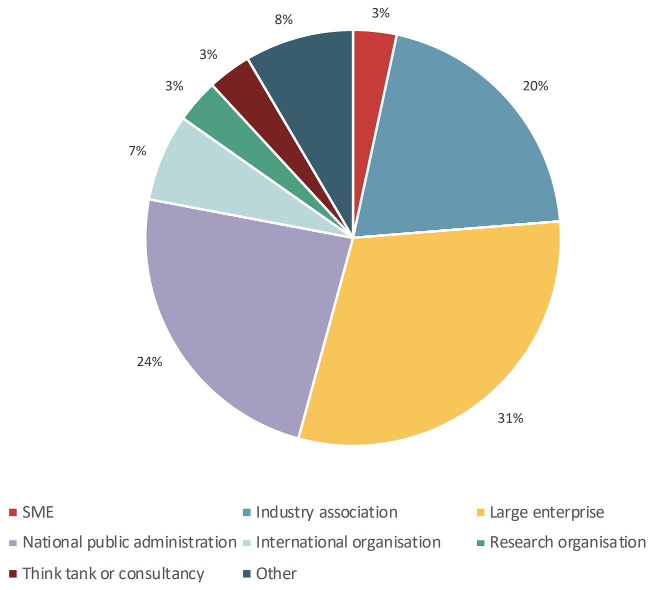
In comparison with in-person events, the number of participants in online ones fluctuates more and is less easy to monitor. The data on the responses provided to our *MentiMeter* questions allows for an estimate of the number of people who participate in the workshop. The total number of respondents varied between 25 and 62, which account for at least 20% of the number of registered participants and is equivalent to the average number of participants in physical workshops on technical topics.

Figure 3 Number of respondents to MentiMeter questions

Note: The third question was open-ended, hence its lower response rate.

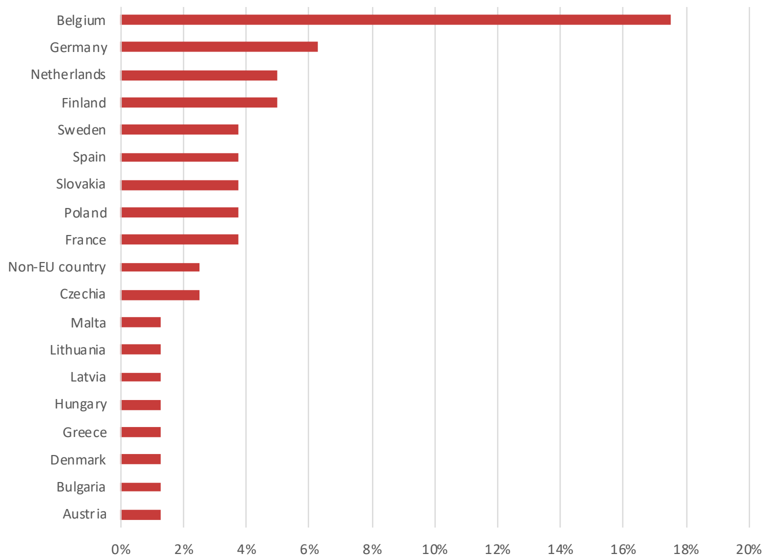
The first two *MentiMeter* questions asked about the profile of the respondents. They aimed to let the participants familiarise with the *MentiMeter* tool and its functioning. They also allowed our team to collect data which would help the analysis of the responses to the subsequent questions[2].

Figure 4 Profile of respondents to MentiMeter (Q1)



Note: Number of respondents: 59

Figure 5 Geographical distribution of respondents to MentiMeter (Q2)



Note: Number of respondents: 54

[2] MentiMeter registers the responses given by each respondent. They can be extracted in an excel file for their subsequent analysis.

There are no striking differences between the registered participants and the respondents to the *MentiMeter* poll. In both group, Belgium-located organisations and industry (including industry association) are the most represented groups.

5 Inputs from participants

The workshop participants have been invited to react to the methodological approach presented and to share their experience and views on the implementation of Article 7a of the FQD and on the approaches to reduce further GHG emissions from transport fuels through four channels:

- The *MentiMeter* poll (see Annex B)
- The WebEx-embedded chat function (see Annex C)
- Orally during dedicated Q&A sessions and/or upon invitation by the moderators (see the minutes of the event in Annex D)
- By email using the functional project email address. In total, we have received 11 emails from participants.

All these inputs will be used for refining our methodological approach, especially for stakeholder consultations, where needed, and will serve – after their triangulation with other collected data and information – the analyses underpinning the evaluation of Article 7a and the assessment of the impacts of options to reduce further GHG emissions from transport fuels. The inputs collected through the live polling and the discussions held at the event will inform the future work of the Study Team on Task 1 and 3, including regarding the design of the questionnaire for the Survey, the drafting of the interview guidelines, the Cost and Benefit Assessment. In general the inputs collected will contribute to the understanding of if and how the FQD has worked, identifying drivers and barriers to the achievement of the objectives. Likewise, the feedback collected will enhance the qualification of the options proposed to achieve the progressive reduction of GHG emissions intensity of fuels towards 2030 and 2050 and initial identification of the impact of the proposed options such as wider technological, economic, environmental, market-related effects.

6 Analysis of participants' inputs

This section summarises the main insights from the workshop participants into (1) the evaluation of Article 7a of the FQD and (2) the options to reduce further GHG emissions from transport fuels.

6.1 Evaluation of Article 7a of the FQD

6.1.1 Session on the targets in Article 7a of the FQD

The participants (whatever stakeholder category they belong to) confirmed through the *MentiMeter* poll survey that the most likely impact of Article 7a of the FQD will be a decrease in GHG emissions from transport fuels.

The participants discussed the contribution of the biofuels to the achievement of the targets set in Article 7a of the FQD. Some highlighted that, because biofuels have lower energy density, vehicle engines will need to consume higher volumes for maintaining the same volume of performance as with conventional fuels. In other words, their efficiency will decrease. Others, while agreeing with this observation, noted that the thermal efficiency of vehicle engines, which they deemed to be most relevant measure of their efficiency, will not be strongly affected.

The participants answered in the poll that the main EU-added value of Article 7a of the FQD relies in its contribution to the reduction of GHG emissions from transport (environmental and social impacts), the functioning of the Single Market, and the competitiveness of the EU companies. They elaborated on their answer in a following discussion. For some of them, the provisions of Article 7a create a "legal basis" and give common objectives encouraging thereby Member States to take actions to reduce GHG emissions from transport. Nevertheless, a few participants discussed the results of the *MentiMeter* poll and stated that the lack of alignment between FQD and RED and the diverse approaches in their national transposition could have instead accelerated the fragmentation of the market.

According to the poll results, more than half of the respondents (57%) view the lack of technical specifications to support higher blending of alternative fuels as the main obstacle to the attainment of the goals set in Article 7a of the FQD. Interestingly, most of responding companies (56%) reported that the lack of incentives / penalties could also negatively affect the likelihood to attain the goals in terms of reduction of GHG emission intensity of transport fuels. Inversely, it should be noted that a few participants considered that the targets in Article 7a are too high to be attained by 2020 (6%) and that supply of alternative fuels is insufficient (4%). Some participants discussed that the poll overlooked some hampering factors, such as, the lack of consistency with RED, and the lack of EU-level enforcement mechanisms which would ensure a level-playing field and that non-compliant companies / countries would not benefit from a competitive advantage.

When asked about the interactions between the FQD and the RED2, the poll respondents foresaw mostly overlaps that would affect the overall clarity of the legal framework. They extensively elaborated on this topic during the workshop discussions. They agreed that the scope of the two directives is rather different. A fundamental problem is the potential contradiction between the respective targets of those directives, as it would be possible to comply with one while moving away from the targets of the other. For instance, the reduction of GHG emission intensity of transport fuels (objectives of the FQD) could be achieved through the increased supply of fossil fuels with low GHG intensity, which would not be compliant with the RED. However, the achievement of RED objectives could help achieve those of the FQD. Also, a renewable energy expert noted that the RED allowed for double counting which had negatively affected the volume of biofuels on the markets and therefore the capacity to achieve the targets of the FQD. Finally, in the view of a fuel expert, the results of the poll and the subsequent discussion reflected the difficulty in implementing both directives and the fact that Member States transposed the FQD through their renewable energy policy, creating a confusion with RED and diminishing the specificities of FQD.

6.1.2 Session on the methods of calculating GHG emission intensity of transport fuels

The participants did not report, through the poll, any major issue with the accuracy of the methods of calculating reduction of life cycle GHG emission of transport fuels. Reacting to this result, some participants (a representative of an NGO and a fuel expert) contended that these methods do not currently take into sufficient consideration ILUC emissions of biofuels and that the default values are not disaggregated enough.

The respondents to the survey did not identify any activity as particularly difficult for the monitoring and reporting of the GHG emission intensity of transport fuels. Nevertheless, most of them deemed that the methods could be improved by a revision of the default values (71%), a better estimate of the contribution of electric vehicles to GHG emissions (64%), and an assessment of the upstream emission reduction efforts (52%). A participant nevertheless reminded the complexity of calculating the GHG emissions of different transport fuels in a harmonised manner without creating too much burden on market operators.

6.1.3 Session on the costs induced by Article 7a of the FQD

It is a striking result from the poll that half of the participants (and more than 60% of the responding companies) could not assess the total efforts required for administrative activities induced by the obligation of monitoring life cycle GHG emissions of transport fuels. A representative of a national competent authority explained that administrative costs could increase if the UERs have to be taken into consideration in the monitoring of progress towards Article 7a targets.

Most of the poll respondents nevertheless remembered that they did not need outsourcing nor subcontracting to comply with their obligations introduced by Article 7a of the FQD. A fuel expert nevertheless reminded that there are confidentiality and competitive issues at stake when dealing with biofuel data.

The participants (even, among them, the companies) did not report substantial costs induced by the compliance with the binding obligation to reduce GHG emissions set in Art.7a of the FQD.

The companies responding to the poll nevertheless agreed on the existence of indirect costs induced by Article 7a of the FQD, of which especially barriers to entry to markets due to, again, a lack of harmonisation across Member States. On average, the respondents mostly reported indirect costs transmitted through changes in the price of fuels.

Finally, around 40% of the respondents to the poll considered likely that Article 7a targets will not be attained. This share notably amounts to 70% among responding national competent authorities. It is nevertheless worth noticing that half of the responding companies declared not to have any idea about the level of attainment of Art.7a targets and therefore did not seem to be concerned about penalties.

6.1.4 Overview of the workshop inputs to the evaluation questions

The table below summarises the main inputs from the workshop to the evaluation questions.

Table 1 Workshop inputs per evaluation question

Criterion	Evaluation question	Inputs
Relevance	To what extent did the target in Article 7a of the FQD still correspond to the ambitions and obligations of the European Union in terms of reduction of GHG emissions?	› From the poll: › The (only) likely impact of Article 7a of the FQD is a reduction of GHG emissions from transport fuels. › Other technological, economic, environmental, social impacts are less than likely. › From the discussion: vehicle engine may limit the contribution of biofuels to the reduction of GHG emission intensity of transport fuels
	How relevant are the targets in terms of reduction of the life cycle GHG emission intensity of transport fuels?	› From the poll: less than 10% of respondents think that the targets in Article 7a are too ambitious

Criterion	Evaluation question	Inputs
Effectiveness	Does Article 7a of the FQD contribute to reducing the life cycle GHG emission intensity of transport fuels until end of 2020?	› From the poll: most respondent believe that the targets in Article 7a will not be achieved

	What factors contribute to or hinder the monitoring and reporting of the life cycle GHG emission intensity of transport fuels?	› From the poll: overall the methods of calculating reduction of GHG emissions of transport fuel are accurate
		› From the survey: the methods of calculating reduction of GHG emissions of transport fuels could be improved by:
		  › Revising default values
		  › A better estimate of the contribution of electric vehicles
		  › An assessment of the UER
		› From the discussion: the current methods of calculating reduction of GHG emissions of transport fuels do not take enough into account ILUC emissions of biofuels and use aggregated default values that are not disaggregated enough

	What factors contribute to or hinder the reduction of the life cycle GHG emission intensity of transport fuels?	› From the poll: the main obstacles to the achievement of the goals in Article 7a of the FQD are:
		  › The lack of technical specifications to support higher blending of alternative fuels
		  › For companies: lack of incentives / penalties
		› From the discussion:
		  › the lack of alignment between FQD and RED impedes achievement of FQD's objectives
		  › the national transpositions of FQD and RED have an influence on their effectiveness

Efficiency	Are the reporting and monitoring of the life cycle GHG emission intensity of transport fuels cost-effective?	› From the poll:
		  › no estimate of the efforts
		  › subcontracting is not common

	Is the obligation to reduce life cycle GHG emission intensity of transport fuels cost effective?	› From the poll: › No substantial costs

Criterion	Evaluation question	Inputs
		› Indirect costs: barriers to entry to markets (because of market fragmentation)
Coherence	To what extent is Article 7a of the FQD coherent with other provisions in the FQD?	› From the poll: Overlaps between FQD and RED › From the discussion: it is possible to comply with FQD while moving away from the objectives of RED
EU-added value	Does the definition of goals at the EU level allow for the achievement of the overarching objectives relative GHG emission?	› From the poll: the EU-added values of Article 7a of the FQD are its contribution to the reduction of GHG emissions from transport, the decreased GHG emissions from transport, and a better market position of EU fuel companies

6.2 Insights into approaches to reduce further GHG emissions from transport

6.2.1 Rationales for policy intervention

The Consortium presented two main issues that need to be addressed to support further reduction of GHG emission intensity of transport fuels: (1) the current GHG emissions from transport do not allow for achieving the targeted climate neutrality by 2050, and (2) the fuel market fragmentation. The drivers behind those issues were presented.

The workshop participants recommended taking into consideration technological problems. Because vehicle engines rely still mainly on internal combustion engine technologies, they pose constraints to transport fuels and may therefore limit the uptake of biofuels and other less-emitting fuels.

Another topic of discussion was the coherence of the regulatory framework and especially the alignment between FQD and RED in terms of objectives, methods of calculation, reporting requirements, and sustainability criteria (particularly for REDII). In the current situation, the perceived discrepancies in how the FQD and the RED are transposed in national legislations have caused market fragmentation, while creating uncertainties as to which objectives (reduction of GHG emission intensity of transport fuels or increase of renewable energy and fuel in transport) to pursue in priority and how.

6.2.2 Policy options for a further reduction of GHG emission from transport

In the second part of the workshop, the participants were invited to discuss the different options presented by the Study Team: no change to the framework in place, strengthening of the obligations, or reduction of these obligations.

Several participants called for strengthening the obligations introduced by Article 7a of the FQD. In line with this comment, it has been proposed that the approach of the FQD should be given the priority over the RED. However, this proposal was not endorsed by a representative of the Latvian competent authority, who claimed that the renewable energy targets for transport fuels are already sufficient.

One of the stakeholders highlighted that the gradual reduction in GHG intensity of all fuels put on the market is one of the most cost-effective solution for carbon abatement.

Also, it was argued that the targets could be increased, while a lower cap could be made to food and feed-based biofuels. A representative of national competent authorities nevertheless warned that increasing the targets would be relevant only if the market is able to increase the supply of alternative fuels and if there is a market for UERs.

Participants also discussed the idea to enlarge the scope of the FQD (to include, for instance, gaseous fuels) to reflect better technological progress in fuel production and the vision to move further to decarbonised fuels.

A fuel expert discussed the relevance of enabling vehicles to run on higher alternative fuel blends.

One expert suggested to reflect on the fact that most biofuels with high GHG emission reduction performance today go to California, highlighting the effectiveness of the Low-carbon fuel standard (LCFS) based on Carbon Index reduction over time. This standard could make fossil diesel redundant in 2030 in California and could be considered in Europe.

6.2.3 Workshop inputs to the impact assessment exercise

Overall, the workshop participants did not discuss the accuracy and relevance of the presented problems and policy options. They insisted on the existence of technological pathways that constraint policy options for further reduction of GHG emissions from transport fuel. There was a widely shared opinion that the targets of Article 7a should be raised and that their scope should include additional fuels to make an effective contribution to climate neutrality by 2050. However, any more stringent regulatory framework will need to (1) account for what market actors can reasonably achieve, (2) be accompanied with relevant incentives (e.g. regarding fuel blending mandate), (3) reduce inconsistencies between RED and FQD provisions, and (4) allow for better market harmonisation.

Annex A. Responses to the *MentiMeter* poll

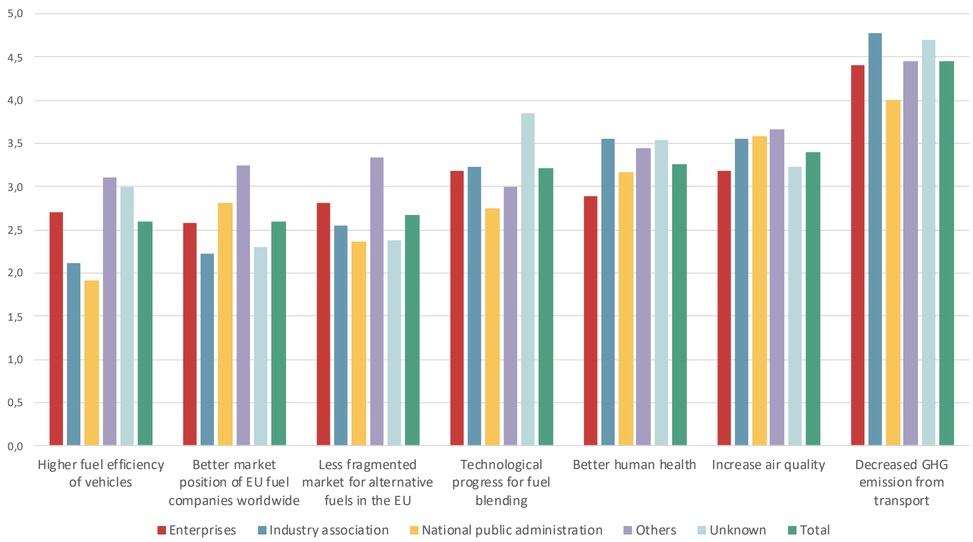
We present below the responses to the *MentiMeter* poll questions. The poll includes three introductory questions. The answers to two of them are showed on Figure 4 and Figure 5. In the third question, the participants were invited to share anonymously their contact details for follow-up.

The responses to the *MentiMeter* poll are broken down per stakeholder category. Considering the profile of the respondents, we propose four categories:

- Enterprises, including large enterprises and SMEs (total respondents: 20)
- Industry associations (total respondents: 12)
- National public administrations (total respondents: 14)
- Others, including research organisations, think tanks and consultancies, international organisations among others (total respondents: 13)

Also, 21 respondents did not provide any information on the stakeholder category they belong to.

Figure 6 Q3: What are the main long-term impacts of the reduction of GHG emissions intensity of supplied transport fuel that you foresee? (average score)



Note: Five-point scale, where 1 = extremely unlikely and 5 = extremely likely

Figure 7 Q4: Which objective(s) could not be achieved if article 7a of the FQD were replaced with national initiatives? (% of respondents)

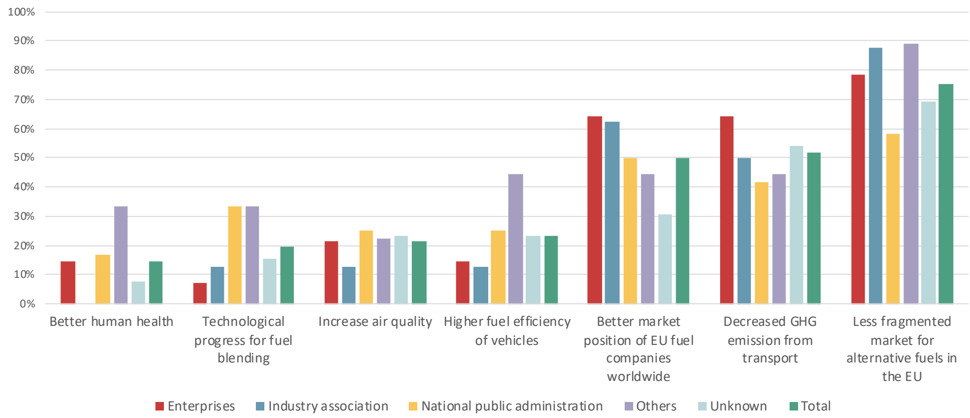


Figure 8 Q5: What are the three main obstacles to attain the compulsory target of reducing by 6% the GHG emission intensity of supplied transport fuels by 2020? (% of respondents)

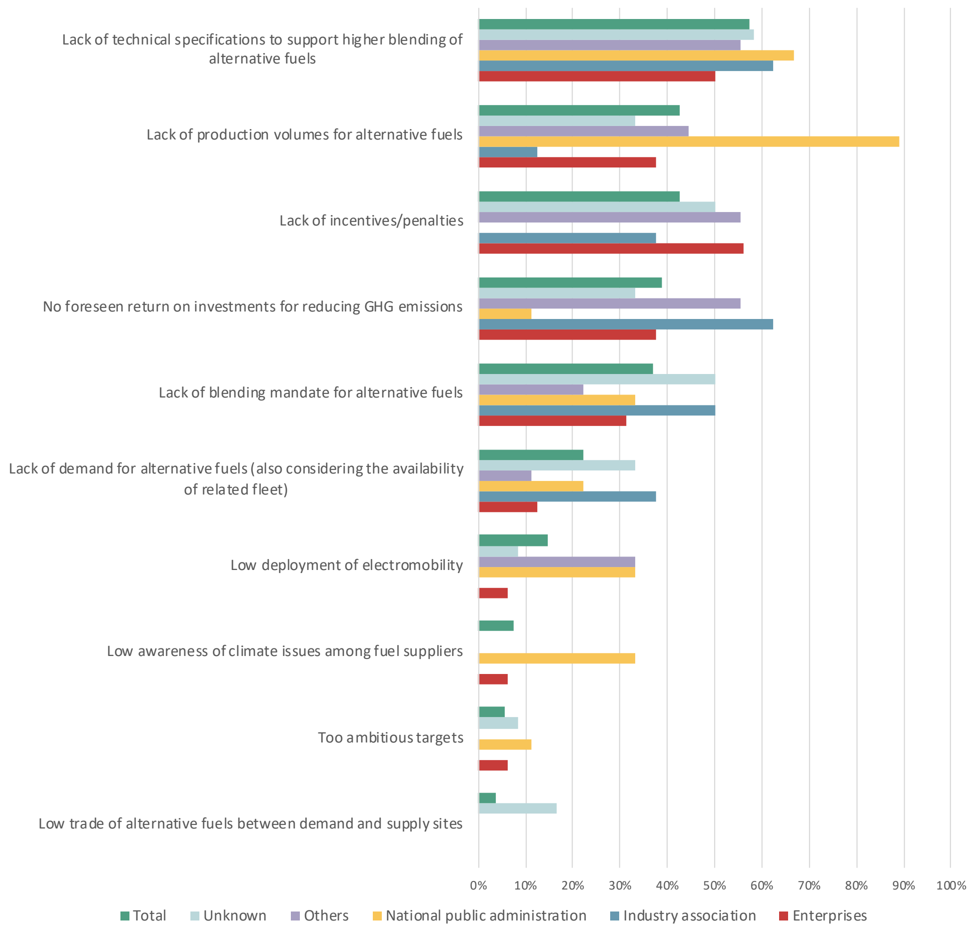
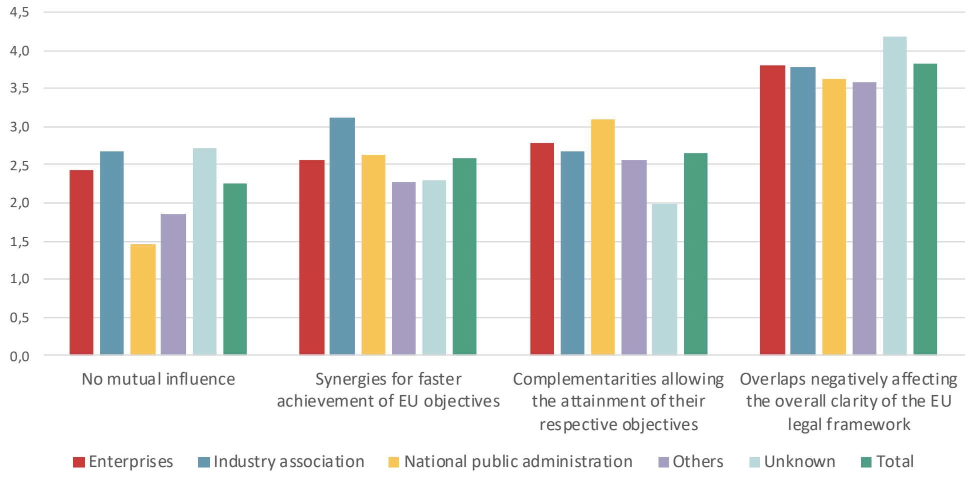
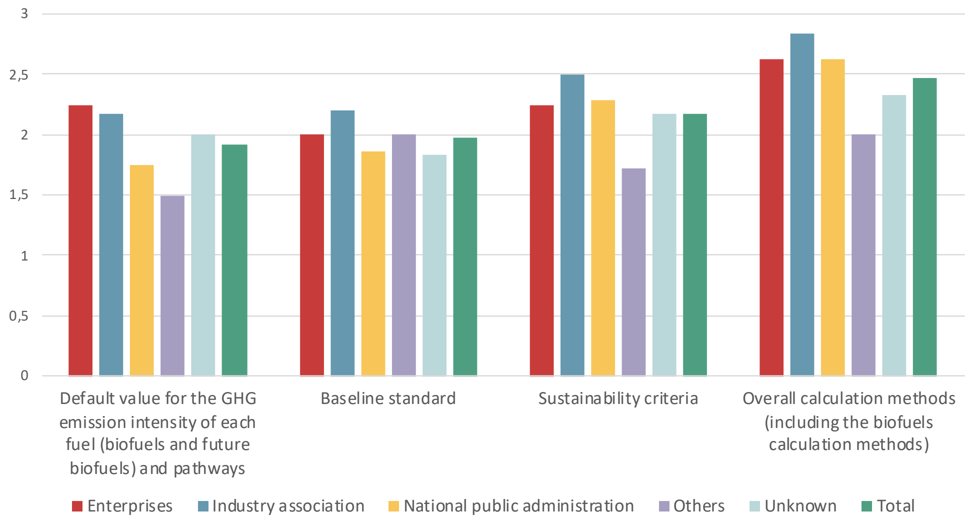


Figure 9 *Q6: In your experience, how have the Fuel Quality Directive and the Renewable Energy Directive II mutually influenced their implementation? (average score)*



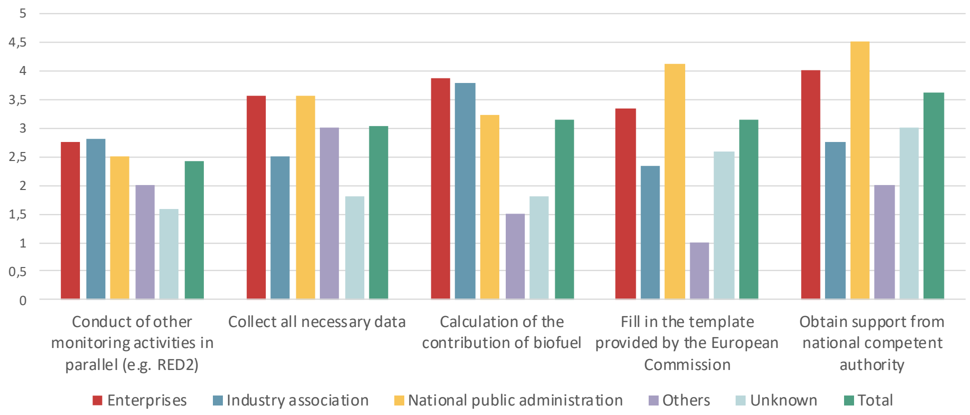
Note: Five-point scale, where 1 = strongly disagree and 5 = strongly agree

Figure 10 *Q7: How accurately do the parameters in the methods of calculation measure reduction in GHG emission intensity of supplied transport fuels? (average score)*



Note: Three-point scale, where 1 = not accurately and 3 = accurately

Figure 11 *Q8: How easy were the following activities for the monitoring and reporting of GHG emission intensity of supplied transport fuels? (average score)*



Note: Five-point scale, where 1 = very difficult and 5 = very easy

Figure 12 *Q9: How could the monitoring and reporting obligations in article 7a of the FQD be improved? (% of respondents)*

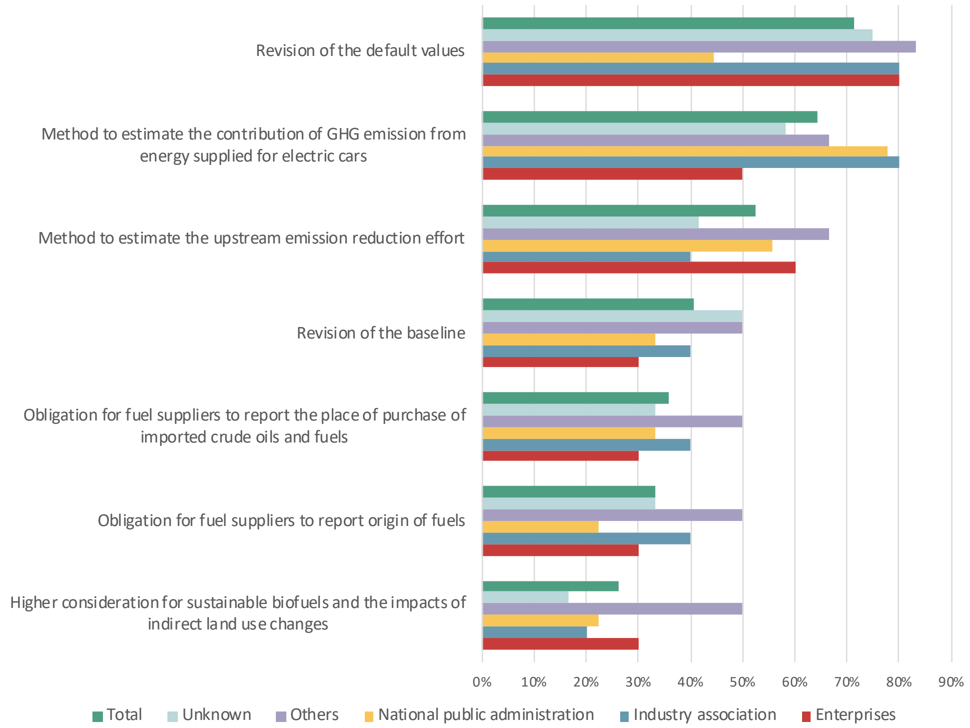


Figure 13 *Q10: What is the total effort required for administrative activities induced by the obligation of monitoring life cycle GHG emissions per unit of energy? (% of respondents)*

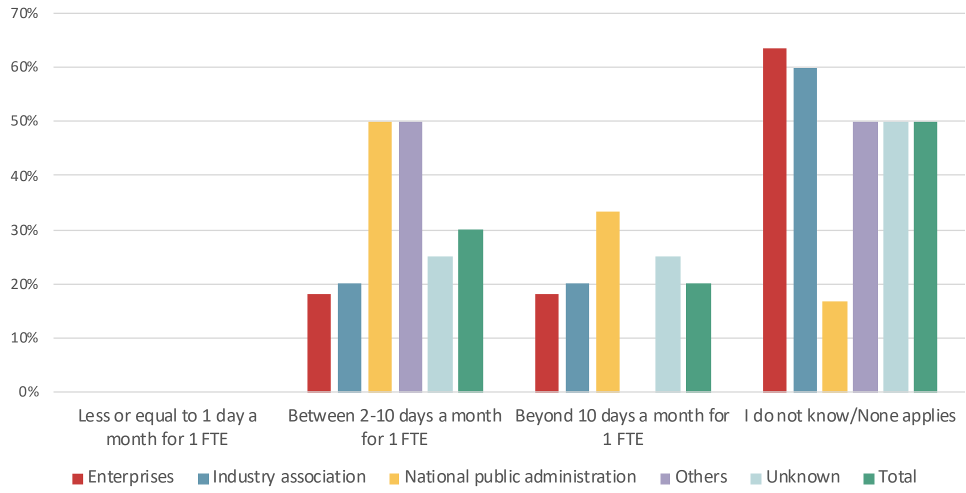


Figure 14 *Q11: Are any administrative activities outsourced/ subcontracted? (% of respondents)*

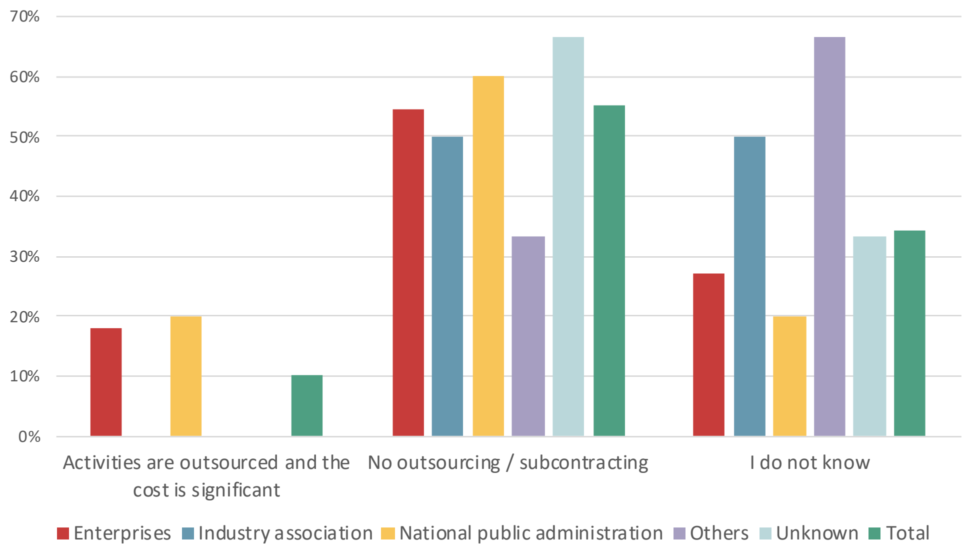
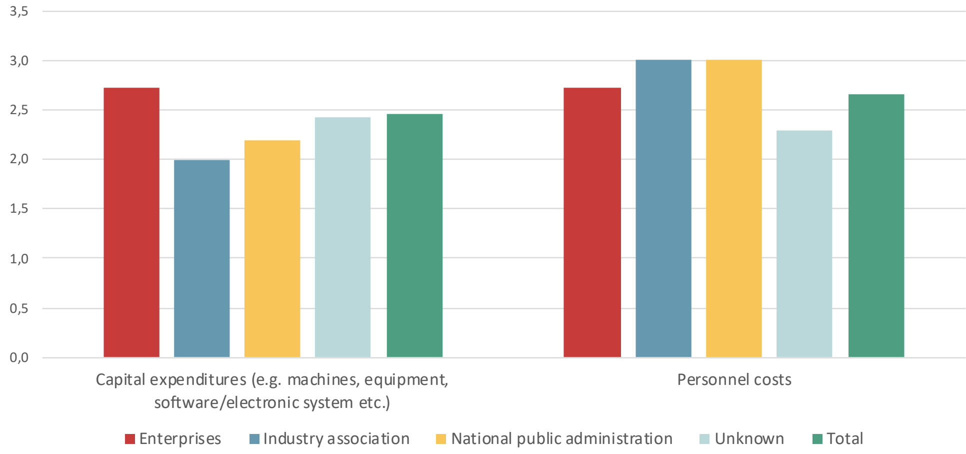
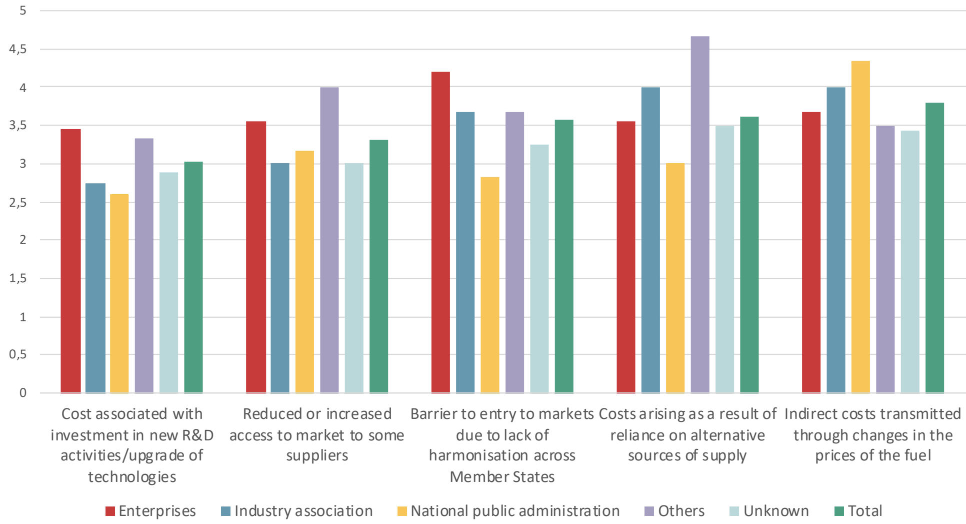


Figure 15 Q12: Did article 7a of the FQD raise any substantive compliance costs to achieve the targeted reduction of GHG emissions? (average score)



Note: Four-point scale, where 1 = no cost and 4 = major cost

Figure 16 Q13: What are in your opinion indirect costs induced by article 7a of the FQD? (average score)



Note: Five-point scale, where 1 = strong disagree and 5 = strongly agree

Figure 17 Q14: Do companies in the country(ies) you operate risk to not be able to attain the target? (% of respondents)

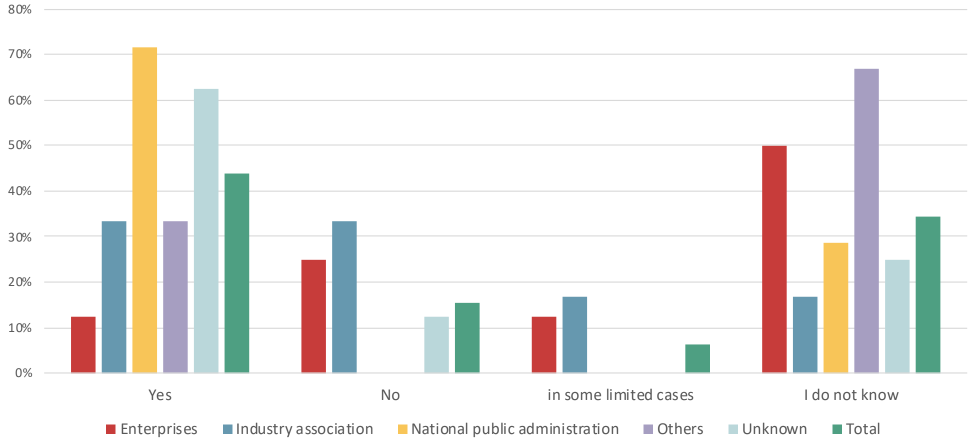


Table 2 Q3: What are the main long-term impacts of the reduction of GHG emissions intensity of supplied transport fuel that you foresee? (average score)

	Higher fuel efficiency of vehicles	Better market position of EU fuel companies worldwide	Less fragmented market for alternative fuels in the EU	Technological progress for fuel blending	Better human health	Increase air quality	Decreased GHG emission from transport
Enterprises (N=17)	2,7	2,6	2,8	3,2	2,9	3,2	4,4
Industry association (N=9)	2,1	2,2	2,6	3,2	3,6	3,6	4,8
National public administration (N=12)	1,9	2,8	2,4	2,8	3,2	3,6	4,0
Others (N=9)	3,1	3,3	3,3	3,0	3,4	3,7	4,4
Unknown (N=13)	3,0	2,3	2,4	3,8	3,5	3,2	4,7
Total (N=60)	2,6	2,6	2,7	3,2	3,3	3,4	4,5

Note: Five-point scale, where 1 = extremely unlikely and 5 = extremely likely

Table 3 Q4: Which objective(s) could not be achieved if article 7a of the FQD were replaced with national initiatives? (% of respondents)

	Better human health	Technological progress for fuel blending	Increase air quality	Higher fuel efficiency of vehicles	Better market position of EU fuel companies worldwide	Decreased GHG emission from transport	Less fragmented market for alternative fuels in the EU
Enterprises (N=14)	14%	7%	21%	14%	64%	64%	79%
Industry association (N=8)	0%	13%	13%	13%	63%	50%	88%

	Better human health	Technological progress for fuel blending	Increase air quality	Higher fuel efficiency of vehicles	Better market position of EU fuel companies worldwide	Decreased GHG emission from transport	Less fragmented market for alternative fuels in the EU
National public administration (N=12)	17%	33%	25%	25%	50%	42%	58%
Others (N=9)	33%	33%	22%	44%	44%	44%	89%
Unknown (N=13)	8%	15%	23%	23%	31%	54%	69%
Total (N=56)	14%	20%	21%	23%	50%	52%	75%

Table 4 *Q5: What are the three main obstacles to attain the compulsory target of reducing by 6% the GHG emission intensity of supplied transport fuels by 2020? (% of respondents)*

	Low trade of alternative fuels between demand and supply sites	Too ambitious targets	Low awareness of climate issues among fuel suppliers	Low deployment of electromobility	Lack of demand for alternative fuels (also considering the availability of related fleet)	Lack of blending mandate for alternative fuels	No foreseen return on investments for reducing GHG emissions	Lack of incentives /penalties	Lack of production volumes for alternative fuels	Lack of technical specifications to support higher blending of alternative fuels
Enterprises (N=16)	0%	6%	6%	6%	13%	31%	38%	56%	38%	50%
Industry association (N=8)	0%	0%	0%	0%	38%	50%	63%	38%	13%	63%

	Low trade of alternative fuels between demand and supply sites	Too ambitious targets	Low awareness of climate issues among fuel suppliers	Low deployment of electromobility	Lack of demand for alternative fuels (also considering the availability of related fleet)	Lack of blending mandate for alternative fuels	No foreseen return on investments for reducing GHG emissions	Lack of incentives /penalties	Lack of production volumes for alternative fuels	Lack of technical specifications to support higher blending of alternative fuels
National public administration (N=9)	0%	11%	33%	33%	22%	33%	11%	0%	89%	67%
Others (N=9)	0%	0%	0%	33%	11%	22%	56%	56%	44%	56%
Unknown (N=12)	17%	8%	0%	8%	33%	50%	33%	50%	33%	58%
Total (N=54)	4%	6%	7%	15%	22%	37%	39%	43%	43%	57%

Table 5 Q6: In your experience, how have the Fuel Quality Directive and the Renewable Energy Directive II mutually influenced their implementation? (average score)

	No mutual influence	Synergies for faster achievement of EU objectives	Complementarities allowing the attainment of their respective objectives	Overlaps negatively affecting the overall clarity of the EU legal framework
Enterprises (N=16)	2,4	2,6	2,8	3,8
Industry association (N=9)	2,7	3,1	2,7	3,8
National public administration (N=11)	1,5	2,6	3,1	3,6
Others (N=7)	1,9	2,3	2,6	3,6
Unknown (N=11)	2,7	2,3	2,0	4,2
Total (N=54)	2,3	2,6	2,6	3,8

Note: Five-point scale, where 1 = strongly disagree and 5 = strongly agree

Table 6 Q7: How accurately do the parameters in the methods of calculation measure reduction in GHG emission intensity of supplied transport fuels? (average score)

	Default value for the GHG emission intensity of each fuel (biofuels and future biofuels) and pathways	Baseline standard	Sustainability criteria	Overall calculation methods (including the biofuels calculation methods)
Enterprises (N=8)	2,3	2,0	2,3	2,6
Industry association (N=6)	2,2	2,2	2,5	2,8
National public administration (N=8)	1,8	1,9	2,3	2,6

	Default value for the GHG emission intensity of each fuel (biofuels and future biofuels) and pathways	Baseline standard	Sustainability criteria	Overall calculation methods (including the biofuels calculation methods)
Others (N=8)	1,5	2,0	1,7	2,0
Unknown (N=6)	2,0	1,8	2,2	2,3
Total (N=36)	1,9	2,0	2,2	2,5

Note: Three-point scale, where 1 = not accurately and 3 = accurately

Table 7 Q8: How easy were the following activities for the monitoring and reporting of GHG emission intensity of supplied transport fuels? (average score)

	Conduct of other monitoring activities in parallel (e.g. RED2)	Collect all necessary data	Calculation of the contribution of biofuel	Fill in the template provided by the European Commission	Obtain support from national competent authority
Enterprises (N=7)	2,8	3,6	3,9	3,3	4,0
Industry association (N=4)	2,8	2,5	3,8	2,3	2,8
National public administration (N=9)	2,5	3,6	3,2	4,1	4,5
Others (N=2)	2,0	3,0	1,5	1,0	2,0
Unknown (N=5)	1,6	1,8	1,8	2,6	3,0
Total (N=27)	2,4	3,0	3,1	3,2	3,6

Note: Five-point scale, where 1 = very difficult and 5 = very easy

Table 8 Q9: How could the monitoring and reporting obligations in article 7a of the FQD be improved? (% of respondents)

	Higher consideration for sustainable biofuels and the impacts of indirect land use changes	Obligation for fuel suppliers to report origin of fuels	Obligation for fuel suppliers to report the place of purchase of imported crude oils and fuels	Revision of the baseline	Method to estimate the upstream emission reduction effort	Method to estimate the contribution of GHG emission from energy supplied for electric cars	Revision of the default values
Enterprises (N=10)	30%	30%	30%	30%	60%	50%	80%
Industry association (N=5)	20%	40%	40%	40%	40%	80%	80%
National public administration (N=9)	22%	22%	33%	33%	56%	78%	44%
Others (N=6)	50%	50%	50%	50%	67%	67%	83%
Unknown (N=12)	17%	33%	33%	50%	42%	58%	75%
Total (N=42)	26%	33%	36%	40%	52%	64%	71%

Table 9 Q10: What is the total effort required for administrative activities induced by the obligation of monitoring life cycle GHG emissions per unit of energy? (% of respondents)

	Less or equal to 1 day a month for 1 FTE	Between 2-10 days a month for 1 FTE	Beyond 10 days a month for 1 FTE	I do not know/None applies
Enterprises (N=11)	0%	18%	18%	64%
Industry association (N=5)	0%	20%	20%	60%
National public administration (N=6)	0%	50%	33%	17%

	Less or equal to 1 day a month for 1 FTE	Between 2-10 days a month for 1 FTE	Beyond 10 days a month for 1 FTE	I do not know/None applies
Others (N=4)	0%	50%	0%	50%
Unknown (N=4)	0%	25%	25%	50%
Total (N=30)	0%	30%	20%	50%

Table 10 Q11: Are any administrative activities outsourced/ subcontracted? (% of respondents)

	Activities are outsourced and the cost is significant	No outsourcing / subcontracting	I do not know
Enterprises (N=11)	18%	55%	27%
Industry association (N=4)	0%	50%	50%
National public administration (N=5)	20%	60%	20%
Others (N=3)	0%	33%	67%
Unknown (N=6)	0%	67%	33%
Total (N=29)	10%	55%	34%

Table 11 Q12: Did article 7a of the FQD raise any substantive compliance costs to achieve the targeted reduction of GHG emissions? (average score)

	Capital expenditures (e.g. machines, equipment, software/electronic system etc.)	Personnel costs
Enterprises (N=7)	2,7	2,7
Industry association (N=1)	2,0	3,0
National public administration (N=5)	2,2	3,0
Others (N=0)		
Unknown (N=7)	2,4	2,3
Total (N=42)	2,5	2,7

Note: Four-point scale, where 1 = no cost and 4 = major cost

Table 12 Q13: What are in your opinion indirect costs induced by article 7a of the FQD? (average score)

	Cost associated with investment in new R&D activities/upgrade of technologies	Reduced or increased access to market to some suppliers	Barrier to entry to markets due to lack of harmonisation across Member States	Costs arising as a result of reliance on alternative sources of supply	Indirect costs transmitted through changes in the prices of the fuel
Enterprises (N=9)	3,4	3,6	4,2	3,6	3,7
Industry association (N=4)	2,8	3,0	3,7	4,0	4,0
National public administration (N=6)	2,6	3,2	2,8	3,0	4,3
Others (N=2)	3,3	4,0	3,7	4,7	3,5
Unknown (N=7)	2,9	3,0	3,3	3,5	3,4

Total (N=28)	3,0	3,3	3,6	3,6	3,8

Note: Five-point scale, where 1 = strong disagree and 5 = strongly agree

Table 13 Q14: Do companies in the country(ies) you operate risk to not be able to attain the target? (% of respondents)

	Yes	No	in some limited cases	I do not know
Enterprises (N=8)	13%	25%	13%	50%
Industry association (N=6)	33%	33%	17%	17%
National public administration (N=7)	71%	0%	0%	29%
Others (N=3)	33%	0%	0%	67%
Unknown (N=8)	63%	13%	0%	25%
Total (N=32)	44%	16%	6%	34%

Appendix H Final Workshop Report (from approved interim report)

JUNE 2021
EUROPEAN COMMISSION, DG CLIMA

SUPPORT STUDY ON THE EVALUATION OF ARTICLE 7A OF THE FUEL QUALITY DIRECTIVE AND ASSESSMENT OF APPROACHES TO REDUCE GHG EMISSIONS FROM TRANSPORT

FRAMEWORK CONTRACT CLIMA.A4/FRA/2019/0011

FINAL WORKSHOP REPORT – **APPENDIX F TO THE INTERIM REPORT**

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JUNE 2021
EUROPEAN COMMISSION, DG CLIMA

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4	09.06.2021	Final Workshop Report (D11)	MLG, SG, LLP	LLP	

CONTENTS

1 Objectives of the workshop

On Tuesday 20 April 2021, the final workshop was held as part of the support study to evaluate Article 7a of the Fuel Quality Directive (FQD) and to assess approaches to reduce greenhouse gas (GHG) emissions intensity from transport fuel. It had a twofold objective:

- Present, discuss and collect feedback on the main findings of the study evaluating Article 7a of the FQD
- Present, discuss and collect feedback on policy options for reducing GHG emissions from transport and assess their impacts.

2 Workshop participants

The workshop targeted experts and relevant stakeholders involved in the implementation of Article 7a. A preliminary list of potential participants included representatives of industry and industry associations (with a focus on the fuel industry and the transport sector), national competent authorities involved in the monitoring and reporting of life cycle GHG emission intensity of transport fuels, research organisations, consultancy and think tanks, individual experts, and representatives of the European Commission, EEA, JRC, and other international organisations.

The registration for the workshop was carried out through the *EventBrite* platform[1]. The consortium partners and individual experts disseminated the invitation in their respective networks and promoted participation.

By 19 April, a total of 215 people had registered to the event, whilst the actual number of participants was 195 (see Annex A). Among the participants, the majority were either representatives of companies (47%), national authorities (23%) or business associations (17%). They represented 25 EU Member States and 18% reported being located in Belgium.

All direct communication with them was carried out using a dedicated functional email address which will be used for all follow-up activities: 7a.fqd.consultation@technopolis-group.com.

[1] https://www.eventbrite.com/e/workshop-to-support-evaluation-of-article-7a-of-the-fuel-quality-directive-tickets-144163682455

Figure 1 Breakdown of participants per type of stakeholder

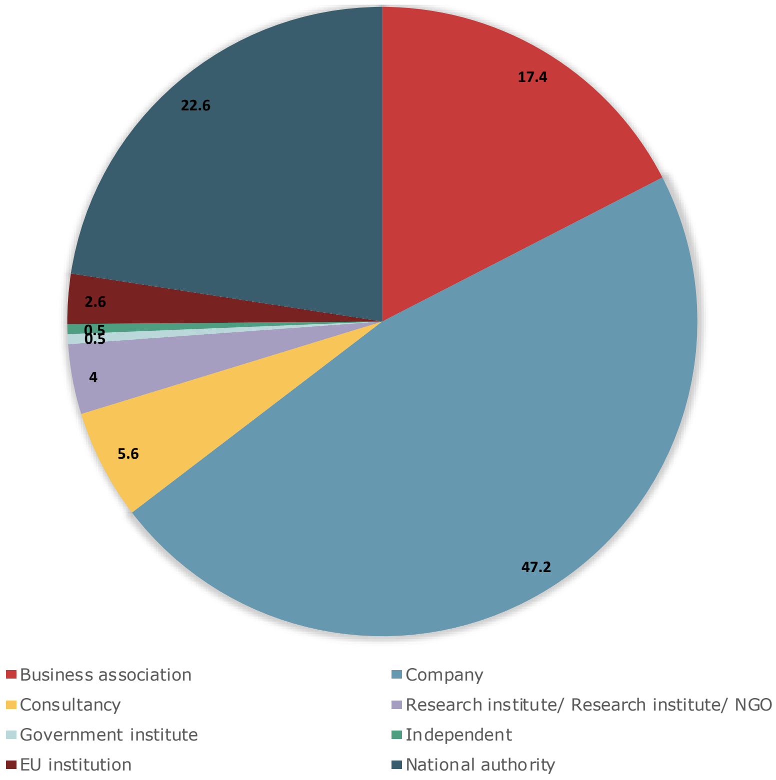
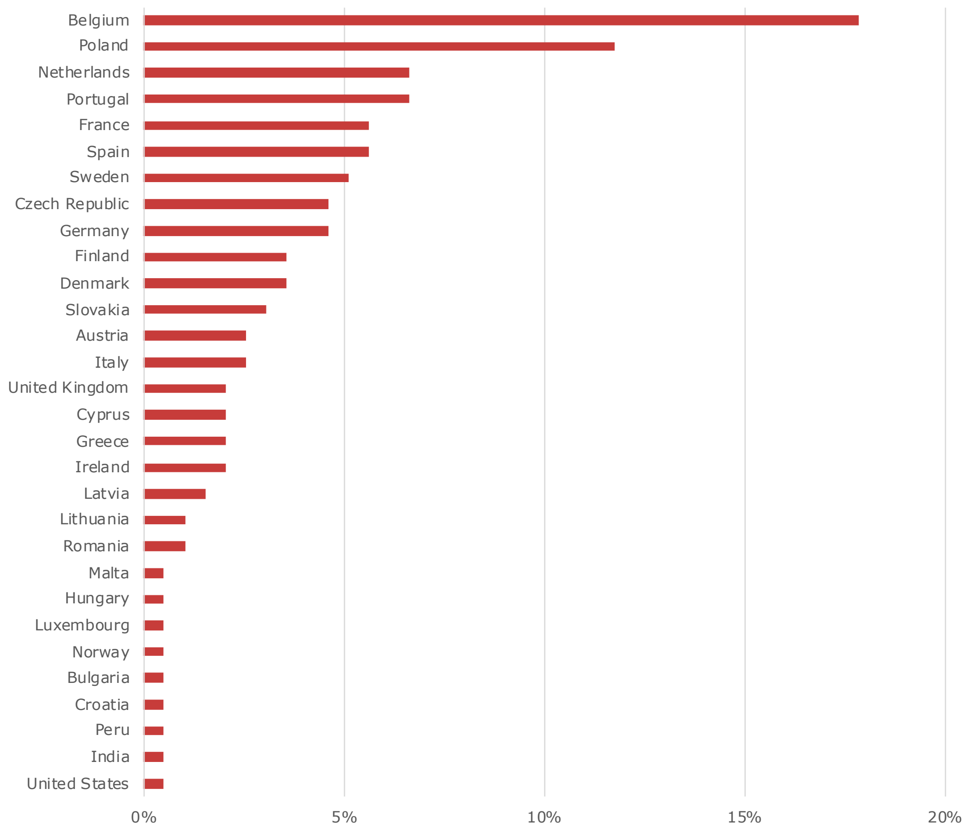


Figure 2 Geographical distribution of participants



3 Organisation and agenda of the workshop

The workshop was held on the WebEx platform, which offers all functionalities for the organisations of such webinars. To facilitate interactions, *MentiMeter* was used, a tool allowing for the organisations of polls and the automatic display of their results.

Except for the first sessions aimed at welcoming the participants and at introducing the study and the agenda of the workshop, the other sessions were designed to be as interactive as possible. Participants were invited to react in writing through the chat room, or through *MentiMeter* polls. Additionally, a questions-and-answers session was scheduled for the participants to react orally.

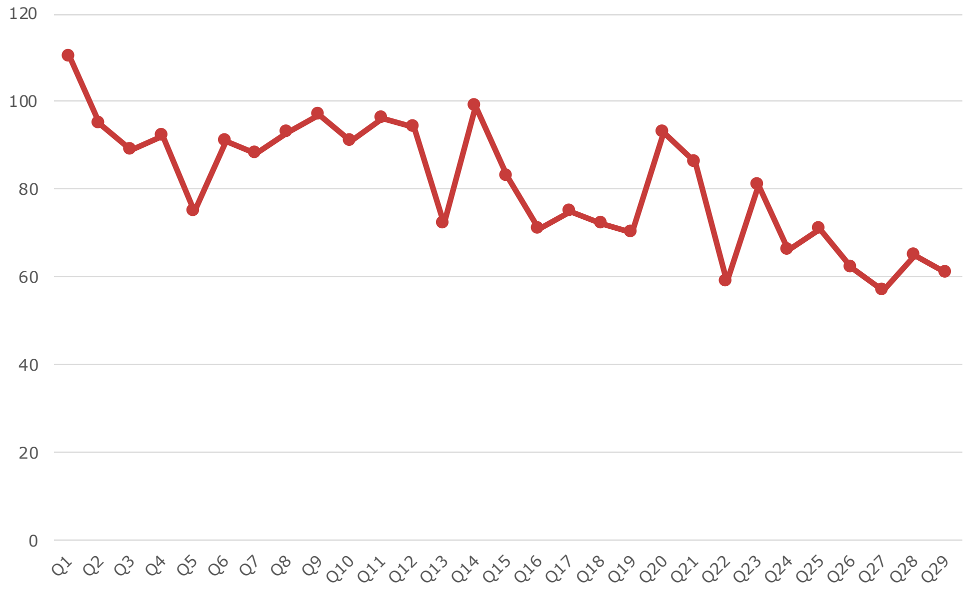
The week before the workshop, the Study Team agreed with the European Commission on the following agenda:

8:45 – 9:00	Opening of the online workshop platform Allowing participants to connect, test their connection, be introduced to the rules to follow and interact at the workshop (speaker: Luigi Lo Piparo, Technopolis)
Opening session	
9:00 – 9:05	Welcome by the moderator (speaker: Luigi Lo Piparo, Technopolis)
9:05 – 9:10	Opening words by the DG CLIMA: Background to the study (speaker: Laura Lonza, European Commission)
Discussion session	
Part I	
9:10 – 10:00	Presentation of the evaluation findings, use of the online tool for interactive discussion (speaker: Luigi Lo Piparo, Paresa Markianidou, Margaux Le Gallou, Technopolis Group)
10:00-10:15 Break	
Part II	
10:15 – 11:00	Presentation of the approach followed for the calculation of the GHG intensity of transport fuels, use of the online tool for interactive discussion (speaker: George Vourliotakis)
11:00 – 12:30	Presentation of the impact assessment of options to steer the progressive reduction of transport fuels' GHG intensity towards 2030 and 2050, use of the online tool for interactive discussions (speaker: Lorenz Carl Wähler, COWI)
12:30 – 12:55	Q&A session (moderator: Luigi Lo Piparo, Technopolis Group)
Closing session	
12:55 – 13:00	Discussion on the next steps (speaker: Laura Lonza, DG CLIMA)

4 Workshop Participants

In comparison with in-person events, the number of participants in online events fluctuates more and is less easy to monitor. The data on the responses provided to our *MentiMeter* questions allows for an estimate of the number of people who participated in the workshop. The total number of respondents varied between 57 and 110, which accounts for at least 29% of the number of participants and is equivalent to the average number of active participants in physical workshops on technical topics.

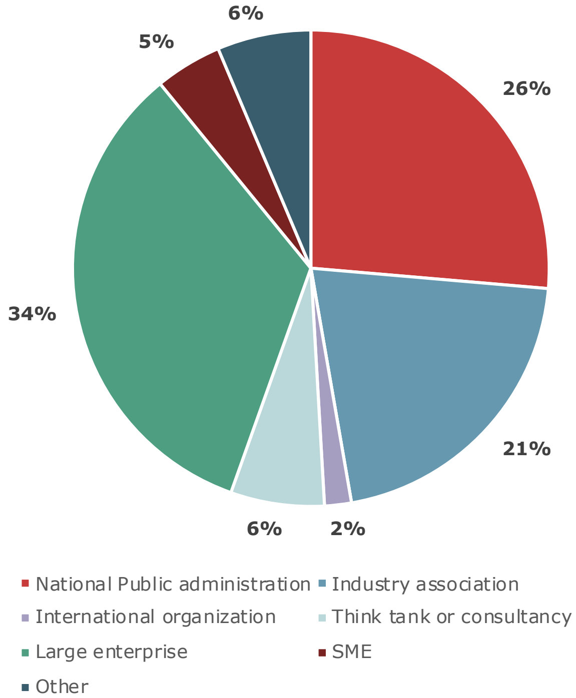
Figure 3 Number of respondents to MentiMeter questions



The *MentiMeter* polls were structured into two parts, the first covering Part I on the evaluation findings (Q1-11), and the second covering the last two discussion sessions (Q12-29). The first *MentiMeter* question of each part (Q1 and Q12) asked about the profile of the respondents. They aimed to let the participants familiarise themselves with the *MentiMeter* tool and its functioning. They also allowed our team to collect data which would help the analysis of the responses to the subsequent questions[2].

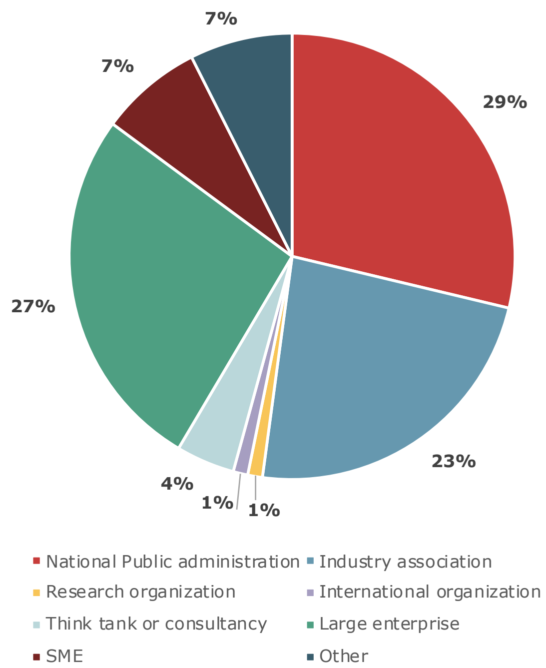
[2] MentiMeter registers the responses given by each respondent. They can be extracted in an excel file for their subsequent analysis.

Figure 4 Profile of respondents to MentiMeter (Q1)



Note: Number of respondents: 110

Figure 5 Profile of respondents to MentiMeter (Q12)



Note: Number of respondents: 94

There are no striking differences between the participants and the respondents to the *MentiMeter* poll. In both groups, industry (including industry associations) and national public administrations are the most represented groups.

5 Inputs from participants

The workshop participants were invited to react to the evaluation findings presented and to share their experience and views on the implementation of Article 7a of the FQD and on the approaches to reduce further GHG emissions from transport fuels through three channels:

- The *MentiMeter* poll (see Annex B)
- The WebEx-embedded chat function (see Annex C and minutes of the event in Annex D)
- By email using the functional project email address.

All the feedback collected during the workshop will be used for refining the evaluation findings, the assumptions and approach used to calculate the GHG intensity of transport fuels, and for enhancing the qualification of the options proposed to achieve the progressive reduction of GHG emissions intensity of fuels towards 2030 and 2050.

6 Analysis of participants' inputs

This section summarises the main insights from the workshop participants for each of the three sessions: (1) the evaluation of Article 7a of the FQD, (2) the assumptions used to calculate the GHG intensity of fuels, and (3) the options for the progressive reduction of GHG emissions intensity from transport fuels.

6.1 Insights from the session on the findings of the evaluation of Article 7a of the FQD

This session presented the preliminary findings of the evaluation of Article 7a of the FQD. The session presented the key findings for all evaluation criteria, namely:

- **Relevance**, considering the validity of Article 7a with the EU ambition to reduce the GHG intensity of transport fuels,
- **Effectiveness**, assessing the extent to which the objectives of Article 7a were reached, and identifying the related enables and barriers
- **Efficiency**, weighing the effects/benefits of Article 7a compared to its costs, including costs induced by its implementation

- **Coherence**, evaluating the interactions of Article 7a with other provisions in the FQD, and other EU and/or international/national/local initiatives that have similar objectives
- **Added value**, determining the additional value resulting from the intervention at the EU level, compared to what could have been achieved at the national or local levels.

A set of questions was asked to the audience to test and collect feedback on the findings of the evaluation criteria throughout the session.

6.1.1 Relevance

The participants confirmed through the *MentiMeter* poll survey that Article 7a of the FQD is relevant to achieve increased competitiveness of fuels with lower GHG intensity and fuel technology progress. A large majority of respondents (69%) also agreed that a technology-neutral approach through Article 7a is relevant to achieving the quantitative targets of reducing life cycle GHG emission intensity.

6.1.2 Effectiveness

According to the poll results, an increase in the supply of, and demand for, fuels with lower GHG emissions intensity is the main positive direct impact achieved by Article 7a (chosen by 40% of respondents). Conversely, a limit to the supply of, and demand for, fuels with lower GHG intensity was also cited by participants as being the main negative direct impact of Article 7a (chosen by 49% of respondents). The stakeholders most likely to highlight the negative impact on supply and demand were enterprises (57% negative vs. 42% positive) and industry associations (50% negative vs. 26% positive).

6.1.3 Efficiency

A large majority of participants to the *MentiMeter* poll (71%) stated that they would favour the harmonisation of penalty systems in terms of structure and rationale to enhance their effectiveness, proportionality and dissuasiveness. This was the case across stakeholder categories.

When asked which type of penalty system was best suited to ensure effectiveness, proportionality and dissuasiveness, half of respondents chose a progressive financial penalty system (i.e. the closer a company is to meeting the target, the lower the penalty per excess tonne of CO2 equivalent). However, whilst 58% of enterprises were in favour of this option, only 39% of industry associations and national public administrations were. The next most popular type of penalty system among respondents was a purely financial penalty system per excess tonne of CO2 equivalent (35% of respondents).

6.1.4 Coherence

A large majority of respondents to the survey (66%) agreed that synergies existed between Article 7a of the FQD and RED II, although some participants mentioned in the WebEx chat functionality that the phrasing of the question was perhaps not correctly done. For example, participants in the chat function mentioned that whilst parts of the text of the two directives are identical (and so in synergy), they were also based on frameworks based on different assumptions, with double counting in RED II and none in the FQD.

When asked what measures were most urgent to consider for reducing emissions from transport fuels and the transport sector, 45% of respondents stated that it was correcting the perceived inconsistencies and overlaps between the FQD and RED II. Interestingly, an overwhelming majority of national public administrations (75%) opted for this choice, compared to only 21% of enterprises. One-quarter of respondents stated that the most urgent option to consider was more ambitious regulations at the national level.

6.1.5 EU added value

According to the poll results, respondents were in strong agreement that EU requirements on fuel blends represent a better solution to reduce fragmentation of the EU market for fuels and vehicles than national requirements, with 41% of industry associations strongly agreeing with this statement.

Most respondents also agreed that EU targets for the reduction of GHG intensity represent a better solution to reduce GHG emissions from transport than targets at the national level.

6.1.6 Overview of the workshop inputs to the evaluation questions

The table below summarises the main inputs from the workshop to the evaluation questions.

Table 1 Workshop inputs per evaluation question

Criterion	Evaluation question	Inputs
Relevance	To what extent did the target in Article 7a of the FQD still correspond to the ambitions and obligations of the European Union in terms of reduction of GHG emissions?	› From the poll: Three-quarters of respondents agree or strongly agree that the targets in Article 7a are relevant to achieve increased competitiveness of fuels with lower GHG intensity and fuel technology progress
	How relevant are the targets in terms of reduction of the life cycle GHG emission intensity of transport fuels?	› From the poll: 70% of respondents think that a technology-neutral approach in Article 7a is relevant to achieve the quantitative targets of reducing life cycle GHG emission intensity

Criterion	Evaluation question	Inputs
Effectiveness	Does Article 7a of the FQD contribute to reducing the life cycle GHG emission intensity of transport fuels until end of 2020?	› From the poll: › Most respondents to this question (56%, 52 out of 92 respondents) believe that the main positive direct impact achieved by Article 7a is an increase in the supply of, and demand for, fuels with lower GHG intensity › Fewer than 10% of respondents believe that higher synergies and cooperation between oil-based fuel supplier and producers of renewable and low-carbon fuels will be the main impact achieved.
	What factors contribute to or hinder the reduction of the life cycle GHG emission intensity of transport fuels?	› From the poll: Most respondents (54%, 41 out of 75 respondents) also believe that the main negative impact of Article 7a is to limit the supply of, and demand for, fuels with lower GHG intensity. The outcome of the pool on this question compared to the previous one indicates that the respondents' opinions on this matter are split.
Efficiency	Are the reporting and monitoring of the life cycle GHG emission intensity of transport fuels cost-effective?	› From the poll: › 70% of respondents would be in favour of harmonising penalty systems in terms of their structure and rationale › If such a penalty system were harmonised, the respondents preferred a progressive financial penalty system be put in place
Coherence	To what extent is Article 7a of the FQD coherent with other EU initiatives?	› From the poll: › Most of the respondents agreed that there are synergies between Article 7a of the FQD and RED › Nevertheless, three-quarters of the national public administrations polled thought that the most urgent measure to consider was to correct the perceived inconsistencies and overlaps between the FQD and RED II (45% overall)
EU-added value	Does the definition of goals at the EU level allow for the achievement	› From the poll: A large majority of the respondents polled thought that EU requirements

Criterion	Evaluation question	Inputs
	of the overarching objectives relative GHG emission?	and targets for fuel blends and to reduce GHG intensity represent a better solution to reduce EU market fragmentation and to reduce GHG emissions from transport than measures at the national level

6.2 Insights from the session on the assumptions and approach used to calculate GHG intensity

This session presented the approach followed for performing the calculation of the GHG intensity of fuels considered in the MIX scenario of the 2030 Climate Target Plan, which essentially constitutes the baseline of the current analysis. A presentation of the underlying assumptions and discussions of the effects from the data choices of key parameters was made.

A set of questions was asked to the audience to test and collect feedback on the assumptions used to perform the calculation of the GHG intensity of the various fuel options/categories.

There was a significant level of uncertainty among participants using the WebEx chat function regarding the assumptions used for the calculations, perhaps due to lack of, or limited, familiarity with the data sources and methodologies.

According to respondents to the poll, stakeholders were divided as to which low-carbon solution they believed would have the most significant contribution in the effort to decarbonise the road transport sector. One-quarter opted for waste-based biofuels, and a further quarter opted for electricity (electromobility). Enterprises and industry associations were most likely to opt for the former, and national public administrations for the latter.

When asked which feedstocks for road transport fuels would be most affected due to an expected increase in efforts to decarbonise the maritime and aviation sectors, a majority of respondents (59%) thought that it would be waste-based biofuels.

Participants were asked what the dominant feedstock would be for the production of bioethanol, biodiesel, HVO and biomethane in 2030. For bioethanol, 30% of respondents believed it would be maize, followed by 21% for sugars and 20% for feedstocks listed in Annex IX Part A of RED II. Enterprises were most likely to opt for sugars (27%), industry associations for maize (62%), national public administrations for maize, sugars, and feedstocks listed in RED II (23% each) and 'other stakeholders' for the latter option (30%). For biodiesel, 39% of respondents thought that the dominant feedstock for production in 2030 would be used cooking oil (UCO), followed by rapeseed oil at 25%. For the production of HVO, participants thought that this was also most likely to come from UCO (31%), followed by sustainable palm oil (25%). Lastly, concerning biomethane, half of respondents thought that organic waste was likely to be the dominant feedstock, which was the preferred choice by all stakeholder categories.

Stakeholders believed that RED II (and its revision) was the directive that would have the largest influence on successfully reducing GHG emissions, over the FQD and the regulations setting CO2 performance standards for road transport vehicles (Regulation (EU) 2019/631, Regulation (EU) 2019/1242).

When asked what the main driver for market fragmentation was, 80% of stakeholders stated that either that it was different transpositions of Article 7a (i.e. compliance requirements and penalty structures) or varied application across Member States of double-counting options allowed under RED II.

6.3 Insights from the session on the impact assessment of options to steer the progressive reduction of transport fuels' GHG

To support the progressive reduction of GHG emissions from transport fuels, the study examined the following six options:

- **Option 1** – Continue with the obligation (i.e. 2020 target)
- **Option 2** – Discontinue the obligation
- **Option 3** – Strengthen the obligation
- **Option 3A** – Option 3, plus addition of technical specifications for gaseous fuels to FQD
- **Option 3B** – Option 3, plus introduction of a GHG credit-trading platform
- **Option 3C** – Option 3, plus regulation of fuel suppliers with EU regulation

A set of questions was asked to the audience to test and collect feedback on the findings and contribute to validating the proposed way forward for each option and sub-option.

According to participants, Option 3 was deemed to be the best policy option. It was ranked as the most effective option to reduce GHG emissions from transport fuels and the option with the greatest net benefit. It was also ranked as the option that would have the largest impact on increasing competition among fuel suppliers for conventional biofuel feedstock, on increasing competition among fuel suppliers for advanced biofuel feedstock, and on improving the competition between renewable and recycled fuels.

Option 3C was ranked as the option that would be most effective in eliminating the alternative fuel market fragmentation.

Lastly, when asked how they thought a strengthened GHG obligation would impact affordability of road transport, 42% of respondents thought that affordability would be marginally decreased.

Annex A. Responses to the *MentiMeter* poll

We present below the responses to the *MentiMeter* poll questions. The poll included two introductory questions enquiring as to the profile of the respondents. The answers to these questions are presented in Figure 4 and Figure 5.

Part I

The responses to the *MentiMeter* poll are broken down per stakeholder category. Considering the profile of the respondents, we propose four categories:

- Enterprises, including large enterprises and SMEs (total respondents: 42)
- Industry associations (total respondents: 23)
- National public administrations (total respondents: 29)
- Others, including research organisations, think tanks and consultancies, international organisations among others (total respondents: 16)

Figure 6 Q2: To what extent do you agree that Art.7a is relevant to achieve increased competitiveness of fuels with lower GHG intensity & fuel technology progress? (% of respondents)

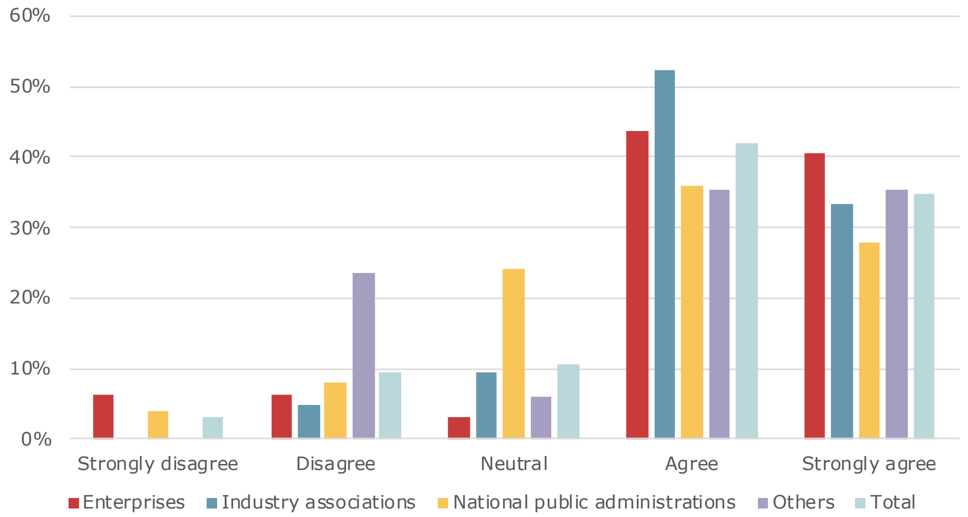


Figure 7 Q3: To what extent is Art.7a a technology-neutral approach relevant to achieve the quanti targets of reduction of life-cycle GHG emission intensity? (% of respondents)

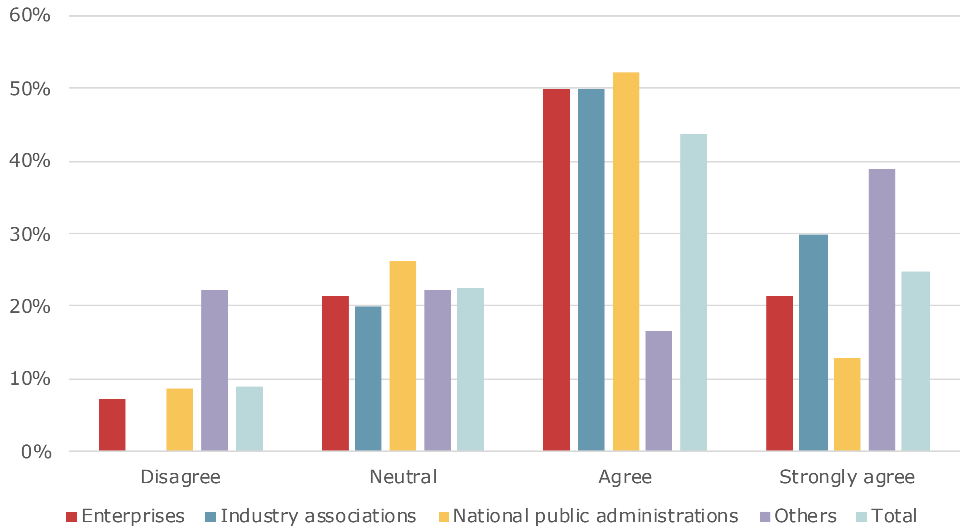


Figure 8 Q4: Which are the main positive direct impacts achieved by Art.7a of the FQD? (% of respondents)

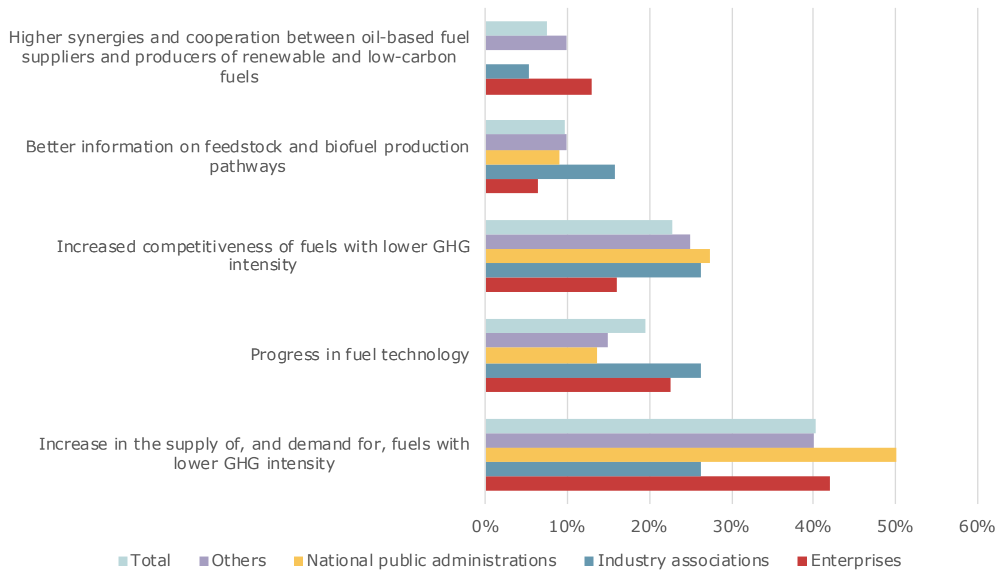


Figure 9 Q5: Which are the main negative impacts achieved by Art.7a of the FQD? (% of respondents)

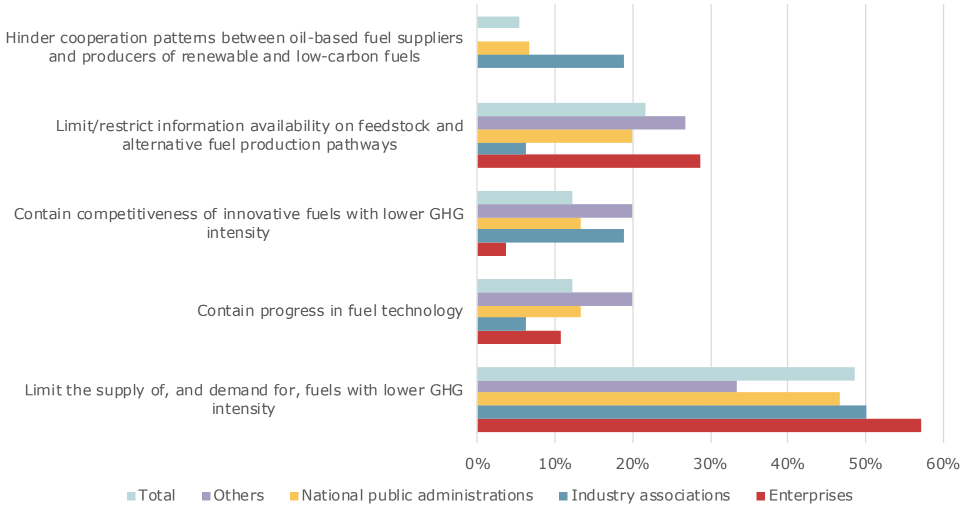


Figure 10 Q6: Would you favour harmonisation of penalty systems in terms of structure & rationale to enhance their effectiveness, proportionality & dissuasiveness? (% of respondents)

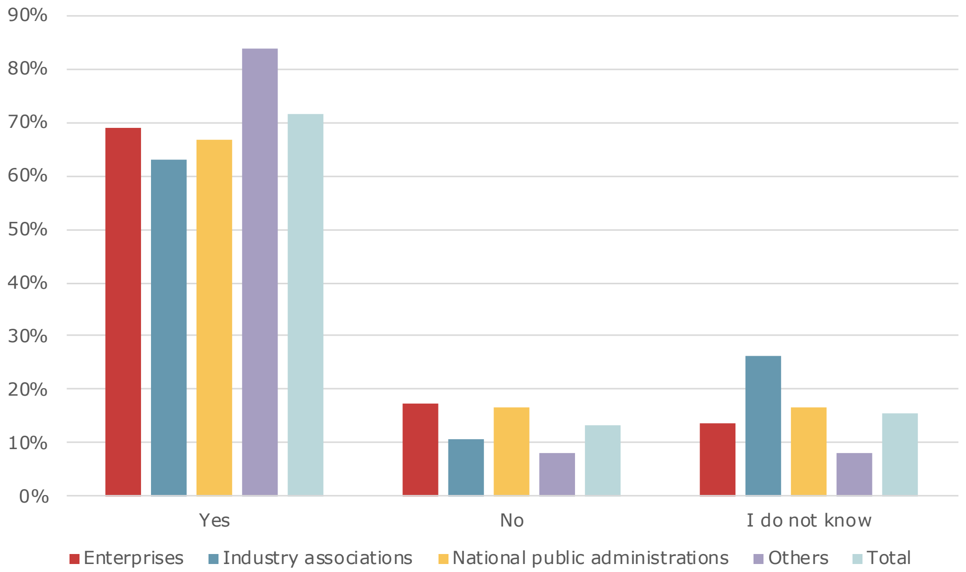


Figure 11 Q7: Which type of penalty system is in your opinion better suited to ensure effectiveness, proportionality and dissuasiveness? (% of respondents)

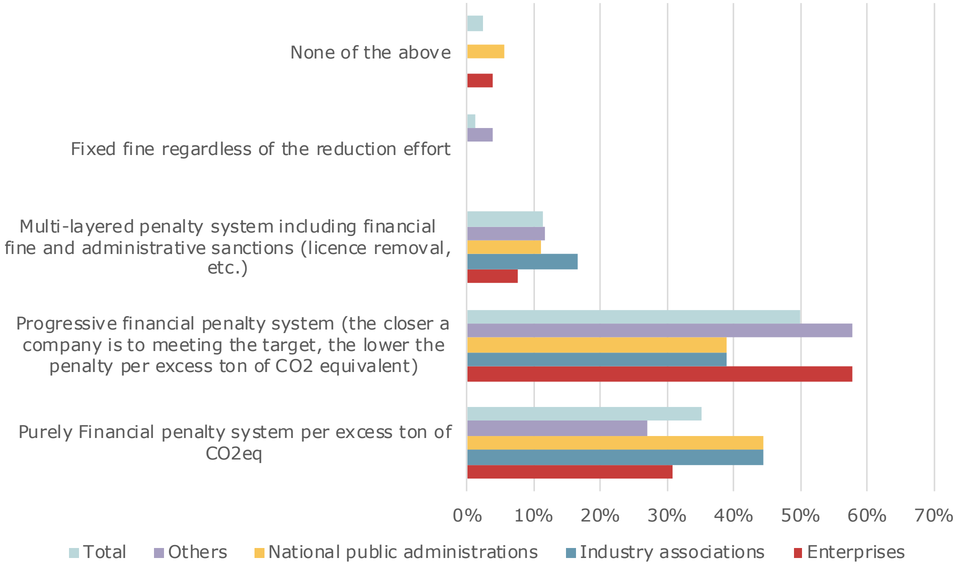


Figure 12 Q8: To what extent would you agree that there are synergies between Art.7a of the FQD and the Renewable Energy Directive (RED) 2? (% of respondents)

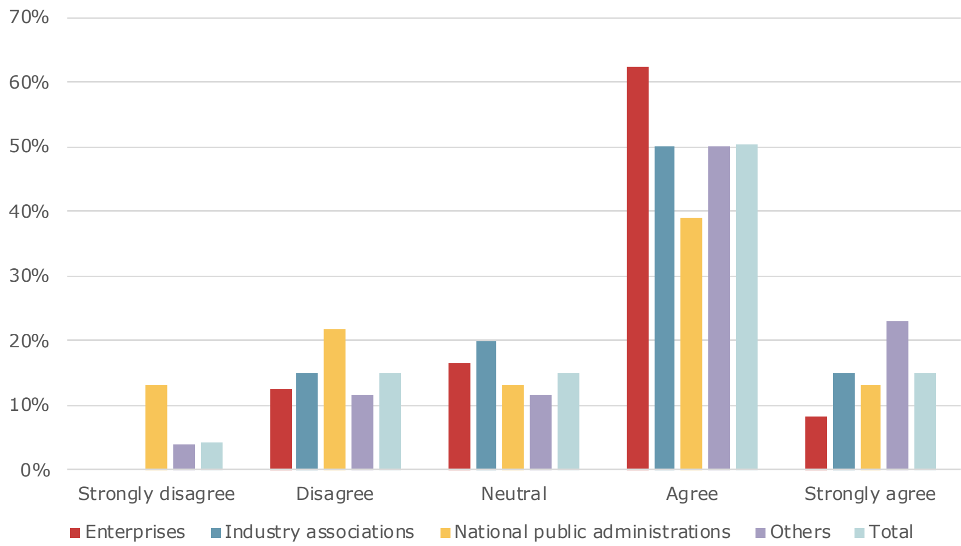


Figure 13 Q9: Which of the following measures are the most urgent to consider for reducing emissions from transport fuels and the transport sector? (% of respondents)

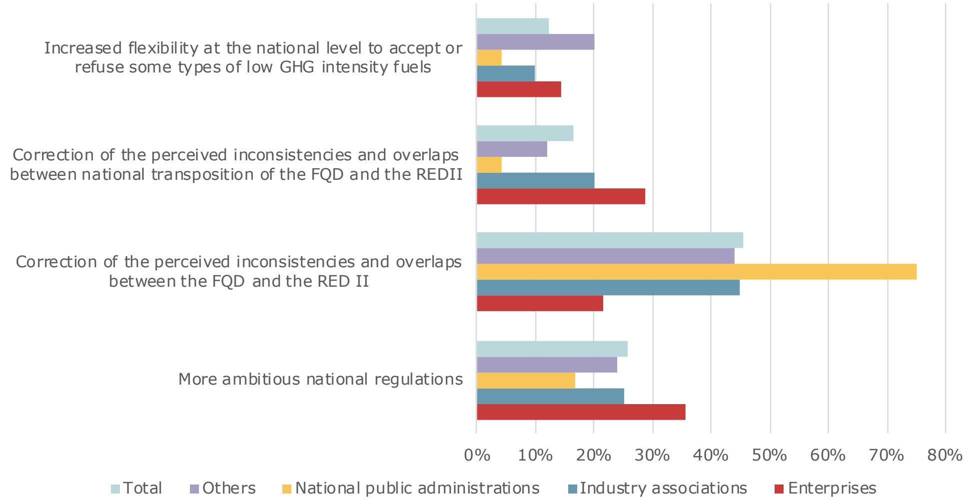


Figure 14 Q10: EU requirements for fuel blends may represent a better solution to reduce fragmentation of EU market for fuels&vehicles than national requirements (% of respondents)

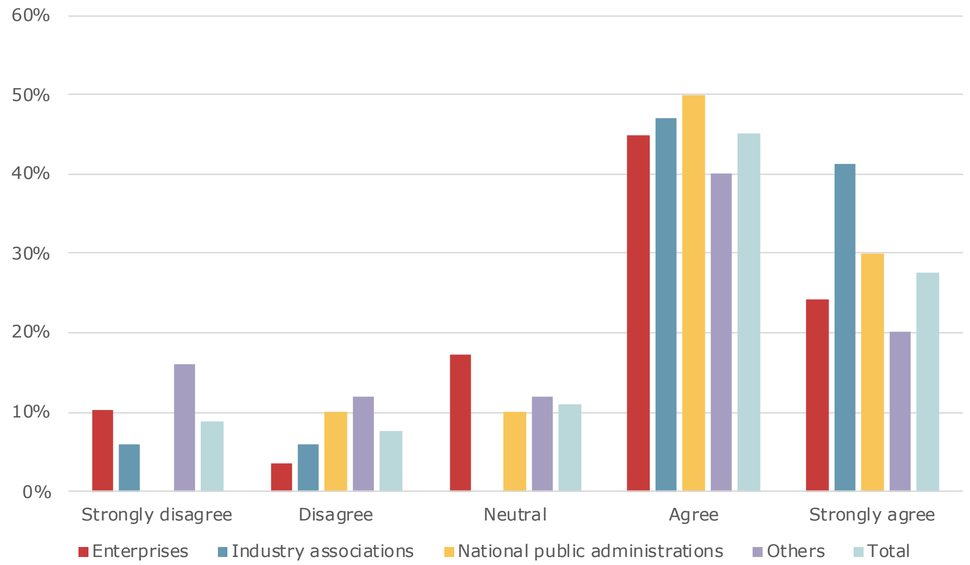
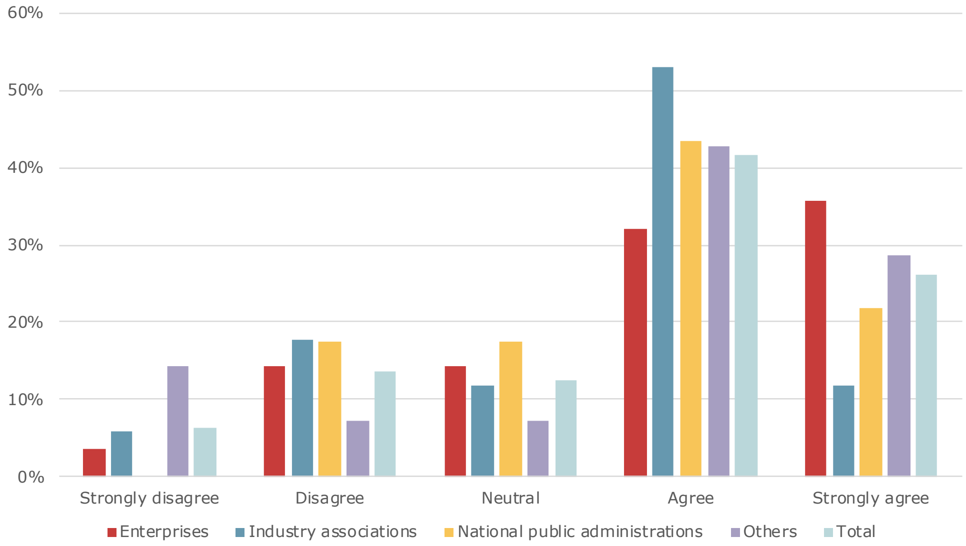


Figure 15 *Q11: EU targets for the reduction of GHG intensity may represent a better solution to reduce GHG emissions from transport than targets at national level (% of respondents)*



Part II

The responses to the *MentiMeter* poll are broken down per stakeholder category. Considering the profile of the respondents, we maintained the same four categories:

- Enterprises, including large enterprises and SMEs (total respondents: 32)
- Industry associations (total respondents: 22)
- National public administrations (total respondents: 27)
- Others, including research organisations, think tanks and consultancies, international organisations among others (total respondents: 13)

Figure 16 Q13: What is your primary focus (for SMEs and large enterprises) (% of respondents)

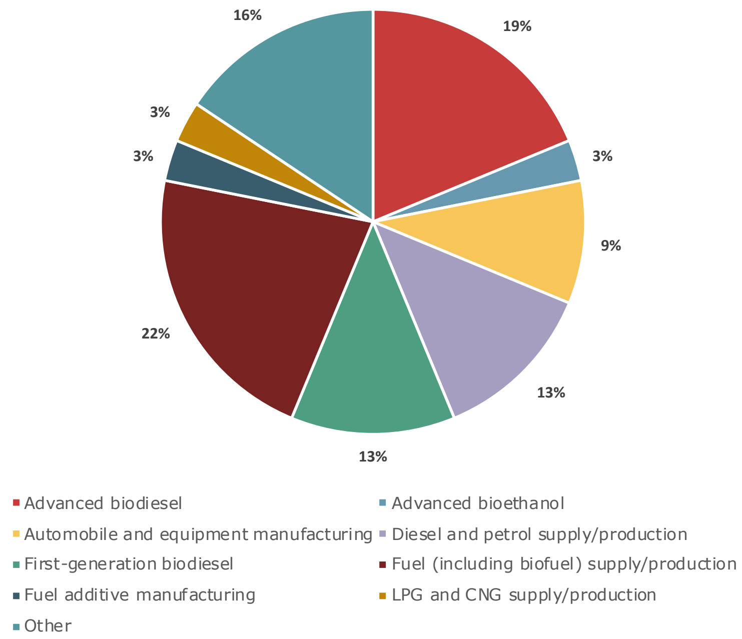


Figure 17 *Q14: Which low-carbon solution do you believe will have the most significant contribution in the effort of the decarbonization of the road transport sector? (% of respondents)*

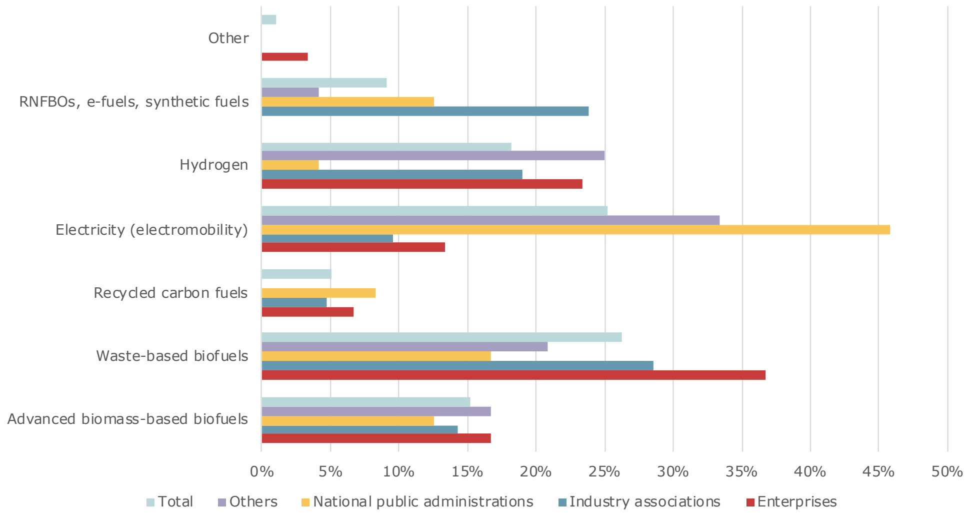


Figure 18 *Q15: Which feedstocks for road transport fuels will be most affected because of expected increase in efforts to decarbonise maritime and aviation sectors? (% of respondents)*

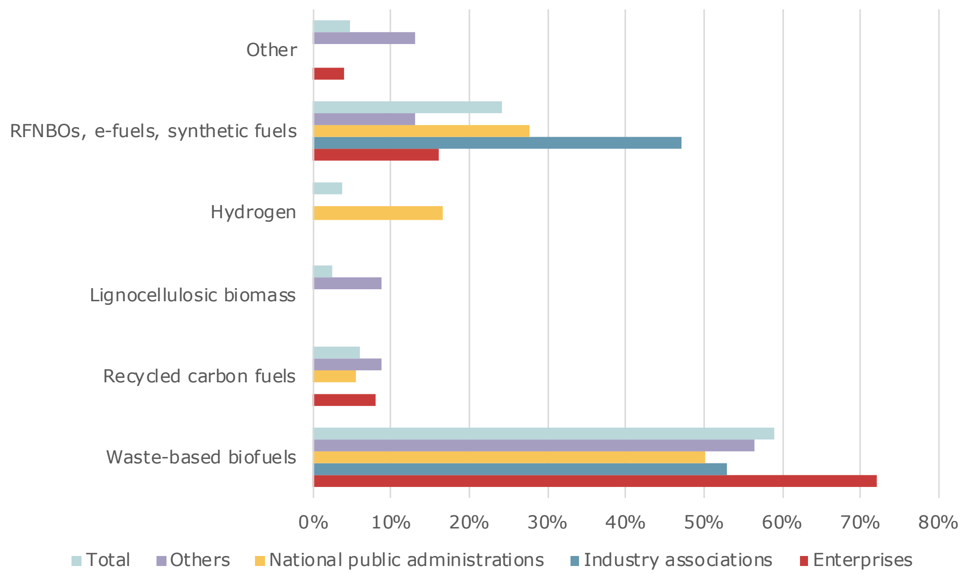


Figure 19 Q16: Which will be the dominant feedstock for the production of bioethanol in 2030? (% of respondents)

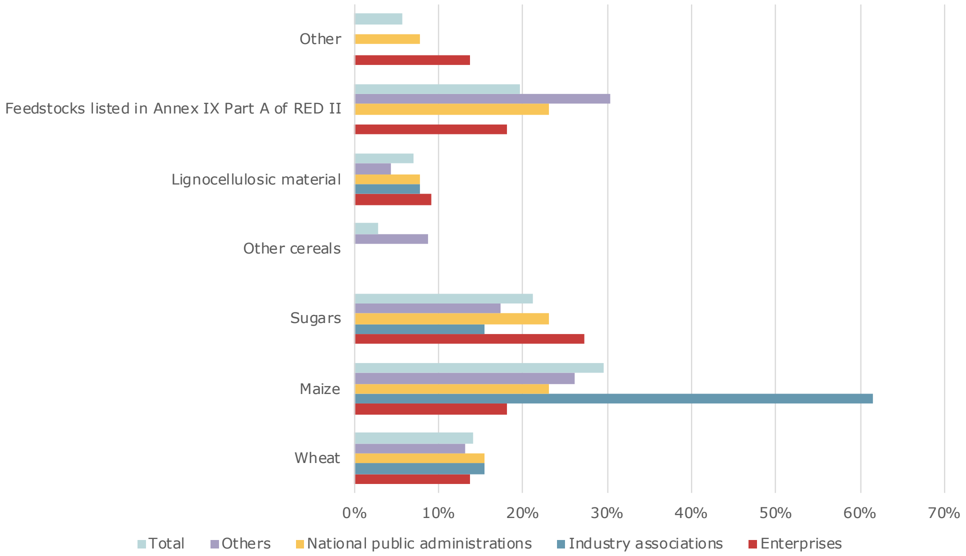


Figure 20 Q17: Which will be the dominant feedstock for the production of biodiesel in 2030? (% of respondents)

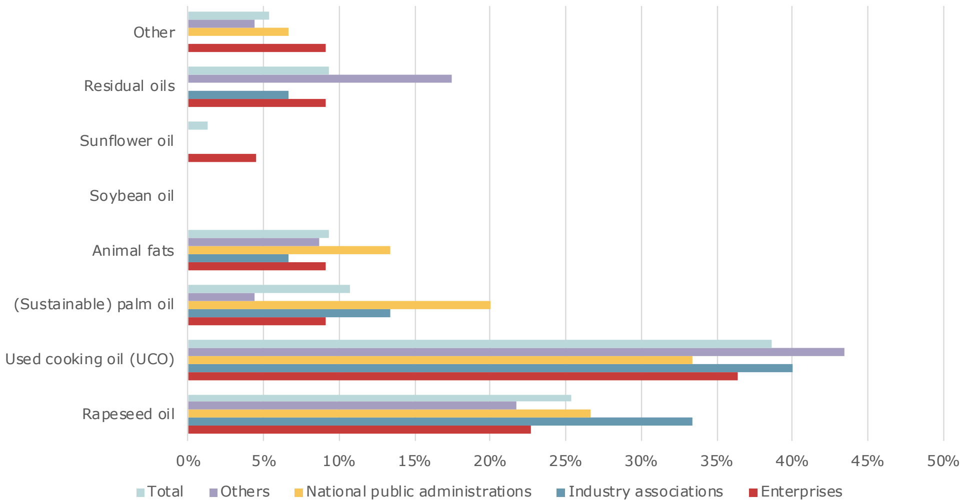


Figure 21 Q18: Which will be the dominant feedstock for the production of HVO in 2030? (% of respondents)

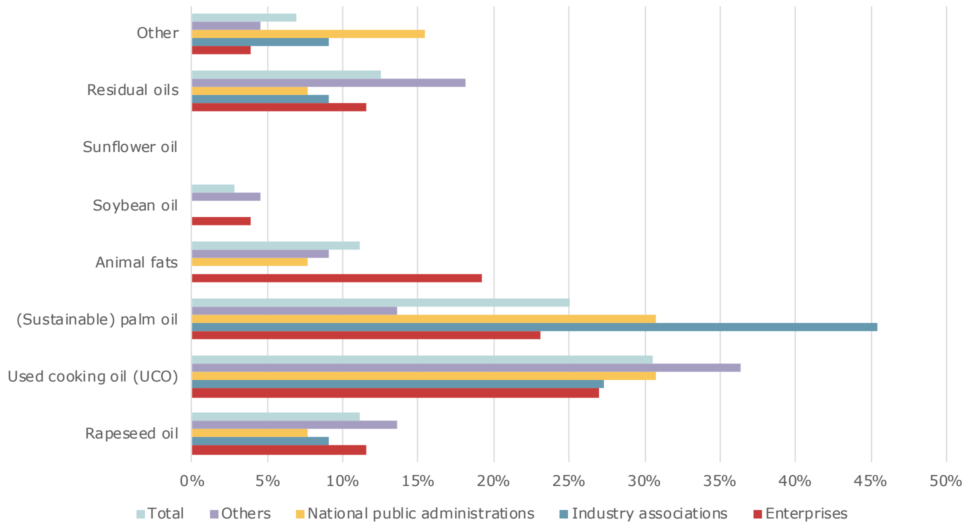


Figure 22 Q19: Which will be the dominant feedstock for the production of biomethane in 2030? (% of respondents)

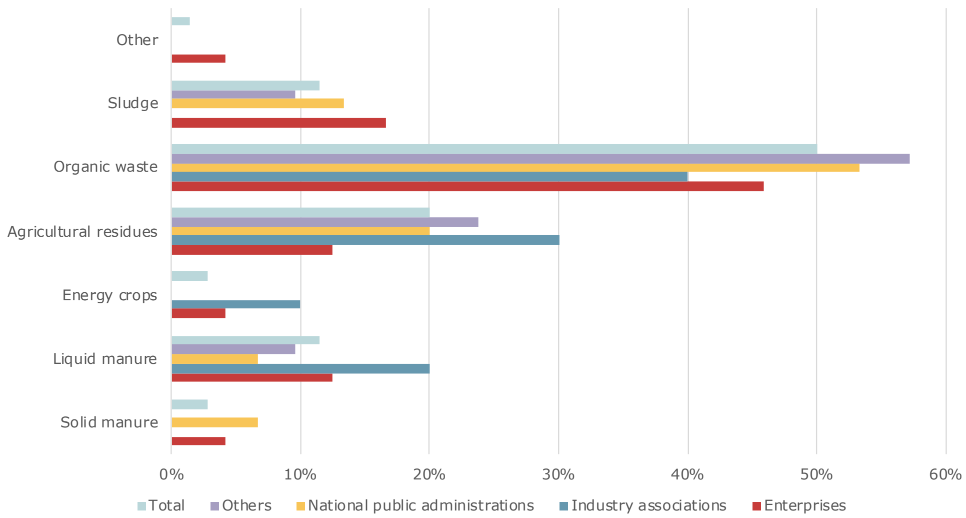


Figure 23 *Q20: Which transport fuel and vehicle related directives do you believe will have the largest influence on a successful GHG reduction outcome towards 2050? (% of respondents)*

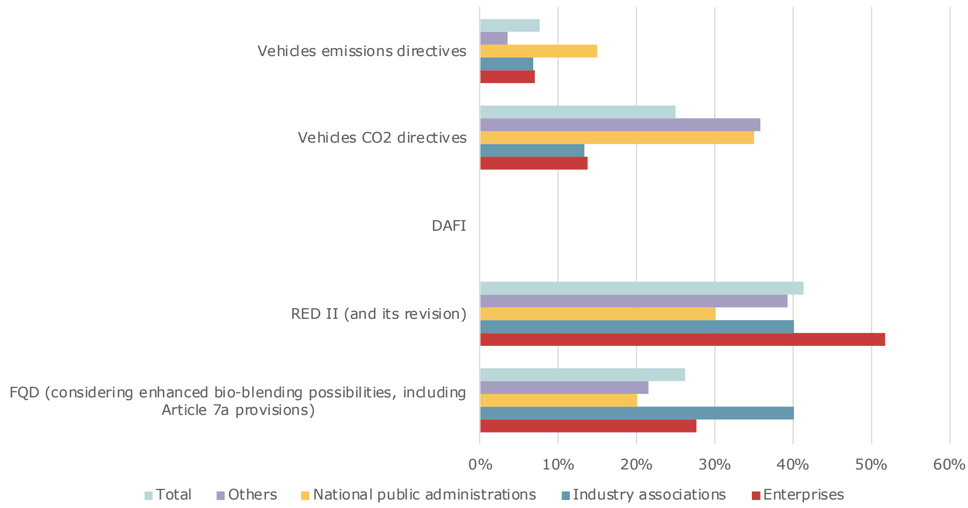


Figure 24 *Q21: In your opinion, what is the main driver for market fragmentation? (% of respondents)*

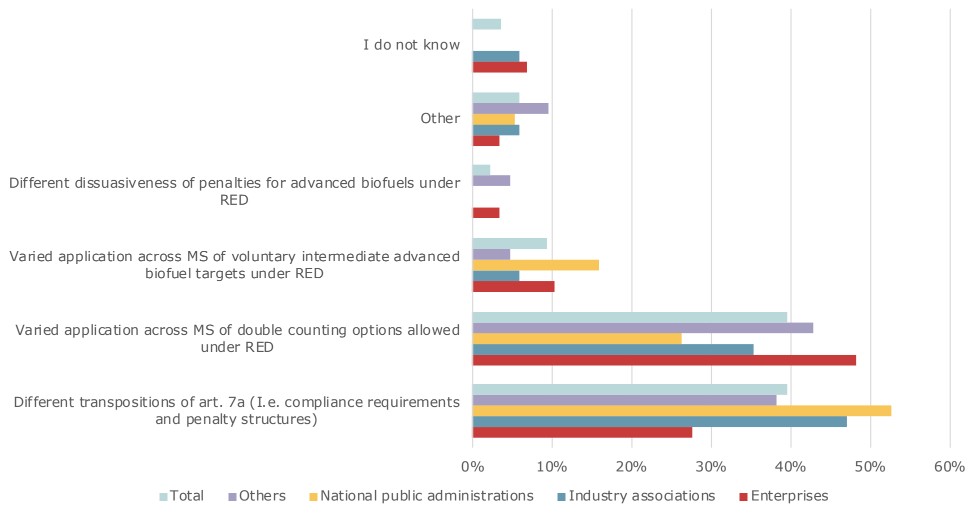


Figure 25 Q22: What is the critical element that is missing in the market system design? (Wordcloud and Funnel chart)

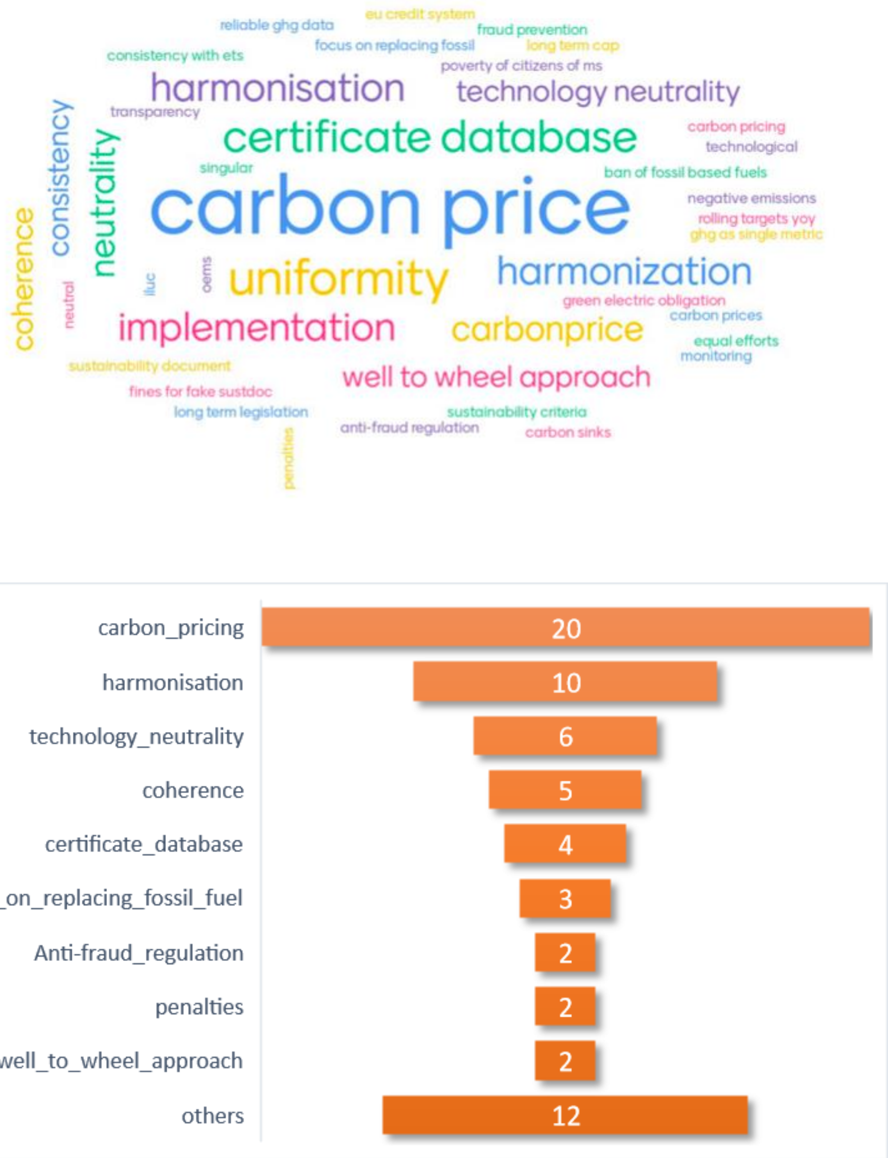
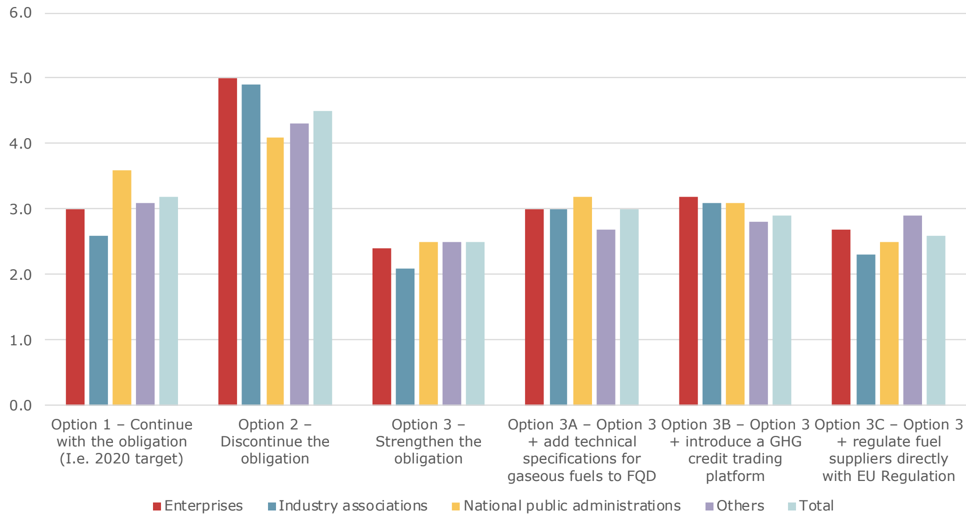
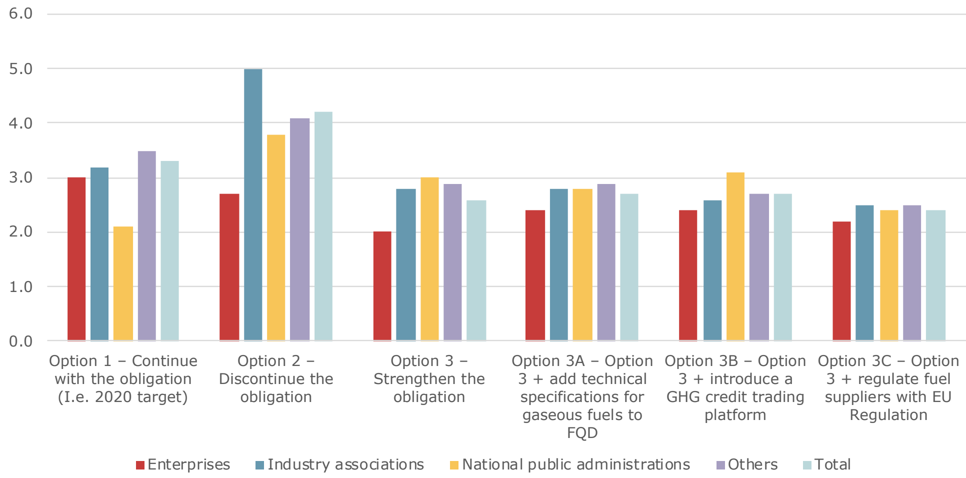


Figure 26 Q23: Please rank the options according to their effectiveness of reducing GHG emissions from transport fuels, according to your view (1= Best to 6=Worst) (average score of respondents)



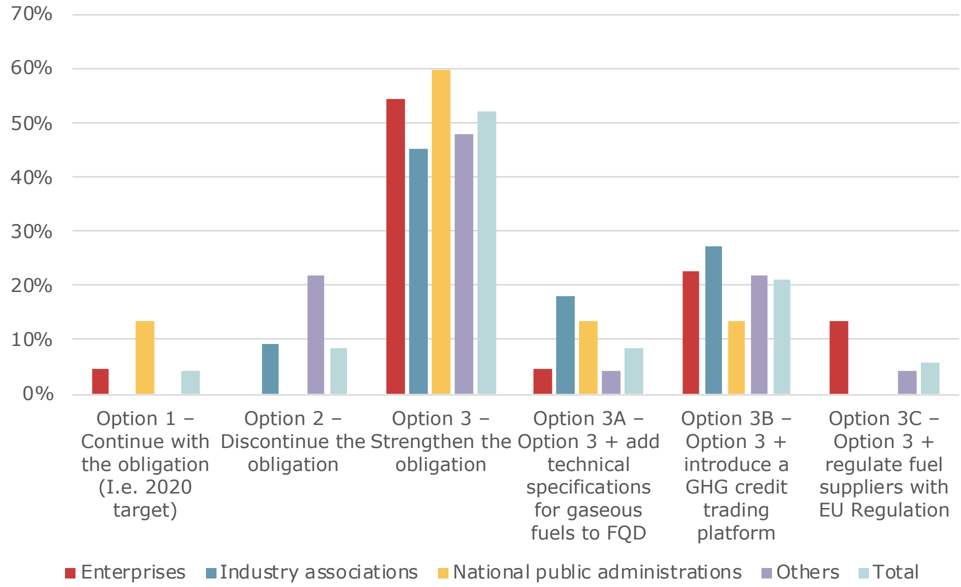
Note: Six-point scale, where 1 = the best and 6 = the worst.

Figure 27 Q24: Please rank the options according to their effectiveness in eliminating the alternative fuel market fragmentation (1= Best to 6=Worst) (average score of respondents)



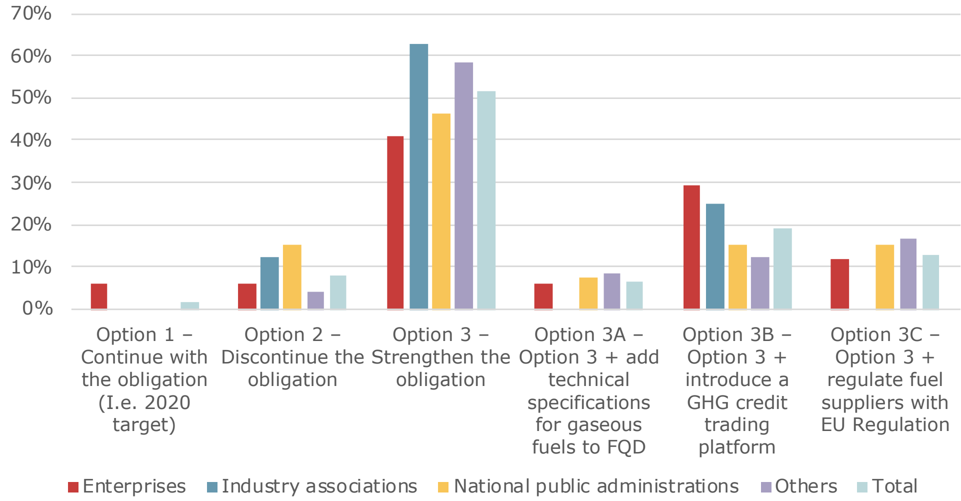
Note: Six-point scale, where 1 = the best and 6 = the worst.

Figure 28 Q25: Which of the options will have the most impact on increasing competition among fuel suppliers for conventional biofuel feedstock? (1= Best to 6=Worst) (average score of respondents)



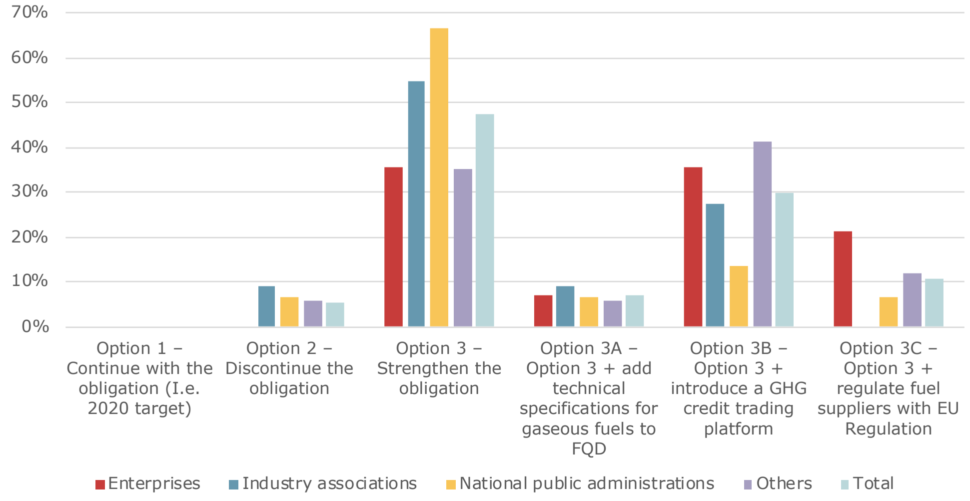
Note: Six-point scale, where 1 = the best and 6 = the worst.

Figure 29 Q26: Which of the options will have the most impact on increasing competition among fuel suppliers for advanced biofuel feedstock? (1= Best to 6=Worst) (average score of respondents)



Note: Six-point scale, where 1 = the best and 6 = the worst.

Figure 30 *Q27: Which of the options will have the most impact on improving the competition between renewable and recycled fuels? (1= Best to 6=Worst) (average score of respondents)*



Note: Six-point scale, where 1 = the best and 6 = the worst.

Figure 31 *Q28: Based on your experience with Art. 7a FQD to-date, how do you think a strengthened GHG obligation will impact affordability of road transport? (% of respondents)*

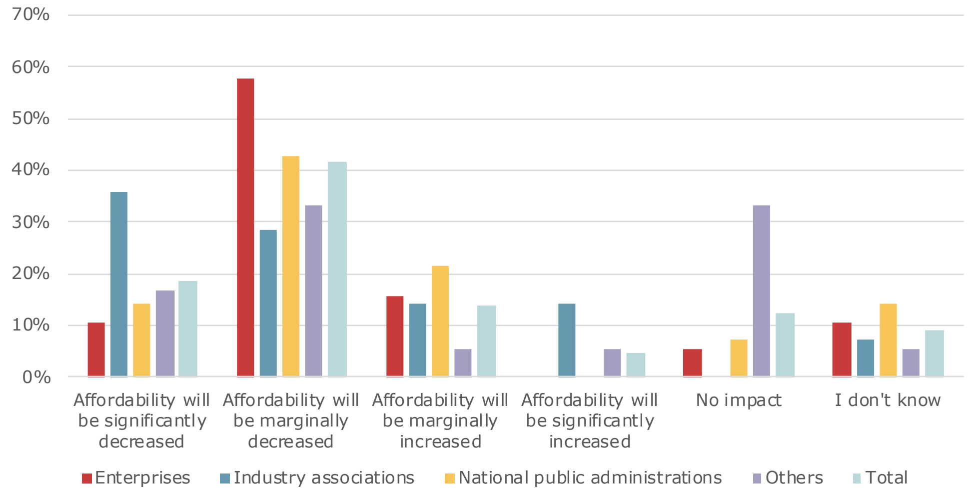
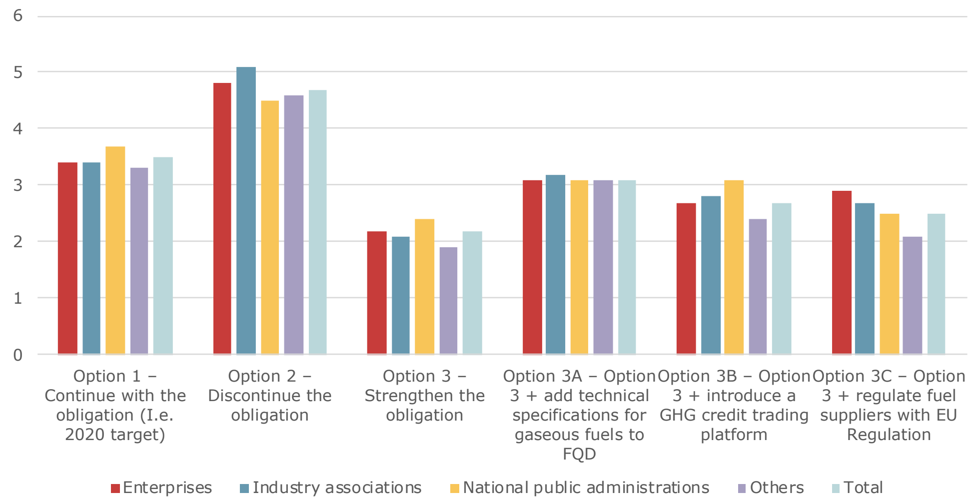


Figure 32 Q29: Please rank the options according to your assessment of their greatest net benefit (1= Best to 6=Worst) (average score of respondents)



Note: Six-point scale, where 1 = the best and 6 = the worst.

Table 2 Q2: To what extent do you agree that Art.7a is relevant to achieve increased competitiveness of fuels with lower GHG intensity & fuel technology progress? (% of respondents)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Enterprises (N=32)	6%	6%	3%	44%	41%
Industry association (N=21)	0%	5%	10%	52%	33%
National public administration (N=25)	4%	8%	24%	36%	28%
Others (N=17)	0%	24%	6%	35%	35%
Total (N=95)	3%	9%	11%	42%	35%

Table 3 Q3: To what extent is Art.7a technology-neutral approach relevant to achieve the quanti targets of reduction of life-cycle GHG emission intensity? (% of respondents)

	Disagree	Neutral	Agree	Strongly agree
Enterprises (N=28)	7%	21%	50%	21%
Industry association (N=20)	0%	20%	50%	30%
National public administration (N=23)	9%	26%	52%	13%
Others (N=18)	22%	22%	17%	39%
Total (N=89)	9%	22%	44%	25%

Table 4 Q4: Which are the main positive direct impacts achieved by Art.7a of the FQD? (% of respondents)

	Increase in the supply of, and demand for, fuels with lower GHG intensity	Progress in fuel technology	Increased competitiveness of fuels with lower GHG intensity	Better information on feedstock and biofuel production pathways	Higher synergies and cooperation between oil-based fuel suppliers and producers of renewable and low-carbon fuels
Enterprises (N=31)	42%	23%	16%	6%	13%
Industry association (N=19)	26%	26%	26%	16%	5%
National public administration (N=22)	50%	14%	27%	9%	0%
Others (N=20)	40%	15%	25%	10%	10%
Total (N=92)	40%	20%	23%	10%	8%

Table 5 Q5: Which are the main negative impacts achieved by Art.7a of the FQD? (% of respondents)

	Limit the supply of, and demand for, fuels with lower GHG intensity	Contain progress in fuel technology	Contain competitiveness of innovative fuels with lower GHG intensity	Limit/restrict information availability on feedstock and alternative fuel production pathways	Hinder cooperation patterns between oil-based fuel suppliers and producers of renewable and low-carbon fuels
Enterprises (N=28)	57%	11%	4%	29%	0%
Industry association (N=16)	50%	6%	19%	6%	19%
National public administration (N=15)	47%	13%	13%	20%	7%
Others (N=15)	33%	20%	20%	27%	0%

Total (N=74)	49%	12%	12%	22%	5%

Table 6 Q6: To what extent is Art.7a technology-neutral approach relevant to achieve the quanti targets of reduction of life-cycle GHG emission intensity? (% of respondents)

	Yes	No	I do not know
Enterprises (N=29)	69%	17%	14%
Industry association (N=19)	63%	11%	26%
National public administration (N=18)	67%	17%	17%
Others (N=25)	84%	8%	8%
Total (N=91)	71%	13%	15%

Table 7 Q7: Which type of penalty system is in your opinion better suited to ensure effectiveness, proportionality and dissuasiveness? (% of respondents)

	Purely Financial penalty system per excess ton of CO2eq	Progressive financial penalty system (the closer a company is to meeting the target, the lower the penalty per excess ton of CO2 equivalent)	Multi-layered penalty system including financial fine and administrative sanctions (licence removal, etc.)	Fixed fine regardless of the reduction effort	None of the above
Enterprises (N=26)	31%	58%	8%	0%	4%
Industry association (N=18)	44%	39%	17%	0%	0%
National public administration (N=18)	44%	39%	11%	0%	6%
Others (N=26)	27%	58%	12%	4%	0%
Total (N=88)	35%	50%	11%	1%	2%

Table 8 Q8: To what extent would you agree that there are synergies between Art.7a of the FQD and the Renewable Energy Directive (RED) 2? (% of respondents)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Enterprises (N=24)	0%	13%	17%	63%	8%
Industry association (N=20)	0%	15%	20%	50%	15%
National public administration (N=23)	13%	22%	13%	39%	13%
Others (N=26)	4%	12%	12%	50%	23%
Total (N=93)	4%	15%	15%	51%	15%

Table 9 Q9: Which of the following measures are the most urgent to consider for reducing emissions from transport fuels and the transport sector? (% of respondents)

	More ambitious national regulations	Correction of the perceived inconsistencies and overlaps between the FQD and the RED II	Correction of the perceived inconsistencies and overlaps between national transposition of the FQD and the REDII	Increased flexibility at the national level to accept or refuse some types of low GHG intensity fuels
Enterprises (N=28)	36%	21%	29%	14%
Industry association (N=20)	25%	45%	20%	10%
National public administration (N=24)	17%	75%	4%	4%
Others (N=25)	24%	44%	12%	20%
Total (N=97)	26%	45%	16%	12%

Table 10 Q10: EU requirements for fuel blends may represent a better solution to reduce fragmentation of EU market for fuels&vehicles than national requirements (% of respondents)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Enterprises (N=29)	10%	3%	17%	45%	24%
Industry association (N=17)	6%	6%	0%	47%	41%
National public administration (N=20)	0%	10%	10%	50%	30%
Others (N=25)	16%	12%	12%	40%	20%
Total (N=91)	9%	8%	11%	45%	27%

Table 11 Q11: EU targets for the reduction of GHG intensity may represent a better solution to reduce GHG emissions from transport than targets at national level (% of respondents)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Enterprises (N=28)	4%	14%	14%	32%	36%
Industry association (N=17)	6%	18%	12%	53%	12%
National public administration (N=23)	0%	17%	17%	43%	22%
Others (N=28)	14%	7%	7%	43%	29%
Total (N=96)	6%	14%	13%	42%	26%

Table 12 Q13: Which is your primary focus? (for SMEs and Large Enterprises) (% of respondents)

	Advanced biodiesel	Advanced bioethanol	Automobile and equipment manufacturing	Diesel and petrol supply/production	First-general bioethanol	First-generation biodiesel	Fuel (including biofuel) supply/production	Fuel additive manufacturing	LPG and CNG supply/production	Transport industry	Other
Enterprises (N=32)	19%	3%	9%	13%	0%	13%	22%	3%	3%	0%	16%

Table 13 Q14: Which low-carbon solution do you believe will have the most significant contribution in the effort of the decarbonization of the road transport sector? (% of respondents)

	Advanced biomass-based biofuels	Waste-based biofuels	Recycled carbon fuels	Electricity (electromobility)	Hydrogen	RNFBOs, e-fuels, synthetic fuels	Other
Enterprises (N=30)	17%	37%	7%	13%	23%	0%	3%
Industry association (N=21)	14%	29%	5%	10%	19%	24%	0%
National public administration (N=24)	13%	17%	8%	46%	4%	13%	0%
Others (N=24)	17%	21%	0%	33%	25%	4%	0%
Total (N=99)	15%	26%	5%	25%	18%	9%	1%

Table 14 Q15: Which feedstocks for road transport fuels will be most affected because of expected increase in efforts to decarbonise maritime and aviation sectors? (% of respondents)

	Water-based biofuels	Recycled carbon fuels	Lignocellulosic biomass	Hydrogen	RFNBOs, e-fuels, synthetic fuels	Other
Enterprises (N=25)	72%	8%	0%	0%	16%	4%
Industry association (N=17)	53%	0%	0%	0%	47%	0%
National public administration (N=18)	50%	6%	0%	17%	28%	0%
Others (N=23)	57%	9%	9%	0%	13%	13%
Total (N=83)	59%	6%	2%	4%	24%	5%

Table 15 Q16: Which will be the dominant feedstock for the production of bioethanol in 2030? (% of respondents)

	Wheat	Maize	Sugars	Other cereals	Lignocellulosic material	Feedstocks listed in Annex IX Part A of RED II	Other
Enterprises (N=22)	14%	18%	27%	0%	9%	18%	14%
Industry association (N=13)	15%	62%	15%	0%	8%	0%	0%
National public administration (N=13)	15%	23%	23%	0%	8%	23%	8%
Others (N=23)	13%	26%	17%	9%	4%	30%	0%
Total (N=71)	14%	30%	21%	3%	7%	20%	6%

Table 16 Q17: Which will be the dominant feedstock for the production of biodiesel in 2030? (% of respondents)

	Rapeseed oil	Used cooking oil (UCO)	(Sustainable) palm oil	Animal fats	Soybean oil	Sunflower oil	Residual oils	Other
Enterprises (N=22)	23%	36%	9%	9%	0%	5%	9%	9%
Industry association (N=15)	33%	40%	13%	7%	0%	0%	7%	0%
National public administration (N=15)	27%	33%	20%	13%	0%	0%	0%	7%
Others (N=23)	22%	43%	4%	9%	0%	0%	17%	4%
Total (N=75)	25%	39%	11%	9%	0%	1%	9%	5%

Table 17 Q18: Which will be the dominant feedstock for the production of HVO in 2030? (% of respondents)

	Rapeseed oil	Used cooking oil (UCO)	(Sustainable) palm oil	Animal fats	Soybean oil	Sunflower oil	Residual oils	Other
Enterprises (N=26)	12%	27%	23%	19%	4%	0%	12%	4%
Industry association (N=11)	9%	27%	45%	0%	0%	0%	9%	9%
National public administration (N=13)	8%	31%	31%	8%	0%	0%	8%	15%
Others (N=22)	14%	36%	14%	9%	5%	0%	18%	5%
Total (N=72)	11%	31%	25%	11%	3%	0%	13%	7%

Table 18 Q19: Which will be the dominant feedstock for the production of biomethane in 2030? (% of respondents)

	Solid manure	Liquid manure	Energy crops	Agricultural residues	Organic waste	Sludge	Other
Enterprises (N=24)	4%	13%	4%	13%	46%	17%	4%
Industry association (N=10)	0%	20%	10%	30%	40%	0%	0%
National public administration (N=15)	7%	7%	0%	20%	53%	13%	0%
Others (N=21)	0%	10%	0%	24%	57%	10%	0%
Total (N=70)	3%	11%	3%	20%	50%	11%	1%

Table 19 Q20: Which transport fuel and vehicle related directives do you believe will have the largest influence on a successful GHG reduction outcome towards 2050? (% of respondents)

	FQD (considering enhanced bio-blending possibilities, including Article 7a provisions)	RED II (and its revision)	DAFI	Vehicles CO2 directives	Vehicles emissions directives
Enterprises (N=29)	28%	52%	0%	14%	7%
Industry association (N=15)	40%	40%	0%	13%	7%
National public administration (N=20)	20%	30%	0%	35%	15%
Others (N=28)	21%	39%	0%	36%	4%
Total (N=92)	26%	41%	0%	25%	8%

Table 20 Q21: In your opinion, what is the main driver for market fragmentation? (% of respondents)

	Different transpositions of Art.7a (i.e. compliance requirements and penalty structure)	Varied application across MS of double counting options allowed under RED	Varied application across MS of voluntary intermediate advanced biofuel targets under RED	Different dissuasiveness of penalties for advanced biofuels under RED	Other	I do not know
Enterprises (N=29)	28%	48%	10%	3%	3%	7%
Industry association (N=17)	47%	35%	6%	0%	6%	6%
National public administration (N=19)	53%	26%	16%	0%	5%	0%
Others (N=21)	38%	43%	5%	5%	10%	0%
Total (N=86)	40%	40%	9%	2%	6%	3%

Table 21 Q22: What is the critical element that is missing in the market system design? (Wordcloud)

	Anti-fraud measures	Carbon price and harmonisation	Certificate database	Implementation uniformity	Technological neutrality	Other
Total (N=56)	7%	46%	7%	11%	9%	25%

Note: 'Other' options proposed were: ILUC, long-term legislation, monitoring, OEMs, long-term cap, consistency with ETS, reliable data, transparency, ban on fossil-based fuels, carbon sinks. None of these options was cited more than once.

Table 22 Q23: Please rank the options according to their effectiveness of reducing GHG emissions from transport fuels, according to your view (1= Best to 6=Worst) (average score)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=23)	3.0	5.0	2.4	3.0	3.2	2.7
Industry association (N=14)	2.6	4.9	2.1	3.0	3.1	2.3
National public administration (N=17)	3.6	4.1	2.5	3.2	3.1	2.5
Others (N=28)	3.1	4.3	2.5	2.7	2.8	2.9
Total (N=82)	3.2	4.5	2.5	3.0	2.9	2.6

Note: Six-point scale, where 1 = the best and 6 = the worst.

Table 23 Q24: Please rank the options according to their effectiveness in eliminating the alternative fuel market fragmentation (1= Best to 6=Worst) (average score)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=21)	3.0	2.7	2.0	2.4	2.4	2.2
Industry association (N=11)	3.2	5.0	2.8	2.8	2.6	2.5
National public administration (N=14)	2.1	3.8	3.0	2.8	3.1	2.4
Others (N=20)	3.5	4.1	2.9	2.9	2.7	2.5
Total (N=58)	3.3	4.2	2.6	2.7	2.7	2.4

Note: Six-point scale, where 1 = the best and 6 = the worst.

Table 24 Q25: Which of the options will have the most impact on increasing competition among fuel suppliers for conventional biofuel feedstock? (% of respondents)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=22)	5%	0%	55%	5%	23%	14%
Industry association (N=11)	0%	9%	45%	18%	27%	0%
National public administration (N=15)	13%	0%	60%	13%	13%	0%
Others (N=23)	0%	22%	48%	4%	22%	4%
Total (N=71)	4%	8%	52%	8%	21%	6%

Table 25 Q26: Which of the options will have the most impact on increasing competition among fuel suppliers for advanced biofuel feedstock? (% of respondents)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=17)	6%	6%	41%	6%	29%	12%
Industry association (N=8)	0%	13%	63%	0%	25%	0%
National public administration (N=13)	0%	15%	46%	8%	15%	15%
Others (N=24)	0%	4%	58%	8%	13%	17%
Total (N=62)	2%	8%	52%	6%	19%	13%

Table 26 Q27: Which of the options will have the most impact on improving the competition between renewable and recycled fuels? (% of respondents)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=14)	0%	0%	36%	7%	36%	21%
Industry association (N=11)	0%	9%	55%	9%	27%	0%
National public administration (N=15)	0%	7%	67%	7%	13%	7%
Others (N=17)	0%	6%	35%	6%	41%	12%
Total (N=57)	0%	5%	47%	7%	30%	11%

Table 27 Q28: Based on your experience with Art. 7a FQD to-date, how do you think a strengthened GHG obligation will impact affordability of road transport? (% of respondents)

	Affordability will be significantly decreased	Affordability will be marginally decreased	Affordability will be marginally increased	Affordability will be significantly increased	No impact	I don't know
Enterprises (N=19)	11%	58%	16%	0%	5%	11%
Industry association (N=14)	36%	29%	14%	14%	0%	7%
National public administration (N=14)	14%	43%	21%	0%	7%	14%
Others (N=18)	17%	33%	6%	6%	33%	6%
Total (N=65)	18%	42%	14%	5%	12%	9%

Table 28 Q29: Please rank the options according to your assessment of their greatest net benefit (1= Best to 6=Worst) (average score)

	Option 1 – Continue with the obligation (i.e. 2020 target)	Option 2 – Discontinue the obligation	Option 3 – Strengthen the obligation	Option 3A – Option 3 + add technical specifications for gaseous fuels to FQD	Option 3B – Option 3 + introduce a GHG credit trading platform	Option 3C – Option 3 + regulate fuel suppliers directly with EU regulation
Enterprises (N=17)	3.4	4.8	2.2	3.1	2.7	2.9
Industry association (N=12)	3.4	5.1	2.1	3.2	2.8	2.7
National public administration (N=14)	3.7	4.5	2.4	3.1	3.1	2.5
Others (N=18)	3.3	4.6	1.9	3.1	2.4	2.1
Total (N=61)	3.5	4.7	2.2	3.1	2.7	2.5

Note: Six-point scale, where 1 = the best and 6 = the worst.

Appendix I Problem Definition

P1: Current GHG emissions from transport are a barrier to achieving climate neutrality by 2050

Since 2005, overall emissions from transport, including road transport, have increased against the 1990 baseline. An assessment by the European Environmental Agency (EEA) of the Member States' draft National Energy and Climate Plans (NECPs) indicates that even with additional measures already planned, the Member States will reduce transport emissions by approximately 20% instead of the targeted 30% by 2030.[100] Hence, there is a need for further action to decrease GHG emissions in the transport sector to support the 2030 CTP objective and the 2050 objective of climate neutrality.

P2: Fragmented incentive schemes to reduce GHG intensity in road transport

The framing of options available to comply with the current FQD mandatory target and the variety of incentive schemes across Member States constitute a barrier for reaching the fuel mandates under the FQD. The legal basis of the FQD is geared to enhance the functioning of the Single Market. A technology-neutral approach is pursued accordingly. However, the incentive structure differs among Member States (see discussion on Driver 6 below), which leads to fragmented incentive schemes.

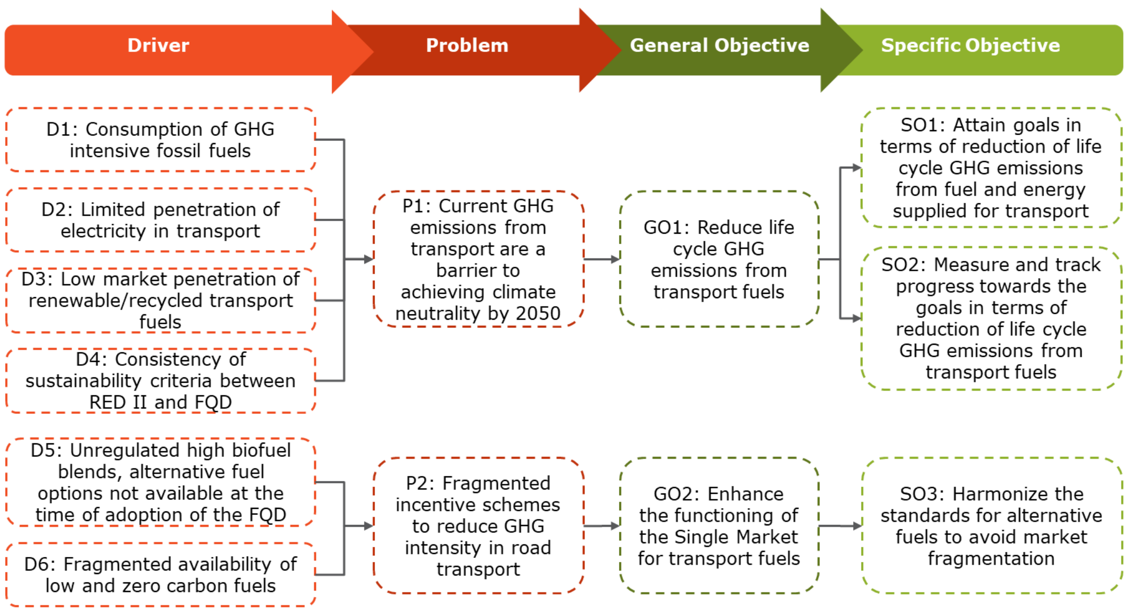
What objectives derive from the problem?

Policies to reduce GHG emissions intensity of transport fuels aim at discouraging the use of high-carbon fuels and promote the development of low- and zero-carbon alternatives, consistently with technical parameters of relevant European Norm (EN) voluntary standards ensuring compatibility with the existing vehicle fleet.

Problem drivers

The study has identified six problem drivers, which are elaborated below. Drivers D1 to D4 relate to problem P1, and Drivers D5 and D6 relate primarily to problem P2 as shown also in the Problem Tree (Figure 19 below).

Figure 19 Problem tree



Source: authors.

[100] EEA (2020), Trends and projections in Europe 2020.

D1: Consumption of GHG intensive fossil fuels

According to the most updated reported data for year 2018,[101] EU fuel suppliers were, on average, behind their objective of reducing the GHG intensity of transport fuels by 6% by 2020 compared with 2010.

D2: Limited penetration of electricity in transport

The increased use of electric vehicles (EVs) can also contribute to the reduction of GHG intensity of fuels. Despite growing demand, the market penetration of BEVs remains limited. In 2020, battery electric vehicles (BEV) constituted 5.3% and plug-in hybrid electric vehicles (PHEV) 5.2% of new passenger cars registered in the EU.[102]

D3: Low market penetration of renewable/recycled transport fuels

The use of renewable/recycled (substitution of fossil fuels), EVs (as indicated above) and the optional mechanism of upstream emission reductions (UERs) can contribute to meeting the current 6% reduction target of the FQD.

The share of renewable energy in transport corresponded to 8.9% in the EU27 countries in 2019, with four Member States exceeding the 10% transport target by 2020 of RED.[103] The penetration of renewable fuels is thus low.

The so-called ILUC Directive 2015/1513 amending both the RED and the FQD, implements a 7% cap on biofuels from agricultural feedstocks counting towards the respective 2020 targets for Member States.[104] Whereas it is mandatory in RED, it is voluntary in FQD. This difference in legal requirements can have implications in terms of certainty for operators and regulators and – ultimately - for progress on the volumes of low-carbon fuels in transport.

Biofuels comprised about 5% of the energy supply in road transport in 2018. Crop-based biofuels were the primary types of biofuels supplied. The three dominant types of biofuels supplied were Biodiesel, Bioethanol, Hydrotreated Vegetable Oil (HVO), accounting for 97% of biofuel supply.[105] Biodiesel's primary production pathways are crop-based sources. However, waste vegetable oil or animal fat biodiesel comprise nearly 22% of the production pathway.[106] Bioethanol is dominated by crop-based fuels. For HVO, waste or residue sources compose a high share of the production pathways: 48% are either from Palm Fatty Acid Distillate (PFAD; a palm oil residue), or waste vegetable or animal oils.

D4: Consistency of sustainability criteria between RED II and FQD

The biofuels used to achieve the target must comply with the sustainability criteria defined in the FQD, which are aligned with those in RED adopted in 2009. The adoption of RED II increased the stringency of the sustainability criteria for biofuels to count towards the 2030 target. As such, issues of consistency of sustainability criteria between the RED II and FQD can be expected, when RED II is fully transposed in July 2021. This creates uncertainty for the operators and regulators. A comparative view of sustainability criteria in the FQD and RED II is presented in Table 12.

Table 24 Comparison of the sustainability criteria under FQD and RED II

	FQD	RED II
GHG emissions	GHG emission saving from the use of biofuels shall be at least 35%; from January 2017 GHG emission saving shall be at least 60% for biofuels produced in installations starting	GHG emissions savings for transport biofuels is 50% before October 2015, 60% after October 2015, 65% after 2021.

[101] EEA (2020), Greenhouse gas intensities of road transport fuels in the EU in 2018
[102] https://www.eafo.eu/vehicles-and-fleet/m1
[103] Eurostat, 2021, Share of energy from renewable sources
[104]
[105] EEA (2020), Greenhouse gas intensities of road transport fuels in the EU in 2018
[106] EEA (2020), Greenhouse gas intensities of road transport fuels in the EU in 2018

	FQD	RED II
	operation after 5 October 2015. An installation shall be considered to be in operation if the physical production of biofuels has taken place.	
ILUC	Limits on ILUC-risk biofuels: The share of energy from biofuels produced from cereal and other starch-rich crops, sugars and oil crops, and crops grown primarily for energy purposes, is capped at 7% of the final consumption of energy in transport (Art 7a(2)).	Limits on high ILUC-risk biofuels, bioliquids and biomass fuels; These limits consist of a freeze at 2019 levels for the period 2021-2023, which will gradually decrease from the end of 2023 to zero by 2030. Exemption from these limits for biofuels, bioliquids and biomass fuels certified as low ILUC-risk.
Cap on food & feed crops	Voluntary cap: Member States may require that the maximum contribution of biofuels produced from cereal and other starch-rich crops, sugars and oil crops and from crops grown as main crops primarily for energy purposes on agricultural land for the purpose of compliance with the target shall not exceed the maximum contribution established in point (d) of the second subparagraph of Article 3(4) of Directive 2009/28/EC.	Mandatory cap: The share shall be no more than one percentage point higher than the share of such fuels in the final consumption of energy in the road and rail transport sectors in 2020 in that Member State, with a maximum of 7% of final consumption of energy.
Advanced biofuels	Encourage greater research and development and production of advanced biofuels; Promote the consumption of advanced biofuels and seek to attain a minimum level of consumption on their territory of advanced biofuels through setting a non-legally binding national target; Reporting obligations on the consumption on advanced biofuels.	Share of advanced biofuels in the final consumption of energy in the transport sector shall be at least 0.2% in 2022, at least 1% in 2025 and at least 3.5% in 2030. The share is inclusive of the double-counting possibility available in RED II.
Other		Annex IX, Part B biofuels: the share of biofuels and biogas produced from (a) Used cooking oil; (b) Animal fats shall be limited to 1.7% of the energy content of transport fuels supplied for consumption or use on the market (exception for Cyprus and Malta).

Source: FQD, ILUC and RED II.

In March 2019, the Commission adopted the Delegated Act to RED II on the new approach for determining high ILUC-risk feedstock and certifying low ILUC-risk biofuels.[107] The high-risk ILUC biofuels will be phased out by 2030.

D5: Unregulated high biofuel blends

High biofuel blends (bio-based component above 30% of fuel composition) are out of scope in the current formulation of the FQD and are therefore unregulated.[108] In consideration of the higher ambition level for transport fuel decarbonisation while ensuring a smoothly functioning internal market, high biofuel blends may need to be considered for inclusion in the scope of the FQD. This aspect is further investigated but limited to the implications on GHG-intensity reduction of high biofuel blends in the 2030 and 2050 fuel mixes.

D6: Fragmented availability of low and zero carbon fuels

As Section 4 already presents, there is evidence suggesting that the fuel market for biofuels is fragmented. The fragmentation of national markets through non-harmonious transposition is

[107] https://ec.europa.eu/energy/sites/ener/files/documents/2_en_act_part1_v3.pdf
[108] SWD(2017) 178 final, and EC report on Evaluation of Directive 98/70/EC prepared by Amec (2017)

moreover seen by most stakeholders as the main impediment to an enhanced global competitiveness of the EU fuel industry. This is also coherent with the findings in a 2016 study by Vierhout on obstacles to the single market of biofuels, which concludes the EU biofuel market to be "badly fragmented".[109]

Differing approaches to the implementation of Art.7A across Member States leads to differences in the willingness to pay for especially (very) low carbon transport fuels. Further factors that might feed into this fragmentation are differences in the implementation of advanced biofuel policies between Member States and that the uptake and availability of biofuel blends varies among Member States, as further elaborated below.

Fragmented biofuel feedstock supply

The monitoring data of the FQD indicates that the biofuel feedstock supply is fragmented. Table 13 below presents the distribution of the biofuel consumption and the GHG emissions from biofuels, as well as the average GHG intensity of consumed biofuels for each Member State. France and Germany, the two largest biofuel consumers, account for similar shares of biofuel consumption. Germany's GHG emissions from biofuels are however, less than half of those of France. Whereas Germany's GHG intensity from biofuels is among the lowest in the EU, France's GHG intensity is above the EU28 average. The German picture applies also to Italy, Sweden and the United Kingdom (i.e. a large biofuel consumer with relatively low emissions intensity), while the French picture also applies to Spain and Poland (i.e. a large biofuel consumer with relatively high emissions intensity).

Table 25 Calculated share of EU biofuel consumption, share of EU GHG emissions from biofuels (%), average GHG intensity of biofuels (g CO_2/MJ), dominant biofuel feedstocks in 2018, sanction type structure, advanced biofuel targets for 2020, as well as double counting (under RED) per Member State. The highlighted cells indicate how far a Member State is deviating from the EU28 average.

EU28	% of EU biofuel consumption	% of EU GHG emissions from biofuels	Average GHG intensity of biofuels (g CO_2e/MJ)	Dominant feedstock (2018)	Sanction type	Advanced biofuel target (% of energy, by 2020, RED)	Double Counting (RED)
Austria	3%	4%	35	Crop	Type 1	0.5%	Yes
Belgium	3%	4%	32	Crop	Type 3	0.1%	Yes
Bulgaria	1%	1%	46	Crop; IX-B	Type 3	0.05%	No
Croatia	>0%	>0%	21	IX-A	Type 3	0.1%	Yes
Cyprus	>0%	>0%	13	IX-B	Type 3	None	Yes
Czechia	2%	2%	27	Crop	Type 1	None	Yes
Denmark	1%	2%	35	Crop	Type 3	0.17%	Yes
Estonia	>0%	>0%	36	Crop	Type 3	0.5%	Yes
Finland	2%	1%	14	IX-A; Crop	Type 1	0.5%	Yes

[109] Vierhout, R. (2016), Obstacles to achieve an internal market for transportation fuels with bio-components, https://www.upei.org/ images/160804_Obstacles_to_an_internal_market_for_biofuels_DEF.pdf

EU28	% of EU biofuel consumption	% of EU GHG emissions from biofuels	Average GHG intensity of biofuels (g CO_2e/MJ)	Dominant feedstock (2018)	Sanction type	Advanced biofuel target (% of energy, by 2020, RED)	Double Counting (RED)
France	18%	23%	32	Crop	Type 3	0.7% (gas.)	Yes
Germany	16%	10%	15	Crop; IX-B	Type 1	0.05%	No
Greece	1%	1%	31	Crop	Type 1	0.02% (vol.)	No
Hungary	1%	1%	20	Crop; IX-B	Type 1	None	Yes
Ireland	1%	1%	14	IX-B; Crop	Type 3	0.25%	Yes
Italy	7%	5%	17	IX-B; Other; Crop	Type 2	0.9%	Yes
Latvia	>0%	>0%	38	Crop	Type 3	None	Yes
Lithuania	>0%	1%	40	Crop	Type 2	0.5%	No
Luxembourg	1%	1%	32	Crop	Type 1	None	Yes
Malta	>0%	>0%	23	IX-B	Type 3	0.1%	Yes
Netherlands	3%	2%	18	IX-B; Crop; (IX-A)	Type 3	1%	Yes
Poland	7%	10%	37	IX-B; Crop	Type 2	0.1%	Yes
Portugal	1%	1%	21	Crop	Type 3	0.5%	Yes
Romania	1%	2%	32	Crop	Type 3	None	Yes
Slovakia	1%	1%	32	Crop	Type 1	0.5%	Yes
Slovenia	>0%	>0%	31	Crop; IX-B	Type 3	0.5%	Yes
Spain	10%	14%	34	Crop	Type 3	0.1%	Yes
Sweden	10%	6%	14	Other; Crop; IX-A	Type 1	None	No
United Kingdom	8%	5%	17	IX-B; Crop; IX-A	Type 1	None	No
EU28	**100%**	**100%**	**25**				

Source: own calculations from EEA (2020),Greenhouse gas intensities of road transport fuels in the EU in 2018,Table 5.1; ePure (2020),Overview of biofuels policies and markets across the EU-27 and the UK; Section 4.

Asymmetric sanctions play a role

As presented in Section 3, stakeholders claim that the national transpositions of Art.7A, including enforcement, have somewhat accelerated the fragmentation of the European fuels market. According to stakeholders, the non-harmonious transposition has diverted biofuels to Member States where the demand and costs of non-compliance are higher due to higher sanctions. The evaluation of FQD Art.7A (Section 3) therefore concludes that EU-level requirements may be a better support to the harmonisation of the internal fuel market.

On a broader dimension, the study by Vierhout also points to the fact that non-harmonised transpositions of biofuel policies are drivers to market fragmentation.[110]

The evaluation of FQD Art.7A (Section 3) further demonstrates that a variety of transpositions and penalty systems exists in the EU Member States. In terms of transposition, Germany and Sweden have for example taken a unique approach by replacing a volume-based blending mandate with a GHG reduction quota. Fuel suppliers must therefore ensure that the GHG intensity of the supplied fuel blend reduces according to the annually specified targets. Both Member States have further determined GHG reduction quotas beyond the FQD's time horizon towards 2030, corresponding to a reduction of respectively 22% and 40%.[111]

Other Member States have in turn determined an (energy) blending mandate that takes outset in the biocomponent content by either volume or renewable energy content and are hence more driven by the RED obligation.[112,113]

A further element that is noteworthy, is that some Member States have introduced intermediate targets under either the FQD or RED. Croatia, Estonia, Finland, Germany, Italy, the Netherlands, Slovakia, Slovenia, and Spain have for example intermediate targets in place.[114] As Table 13 above shows, these Member States also tend to have more favourable GHG intensities of biofuels.

The evaluation of FQD Art.7A concludes that a type 1 sanction (and to a lesser extent type 2 sanction) provides a price signal that is easier to read, and relatively easier to assess (see Table 10). Nine Member States are identified as having a type 1 sanction structure and three Member States having a type 2 sanction structure.[115]

However, the level of the sanctions varies strongly: whereas in Austria, a penalty of €15 per excess ton of CO_2 e is imposed, Germany, Finland, and Sweden each have a sanction of several hundred Euros per excess ton of CO_2 e. According to two stakeholders, the sanctions in Germany and Sweden are set at a level that eliminates any economic advantage of non-compliance.[116] Both stakeholders judge therefore both countries as examples of dissuasive sanctions. Indeed, Table 13 above supports this view as Austria has a high GHG intensity of biofuels, while Germany, Finland, and Sweden have one of the lowest GHG intensity of biofuels.

With respect to type 3 sanctions, the evaluation of FQD Art.7A does not provide a conclusion whether these are more/less dissuasive than type 1 and 2 sanctions. Table 13 above shows however that Italy, a Member State with a type 3 structure, also has a low GHG intensity of biofuels. This can be traced back to high sanctions for especially the advanced biofuel target under RED.[117]

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[110] Vierhout, R. (2016), Obstacles to achieve an internal market for transportation fuels with bio-components, https://www.upei.org/images/160804_Obstacles_to_an_internal_market_for_biofuels_DEF.pdf

[111] ICCT (2018), Advanced biofuel policies in select EU member states: 2018 update https://www.cleanenergywire.org/news/german-ministries-agree-emission-reduction-quota-transport-fuels

[112] UPEI (2018), 2018 UPEI Biofuel Matrix; ePure (2020), Overview of biofuels policies and markets across the EU-27 and the UK; http://www.energimyndigheten.se/en/sustainability/sustainable-fuels/greenhouse-gas-reduction-mandate

[113] Germany has further defined mandatory blending caps and targets for respectively crop-based and advanced renewable energy by energy content.

[114] UPEI (2018), 2018 UPEI Biofuel Matrix

[115] Type 1: Austria, Czechia, Finland, Germany, Hungary, Luxembourg, Slovakia, Sweden, and United Kingdom. Type 2: Italy, Lithuania, and Poland (see Appendix A).

[116] The stakeholder cannot be named, as he/she request to remain anonymous

[117] ePure (2020), Overview of biofuels policies and markets across the EU-27 and the UK

Table 13 above also presents the identified sanction types per Member State. Member States with a type 1 sanction (somewhat) tend to have a lower GHG intensity of biofuels than those with a type 3 structure. This supports the evaluation of FQD Art.7A's conclusion that sanctions directly linked to the Art.7A targets provide a clearer price signal, provided that the sanction level is sufficiently dissuasive.

Existing advanced biofuel policies

Table 13 shows which Member States have defined intermediate targets for advanced biofuels in 2020 as part of RED I.[118] It indicates no particular pattern in terms of GHG intensity of biofuels. Germany, Italy, and the Netherlands have for example a low GHG intensity of biofuels as well as an intermediate advanced biofuel target. The targets are also neither notably high nor notably low. Sweden and the United Kingdom also have a low GHG intensity of biofuels, but without an intermediate advanced biofuel target. However, there is no distinctive pattern between the two groups.

A similar picture can be seen for Member States with a high GHG intensity of biofuels, such as Austria, Belgium, and France, which all have an intermediate target in place, and those without an intermediate target, e.g. Latvia, Luxembourg, and Romania. Hence, there is no evidence suggesting that the presence of intermediate advanced biofuel targets currently play a role in fragmenting the biofuels market.

The provisions of RED II enable Member States to double count the share of advanced biofuels. Table 13 presents, which Member States apply double counting in their transposition. Only five EU27 Member States opted to not double count the share of advanced biofuels.[119] However, of these only two Member States have a GHG intensity of biofuels below the EU28 average. There is overall no distinctive pattern when it comes to the correlation between double counting for advanced biofuels and the GHG intensity of biofuels.

Fragmented biofuel blends

As concluded under the evaluation of FQD Art.7A (Section 4), the presence of different blending limits leads to a fragmentation of available biofuel blends, lowering in turn demand for biofuels and hampering the attainment of the Art.7A targets. This is also confirmed in the literature, as different blending limits prevent the tradability of blended fuels across borders and reduce market efficiency.[120, 121]

However, the available data suggests that this fragmentation has decreased. For diesel, B7 was the almost exclusive blend (99.2%) supplied in 2018.[122] B+ as the only alternative accounted for 0.8%. This corresponds to a reduced fragmentation when compared to 2015-2017, where about 20% of the supplied blend was B+. In terms of petrol, E5 was the dominant blend (81.5%). Higher blends, E10 and E+, accounted for respectively 13.5% and 0.2%. Finally, petrol without biocomponents, E0, accounted for 4.9%. This situation has generally not changed significantly since 2014, with only a minor reduction of the market share of E0.

Stakeholders pointed out in the REFIT study that this fragmentation leads to higher compliance costs for fuel suppliers with markets in multiple Member States, as the blending also requires adjustments for meeting the FQD's vapour pressure requirements.[123] However, no evidence could be identified to substantiate this statement. Several stakeholders approached in the consultations highlighted this fragmentation. Two stakeholders suggest reducing this fragmentation through the introduction of minimum requirements for oxygen and ethanol, thereby limiting the scope for

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118 Article 3(4)e, Directive 2009/28/EC.

[119] Bulgaria, Germany, Greece, Lithuania, Sweden, (and United Kingdom)

[120] Vierhout, R. (2016), Obstacles to achieve an internal market for transportation fuels with bio-components, https://www.upei.org/images/160804_Obstacles_to_an_internal_market_for_biofuels_DEF.pdf

[121] CE Delft, TNO (2013), Options to increase EU biofuels volumes beyond the current blending limits, https://ec.europa.eu/energy/sites/ener/files/documents/2013_11_bringing_biofuels_on_the_market.pdf

[122] EEA (2020), Petrol and diesel fuels sold for road transport, https://www.eea.europa.eu/data-and-maps/dashboards/fuel-quality-article-8

[123] It is unclear from the study, whether stakeholders in this respect referred to the FQD's derogations in article 3 (4) and (5)

deviation among different blend levels. The stakeholders have not substantiated the motivation for minimum requirements for oxygen.

With respect to diesel, the REFIT study reports that some Member States have transposed the FQD with a FAME limit of 7% (as stipulated in Annex II of the FQD), whereas some have taken consideration of article 4's specification that Member States may introduce a higher limit than 7% (B8 in France, B100 for dedicated vehicles in captive fleets, or B+ as a general term used in literature).[124] The REFIT study concludes that this has led to inconsistencies across Member States, disturbing the internal market. Given that B7 was the nearly exclusive diesel blend supplied in 2018, this study regards the fragmentation of diesel blends as not significant. With respect to the fragmentation of gasoline blends, neither the REFIT- nor this study could obtain concrete evidence to further substantiate this issue.

Similarly, the interviews conducted in this study show that stakeholders believe the fragmentation to be an issue:

- Four stakeholders (out of 34 interviewed) expressed the opinion that the fragmentation is a critical element to overcome (out of the six identified problem drivers) for achieving the targets of Art.7A, while two stakeholders did not believe it to be a critical problem driver.
- Ten stakeholders further believe that the availability of different biofuel blends pose a problem for achieving the FQD's objectives – while eight stakeholders believed it not to be a problem.

It can hence be concluded that there is a fragmentation with respect to the availability of low and zero carbon fuels. There is also fragmentation in terms of available biofuel blends. However, the study could not obtain factual evidence to quantify to what extent this hinders Member States or fuel suppliers in implementing FQD Art.7A.

Subsidiarity assessment

The point of departure for this section of the study is the subsidiarity assessment of the BRG, consisting most importantly of an assessment of the EU added value.[125] The findings on the EU added value under Section 4 thus provide important evidence to support this assessment. A subsidiarity test was performed by answering the specific questions in line with the principles of the Better Regulation Guidelines.

Does the EU have exclusive competence?

The added value of EU intervention is rooted in its capacity for coordinated action against climate change impacts, a trans-boundary problem.[126] The area of environment is considered a shared competence to regulate with Member States. As regulating the quality of fuels also interacts with the trading of fuels, it has an impact on the common commercial policy, which is an exclusive competence of the EU. [127,128] As such, the interventions fall with the EU's competences to regulate.

Can Member States individually address the issue, without the risk of distorting the market?

The REFIT study concluded that "a Single Market could not be delivered in the absence of the FQD" and that national fuel specifications could lead to fuel market fragmentation.[129] However, the evaluation did not include the assessment of Art.7A focusing on GHG emissions reductions.

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[124] SWD (2017) 178 final, and EC report on Evaluation of Directive 98/70/EC prepared by Amec (2017)
[125] Tool #5 on Legal basis, subsidiarity and proportionality in the Better Regulation Toolbox.
[126] Inception Impact Assessment 2030 Climate Target Plan.
[127] Tool #5 on Legal basis, subsidiarity and proportionality in the Better Regulation Toolbox.
[128] TFEU, Article 3:
[129] European Commission. 2017. Evaluation of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'). Commission Staff Working Document. SWD(2017) 179 final.

The findings of Section 4 (on EU added value of FQD Art.7A) do not provide a clear picture of whether national initiatives would have achieved similar or higher GHG intensity reductions of transport fuels in the absence of Art.7A. The consulted stakeholders have varied views on this question. However, even if Member States can achieve the GHG intensity reduction in transport fuels similar to Art.7A with national initiatives, it could lead to different approaches and requirements across Member States. This in return could lead to a distortion of the fuel market. The findings of the evaluation of FQD Art.7A (Section 4) illustrate that a non-harmonious transposition of Art.7A (particularly in relation to sanction structures) can lead to the fragmentation of the European market, which further supports the action at EU level.

To which extent is the heterogeneous availability of biofuel blending options problematic to achieve the FQD's target and/or the functioning of the internal market?

Based on the analysis presented above, there is fragmentation in terms of available biofuel blends. However, the study could not obtain factual evidence to identify the extent to which this hinders Member States or fuel suppliers in achieving the FQD targets and functioning of the internal market.

To which extent do the heterogenous compliance requirement/enforcement pose a risk to the FQD's target and/or functioning of the internal market?

The fragmentation of national markets through non-harmonised transposition (e.g. varied types of sanctions) is seen by most interviewed stakeholders as the main market barrier to a seamless Single Market for transport fuels. The non-harmonised transposition has diverted low GHG intensity biofuels to Member States where the demand and costs of non-compliance are higher due to higher sanctions. The findings of the evaluation presented above in Section 4 thus suggest that EU-level requirements may be of a better support to the harmonisation of the internal fuel market.

Appendix J Assessment of inclusion of gaseous fuels and introduction of a market based instrument

Extension of scope to gaseous fuels

The product scope of the "core" FQD (Art 1 of the Directive 98/70/EC) consists of petroleum-derived liquid fuels that correspond to CN code 2710 (petroleum oils, containing at least 70% petroleum oil). Petroleum gases and other gaseous hydrocarbons (CN code 2711) are not currently in scope of the FQD.

In the review that led up to Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC, the item of greenhouse gas emission was added (Art 7A-D and additional related annexes). That created a somewhat "conflicting message": the scope related to environmental requirements for market gasolines, diesel fuels and off-road gas oils refers to fuels with a limited share of bio-components to max 30% while the Art. 7A scope considers also neat (100%) biofuels, both liquid and gaseous, as transport fuels (and not only as bio-components that are blended with fossil fuels). Some of those biofuels can be used as components in gasoline or diesel fuel blends up to 30%, but higher blends and the neat biofuels are not covered by the amended FQD and have therefore no legal quality requirements. In many cases, there are only CEN-standards, which are not legally binding in most of the EU countries. Therefore, there is a link between the scope of Art 7A and the product scope of the FQD (Art. 1, Scope of the Directive) when it comes to market fuel types under consideration, liquid and gaseous, and the share of bio-components in their blends.

Gaseous fuel types, incl. from biogenic, made up about 2% of all fuel supplied in 2018 among 28 Member States.[130] While the current role of gaseous fuels is limited, its role may however increase in the future, where other types of gaseous fuels are expected to enter into the transport fuel mix (e.g. clean gas or e-gas). Adding gaseous fuels to the FQD scope could support their further increase.

It is noted that the use of natural gas (either in the form of LNG or CNG) in the road transport sectors (heavy duty and passenger cars) is demonstrated[131] (although not currently at an extensive scale) and the prospects for its use as a transitional fuel in the 2030 horizon have been found to be relevant[132] (mainly in terms of fuel production potential and technological maturity of the available engines[133]). Similar positive prospects have been found for biogenic and renewable gaseous fuels as well. For example, there are numerous studies highlighting the untapped potential of biogas and biomethane for use in the transport sector.[134] Provided that gaseous fuels can deliver a relatively cost-efficient reduction of the GHG intensity in transport, their importance can hence be expected to significantly increase.

The inclusion of gaseous fuels in the scope of the FQD ensures that all available fuel options are clearly listed in the relevant legislative framework and therefore provide an expanded range of eligible options to contribute to the GHG intensity target of Art. 7A; for currently included fuels, their market uptake is expected to be further enhanced, while other types of gaseous fuels will possibly enter the picture.

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[130] EEA (2020), Greenhouse gas intensities of road transport fuels in the EU in 2018, Eionet Report - ETC/CME 2/2020 – November 2020
[131] E.g. https://www.ngva.eu/medias/natural-gas-a-solution-for-a-clean-and-decarbonized-transport-system/
[132] E.g. Le Fevre (2019) A review of prospects for natural gas as a fuel in road transport, Oxford Institute for Energy Studies (OIES)
[133] State of the art on alternative fuels transport systems in the European Union 2020 update
[134] IRENA (2018), Biogas for road vehicles: Technology brief; Scarlat et al. (2018), Biogas: Developments and perspectives in Europe, Renewable Energy 129, Pages 457-472

Considering the individual fuels carbon intensity, fossil gaseous fuels already have a weighed life cycle GHG emission intensity lower than that of fossil liquid fuels[135], thus, directly contribute to D2 (Consumption of GHG intensive gaseous fossil fuels).

Further, the relevant figures in the MIX55 scenario of 2030CTP suggest an increase in the share of gaseous fuels in the transport sectors covered by FQD Art. 7A, from 3.4% in 2020 to slightly above 8% in 2030. Moving towards 2050, natural gas is projected to be substituted by renewable and low-carbon gases. This leads to related changes in the consumption trends of gaseous fuels per sector, where in all considered scenarios gaseous fuels in transport is increased (in some scenarios even significantly) as compared to 2030.

Considering the individual fuels carbon intensity, bio-based gaseous fuel types, e.g. biomethane, offer significant GHG emissions savings as compared to the FQD fossil fuel baseline, while other types of renewable gases such as e-gases, also feature a significantly lower CI value.

Further, it is noted that policies such as the EU strategy on energy system integration[136], which supports the widespread promotion of biomethane[137] and green H2 in the natural gas infrastructure, directly contributes to the reduction of the carbon intensity of fossil gaseous fuels, contributing to the uptake of an eventual "cleaner" gaseous fuel mix by the final consumption sectors[138]. This is further corroborated by some key relevant stakeholders' views on the relevant consultation on the roadmap for "An EU Smart Sector Integration Strategy"[139], while the responses of stakeholder of this study (Section 4) also confirm the benefits of such an approach, considered as an additional tool that should be available towards the decarbonization target.

According to an expert group report on alternative fuels elaborated for DG RTD, significant R&D efforts are on-going on gas combustion engines for road transport, partly to increase diesel substitution rates and enabling a transition to low carbon bio-methane and power-to-gas technologies.[140] As the evaluation of FQD Art7A (Section 4) above further confirms, the current incentives for long-lasting investments or R&D efforts on low and zero carbon fuels are limited given the time-based objective of FQD Art.7A. This finding further underlines the potential of e.g. fossil gaseous fuels as transitional technologies.

The addition gaseous fossil fuels to the scope of the FQD could therefore further provide a push towards the development of renewable-, recycled-, and synthetic gaseous fuels through standardisation, addressing problem driver D3 (low market penetration of renewable/recycled transport fuels).

It should be noted however, that the expected increased demand for gaseous fuels might partially occur at the expense of the demand for liquid fuels and therefore specific effects resulting in the risk of stranded assets, for instance in refuelling infrastructure, but also on powertrain technologies, should be considered.

How would this area of options be operationalised?

Gaseous fuels can be supplied in either pure form or as blends with fossil gas. There is, however, a need to also regulate the specifications for the blending of gaseous transport fuels.[141] For the case of biomethane, the blending is no issue, provided that it is injected in the pipe and accounted through certificates that assert its biological origin and compliance with the technical and operational standards of the infrastructure. This discussion has been currently extended to the use of hydrogen as well (e.g. see the EU Strategy on Energy System Integration).

Irrespective of the availability of blends, it is necessary to add gaseous fuels to the scope of the FQD to support a single market for these fuels. Considering gaseous transport fuels within the

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[135] Annex I, Part 2, Implementing Directive (EU) 2015/652; Greenhouse Gas Intensity from Natural Gas in Transport (NGVA) http://ngvemissionsstudy.eu/)
[136] https://ec.europa.eu/energy/topics/energy-system-integration/eu-strategy-energy-system-integration_en
[137] EU strategy on energy system integration (COM(2020) 299 final, July 2020)): https://ec.europa.eu/energy/topics/energy-system-integration/eu-strategy-energy-system-integration_en
[138] A hydrogen strategy for a climate-neutral Europe (COM (2020) 301 final, 8.7.2020)); Powering a climate-neutral economy: An EU Strategy for Energy System Integration (COM(2020) 299 final, 8.7.2020))
[139] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12383-Clean-energy-strategy-for-energy-system-integration_en (indicative relevant stakeholders mentioned: Enagas, Eni, Fuels Europe, Hydrogen Europe, Liquid Gas Europe)
[140] Bauen et al. (2017), Alternative Fuels expert group report, DG RTD.
[141] CE Delft (2020), Effects of an EU 55% GHG reduction target, Assessment of potential impacts on Dutch climate policies.

scope of the "core" FQD, also corresponds to the requests of five Member States in the evaluation of the FQD (which excluded Art.7A), as a wish to give better support to gaseous fuels[142] through: (a) expanding the scope of the FQD to include gaseous fuels and (b) allowing the use of fuels with a higher blending ratio (beyond the 70/30 ratio that currently stands for the liquid petroleum-based fuels).

There are available CEN standards that set the requirements for the use of gaseous fuels as automotive fuels, and therefore their use in the transport sector. For instance, there is the European standard EN 16723–2:2018[143] which specifically describes methane fuel for use in ICEs. Accordingly, there is the EN 589:2018[144] standard for LPG. There is hence no need to determine technical specifications, but rather ensuring legal compliance of the vehicles using gaseous fuels like methane and LPG over their entire useful life. However, CEN standards have, by themselves, no legal status and only by establishing the relevant ~~specifications~~link in the "core" FQD would make these specifications legally binding. .

Which options can it apply to?

The expansion of the product scope of the FQD to include gaseous fuels is an important element with respect to supporting the single market and regulating gaseous fuels. Regulating gaseous fuels thus removes uptake barriers and ensures that the single market of gaseous fuels is well functioning.

The expansion of the scope can be coupled to both Option 1 (i.e. continuation of the FQD 7A implementation as it currently occurs) and Option 3 (i.e. strengthening the FQD Art 7A implementation) concerning the GHG obligation.

It is understood however, that especially for the case of Option 3, expanding the scope to gaseous fuel would essentially constitute an expansion of the available options that would be employed to allow for an implementation of a strengthened FQD Art 7A.

Market-Based Instruments

The use of market-based instruments in the form of a market place for GHG reductions to further promote compliance with GHG emission intensity reduction obligations is widely regarded as a flexible and cost-efficient approach in the transport sector.[145] Eleven interviewees also express a positive opinion over such a market-based instrument. Some stakeholders expressed specific views, suggesting a market system that entails carbon sinks, symmetric compliance requirements, or annual reduction targets. Three interviewees however also oppose the use of such an instrument, either because they believe it to have a low effectiveness and/or high complexity. A fourth stakeholder suggests subjecting all energy carriers to the EU ETS instead.

Market-based instruments in which credits (for the achievement of GHG reductions) can be traded, namely enable those fuel suppliers with comparably lower costs of reducing their GHG intensity to trade their achievements with fuel suppliers that have comparably higher costs of reducing their GHG intensity. This provides an incentive for individual fuel suppliers to over-achieve the FQD's GHG reduction targets.

A marketplace provides a further advantage for (small) innovative fuel suppliers of low and zero carbon fuels: the sale of overachievements in GHG reductions provide an additional revenue stream.[146] This makes low carbon fuels more economically viable, as it de-risks the investment and lowers production costs, ultimately increasing the market penetration of renewable and recycled fuels.

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[142] SWD (2017) 178 final, and EC report on Evaluation of Directive 98/70/EC prepared by Amec (2017)
[143] EN 16723-2:2018. Natural gas and biomethane for use in transport and biomethane for injection in the natural gas network - Part 2: Automotive fuels specification
[144] EN 589:2018 - Automotive fuels - LPG - Requirements and test methods
[145] IEEP, ICCT, T&E (2015). Low Carbon Transport Fuel Policy for Europe Post 2020; Frontier economics & Flick Gocke Schaumburg (2020). Crediting System for Renewable Fuels in EU Emission Standards for Road Transport. Report for the German Federal Ministry for Economic Affairs and Energy.
[146] Ibid.

A marketplace can moreover provide an incentive to supply additional renewable electricity for electric vehicles. This follows a similar logic as above: a marketplace establishes an additional revenue stream for suppliers of electricity for vehicles. This can increase the economic viability of supplying renewable electricity for transport, and possibly increase the penetration of electricity. The Californian Low Carbon Fuel Standard (LCFS) is for example reported to help boost the market penetration of EVs: the market-based instrument has generated EUR 83 million of additional funding to the electrification of transport in 2016.[147]

Existing systems

This study has reviewed key characteristics of a non-exhaustive set of market-based instruments for the trade of achievements in GHG intensity reductions. This serves the purpose of delineating the framework conditions for a potential market-based instrument to support a GHG reduction obligation in transport. Table 17 below presents key characteristics of three non-EU and three EU market systems:

- Low Carbon Fuel Standard (LCFS) in California, USA
- Carbon Fuel Standard (CFS) in Canada (legislative proposal)
- British Columbian LCFS (BC-LCFS) in Canada
- Federal Immission Control Act (BImSchG) in Germany
- Central Registry for Transport (REV) in the Netherlands; and the
- Fuel Greenhouse Gas Emissions Reporting Regulations (GHG RR) in the UK.

All of the above market systems impose an annual GHG reduction target. The Dutch REV system is primarily driven by the RED, and therefore applies renewable energy targets and caps for advanced-, conventional-, and other types of renewable energy. Based on the specific fuels supplied, the GHG savings can then be derived. The German BImSchG sets GHG reduction targets, but also includes targets and caps in accordance with the RED. The British system runs two parallel schemes that focus on FQD's Art.7A (GHG RR) and the RED (Renewable Transport Fuel Obligation, RTFO). Some market-based instruments allow the banking of GHG credits and transfer these to subsequent target periods. Most of the market-based instruments enable the trade of GHG credits resulting from fuels, UERs, and the supply of energy for EVs and hydrogen fuelled vehicles. Finally, caps on the price or traded amounts only exist for the LCFS and the BC-LCFS.

Table 26 Non-exhaustive overview of characteristics of market-based instruments for reducing GHG intensity in transport, and the scope of reductions that can be traded under such mechanism

Country	Annual targets	Trade unit	Banking	Fuels	UERs	EV/ Hydrogen	Price/ Trade cap
USA [148] (LCFS)	Yes	t CO_2 e	Yes	Yes	Yes	Yes	Price
Canada [149] (CFS)	Yes	t CO_2 e	Limited**	Yes	Yes	Yes	Price
Brit. Col., CA (BC-LCFS) [150]	Yes	g CO_2 e/MJ	Yes	Yes	Yes	Yes	Price
DE [151] (BImSchG)	Yes	kg CO_2 e	No	Yes	Yes	Yes	No

[147] UCS (2020), California's Clean Fuel Standard Boosts the Electric Vehicle Market
[148] https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard
[149] CERI (2019), Economic and Emissions Impacts of Fuel Decarbonization & https://www.canada.ca/en/environment-climate-change/services/managing-pollution/energy-production/fuel-regulations/clean-fuel-standard.html
[150] https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels/fuel-supplier-compliance-50005
[151] Bundes-Immissionsschutzgesetz (BImSchG), § 37a, (6); https://www.dehst.de/SharedDocs/antworten/EN/Climate-projects/065_UER_registry.html

Country	Annual targets	Trade unit	Banking	Fuels	UERs	EV/ Hydrogen	Price/ Trade cap
NL [152] (REV)	Annual RE targets	GJ of RE	Yes	Yes	No	Yes	No
UK [153] (GHG RR)	Yes	kg CO_2 e	No	Yes	Yes	Yes	No

Note: '' The UK has only introduced a market system for GHG reductions in 2019 and runs parallel to the RTFO which regulates renewable fuels;*
*'**' The CFS proposal entails a limit on banking, corresponding to 10% of credit obligations*

Annual targets, unit of credits, banking, and caps

The literature points to strong benefits of annual reduction targets as these incentivise constant progress of fuel suppliers. This helps further developing the market for different feedstocks, as it strengthens the investment signal by securing annual cash flows for low carbon fuel suppliers.[154] Annual targets further enable timely intervention by regulators if there is a risk that the overall target will not be achieved.

Focusing on the case of market-based instruments for the decarbonization of transport, two types of tradable credits are identified: those based on quantities (e.g. tonnes of CO_2 or amounts of renewable MJ) and those based on carbon intensity (gr CO_2/MJ fuel). The effect of each choice on the credits on offer can be different. The latter case would most probably induce a "substitution effect" where an increase in the amount of credits is not straightforward, while the former choice would provoke an "output effect" resulting to an increased availability of credits.[155]

As mentioned above, GHG credits also provide an additional revenue stream. This can be crucial for small innovative fuel suppliers who provide low and zero carbon fuels, as these increase the frequency of cash flows from GHG credits.[156] As Bowyer et al. further point out, *"anything that delays the issuance of credits and the opportunities to sell credits will weaken the investment signal."*[157] This aspect can be particularly relevant with respect to problem drivers D2 and D3.

Banking can be considered as a flexibility mechanism in the market-based instrument, helping (although, in general, temporarily) to lower compliance costs and stabilize credit prices.

To avoid any double counting, such as for the EU ETS and UERs, an appropriate mechanism or accounting principle will need to be developed. In Germany for example, UERs are not eligible for installations subject to the EU ETS.[158]

Scope of GHG credits

No arguments could be identified against a market-based instrument, in which the scope of GHG reductions e.g. should be limited to alternative liquid fuels. GHG reductions from all activities that are eligible under the FQD should therefore be included in the scope of a market-based instrument. This can be considered particularly in the case of electricity (and hydrogen), their inclusion may be crucial to their promotion – as the example of the Californian LCFS above shows.

Guarantees of Origin (GoO) under RED II can play an important role for the issuing of GHG credits for electricity and/or hydrogen use in transport: GoOs can namely verify the supply of carbon

[152] NEA (2020), Totaalrapportage Energie voor Vervoer in Nederland 2019; https://www.emissionsauthority.nl/topics/registry---energy-for-transport/banking-limit---energy-for-transport
[153] UK DfT (2019), Fuel Greenhouse Gas Emissions Reporting Regulations Guidance
[154] IEEP, ICCT, T&E (2015). Low Carbon Transport Fuel Policy for Europe Post 2020; Rubin & Leiby (2013), Tradable credits system design and cost savings for a national low carbon fuel standard for road transport, Energy Policy, 56, 2013, Pp. 16-28,
[155] J. Rubin, P. N. Leiby, Tradable credits system design and cost savings for a national low carbon fuel standard for road transport, Energy Policy, 56, 2013, Pgs. 16-28,
[156] IEEP, ICCT, T&E (2015).
[157] IEEP, ICCT, T&E (2015). p. 43.
[158] https://www.dehst.de/EN/climate-projects_maritime-transport/UERV/projects_fuel_sector_node.html

neutral fuels (i.e. electricity for EVs or H2 after a Power-to-H2 conversion). Making GoOs an eligible form of verification, can support the development of agreements between renewable electricity producers and fuel suppliers (either directly suppliers of electricity or suppliers of H2). GoOs can consequently be used to produce a higher number of GHG credits, as compared to the average GHG intensity of the power grid. In order to avoid double-claiming, the suppliers of electricity and H2 for transport would be required to demonstrate the cancellation of the GoO in the central GoO registry. The added value of this connection to GoOs will be assessed as part of the impacts.

In the UK, electricity providers for EVs are not subjected to a GHG reduction obligation. However, they have the option to apply for GHG reduction credits and sell these to obligated fuel suppliers, provided that the GHG intensity is below the GHG target level.[159] As the provisions of Art.7A also provide, the GHG reductions can be adjusted for powertrain efficiency. As previously mentioned, a market-based instrument provides an incentive for e.g. power utilities to invest into charging infrastructures, which the example of the Californian LCFS shows. The study has not identified further examples where market-based instruments for carbon standards have concretely led to an increased penetration of alternative fuels infrastructures. On the European domain, the study did not identify cases, in which existing market-based instruments contributed to an increased investment into charging infrastructure.

Verification

Under Art.7A and its reporting obligations, the GHG intensity of the reported fuels are verified by accredited third parties or the national authority itself. Fuel quantities (both in aggregated and in individual suppliers' terms) are also typically verified through the tax authorities. Further, the FQD provides the opportunity for fuel suppliers to form a group of suppliers and to jointly meet the reduction obligations. Such provisions could support the implementation of a market-based instrument.

Operationalisation of market-based instrument

Based on the above considerations, the option of a market-based instrument is described here below in more operational terms (i.e. Option 3B).

Given the results of this evaluation, which indicated that the costs for fuel suppliers of achieving intensity reductions have been moderate, we propose that a trading scheme should be simple to keep administrative costs low. The operationalised option is therefore defined with that aim and if the assessment of the impacts of the option indicates that a different design might improve its overall benefit-cost ratio, alternative versions will be considered.

In short, a market-based instrument builds on annual GHG reduction targets, where the banking of credits is permitted. For the market for credits to be established, regularly targets have to be defined. Therefore, annual targets are necessary for a market-based instrument to work.

The market system produces GHG credits, measured in the quantity of GHG savings. The GHG saving is added to the calculation of GHG emissions by fuel suppliers, prior to the calculation of the intensity. Fuel suppliers who do not meet the annual target incur a GHG debt, corresponding to the total GHG emissions above the target. These fuel suppliers have then the option to either purchase GHG credits or pay a sanction.

What is traded?

The traded unit would be amounts of CO_2e. For a given year the reduction target for the CI for each included fuel (petrol, diesel and gaseous fuels) can be translated into a CO_2e intensity benchmark in g CO_2e/MJ. Then each supplier can have its credits or deficits calculated as:

- Deficit/credit = $\sum_i(\text{Benchmark gCO2 e/MJ}) - \text{ specific CI of supplied fuel } i \text{ in g CO2 e/MJ}) * \text{amount of supplied fuel } i \text{ in MJ}$
- With the 2010 baseline intensity of 94.1 g CO_2 e /MJ, a target of 11.5% reduction by 2030 would translate into a benchmark CI value of 83.3 g CO_2 e /MJ.

If a fuel supplier does not meet its annual target (i.e. has a deficit), it needs to use either banked credits or purchase credits. There would need to be annual targets so each year the supplier would need to balance deficits and credits.

[159] UK DfT (2019), Fuel Greenhouse Gas Emissions Reporting Regulations Guidance.

For suppliers of biofuels, they would earn credits based on the same calculation as above. For providers of electricity the credits that can be earned would be calculated based on the same principles as for fuels. The specific CI of electricity would have to be determined and regularly updated.

Electricity is produced with different carbon intensity across EU and in line with the overall energy and climate policies, the intensity will gradually decrease. It is suggested to use the average carbon intensity for electricity at Member State level. In principle, the scheme could also allow for a marginal approach where the supplier of electricity could use his/her specific intensity if able to demonstrate that the electricity would be produced for example purely from renewable sources. Allowing for that would however require additional administrative resources to validate and check that the calculations are correct. The above-mentioned use of GoOs can reduce the administrative burden, as only the CI of the non-renewable share of supplied electricity would need to be checked and validated. The use of GoOs is not relevant for a calculation of GHG credits that builds on the average carbon intensity, as the share of renewable energy is already accounted for in the calculation of the carbon intensity. It can also be argued that electricity would have had an alternative use and therefore affecting the average intensity.

The average carbon intensity for the electricity would then be multiplied by a factor expressing the difference in powertrain efficiency between internal combustion engines and battery electric powertrains. To ensure coherence with the FQD, the adjustment factor should correspond to 40%, and only for battery electric vehicles.[160] An extension of the adjustment factor to electric powertrains of plug-in hybrids may be considered if it is coherent with the FQD.

Another issue is whether to require additionally from those providing electricity or hydrogen. For the market-based instrument to provide additional electricity, it could be required as explained above to demonstrate that electricity or hydrogen is additional.

Who can participate?

Participants are proposed to be the same parties as defined in the current Art.7A (1) as suppliers designated by Member States. It means suppliers of the fuels covered by the scope (see below for fuel types). Fuel suppliers are defined by the point of excise duty. In practices it will be the following:

- Wholesale and retail suppliers of fossil fuels
- Wholesale and retail biofuel suppliers to end-use
- Suppliers of electricity for transport
- Suppliers of hydrogen for transport

Fuel types?

As argued above, gaseous fuels should be included in the scope. Therefore, the covered fossil fuels would be Gasoline, diesel, LPG, CNG and LNG.

Banking?

As mentioned, banking allows for more flexibility and therefore overall lower costs. Hence banking is suggested to be allowed.

Sanction level and/or price cap?

A sanction and a price cap will in practice have the same effect and will thus define a maximum cost of compliance. Currently, there are variations across EU in sanction level. Under a market-based instrument, a sanction level is defined as a cost at which suppliers can buy the difference between their obligations and their possession of credits. Without such a price cap, there could be speculation in the market or large suppliers could buy up credits and thereby prevent smaller suppliers in complying. The specific sanction/price cap level would have to be defined. It should be above the expected price/costs of advanced biofuels so that there is no incentive just to pay the sanction and not provide the reduction in carbon intensity.

[160] Implementing Directive (EU) 2015/652.

How would the calculation and verification be done?

Similar to the current situation, there should be a verification procedure in place to check the claimed CI of the supplied fuels. It means that there should be requirements to have audits on the claims for credits where the CI of the supplied fuels are verified. It should be independent audits by accredited third-party auditors.

Which options can it apply to?

A market-based instrument can be associated with high levels of administration from a regulator's point of view, as is for example reported for the Californian LCFS.[161] The European context can be considered as more complex, considering that different EU DGs as well as all 27 national authorities will have a role in the administration.[162] In relation to the options for the GHG reduction obligation, a market-based instrument is therefore only considered relevant for a strengthened obligation.

As outlined above, a market-based instrument requires a symmetric implementation across the EU and a centrally organised operation. Aspects like annual targets and sanction levels need to be uniform to ensure a level-playing field for the purchase and sale of reduction achievements. The market-based instrument is therefore only regarded as feasible if fuel suppliers are directly regulated via an EU Regulation. It is hence not applicable to the scenario of an EU Directive on Member States.

[161] IEEP, ICCT, T&E (2015).
[162] The assessment of the impacts will shed more detailed light on this.

Appendix K Assessment of the impacts

Environmental impacts

Reduction in GHG emissions from transport

Reduction in GHG emissions from transport is indicated by the Carbon Intensity (CI) of the utilized fuels in transport and/or by the share of RES and low carbon fuels in the transport fuel mix. A change in the mix of policies related to the fuels used in transport will also result in a change to the achieved GHG emissions reduction in the sector.

The final share of RES and low carbon fuels in the overall fuel mix for transport will largely determine the overall reduction of the absolute number of tonnes of CO_2 emitted by the transport activity.

The overall emitted GHG directly impact all European Citizens. Promotion of policies that will result in a reduction of overall GHG emission in transport, will be in line with the overarching targets of Green Deal for a cleaner, greener, healthier environment for the European Citizens.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The MIX55 scenario of the 2030 CTP estimates the expected reduction of GHG emissions in the whole transport sector. Simulations reported in the 2030 CTP of the MIX55 scenario anticipate a 16.3% GHG reduction in the transport sector in 2030. According to the reported modelling results, in road transport annual CO_2 emissions reduction doubles compared to the period 2005-2015.

A significant driver for the reduction of GHG emissions in transport is the achieved penetration of 'alternative fuels' in the sector. In MIX55 scenario, a total of approximately 14 % of these fuels (in real energy terms excluding the RED II multipliers) in the transport sector is projected to contribute in the transport fuel mix in 2030. Alternative fuels cover all non-oil products, i.e. anything that is not fossil gasoline and fossil diesel, such as: Electricity, Hydrogen, E-Gas, Biogas, Natural Gas, Liquid Biofuel, E-Liquids and considers aviation and maritime sectors. According to the results of 2030CTP, the share of liquid biofuels and biomethane reaches 6.6% of transport energy demand, thanks to dedicated fuel policies, including policies for aviation and maritime, while e-fuels will represent around 0.2% of the transport energy demand, driven by fuel obligations for the aviation and maritime transport sectors. Electrification of transport adds a 3.8% while natural gas accounts for the remaining percentage of alternative fuels in transport in 2030 (% in real energy terms). Note that considering the above transport fuel mix and the RED II multipliers, the RES-T share reaches 26.3% in 2030.

Impacts of a discontinued obligation (Option 2)

In case of FQD Art. 7A abolishment, RED II and its provisions (also considering its potential revision) will mainly determine the fuel mix in transport. In that case, the RES-T share in actual energy terms is considered as a generic proxy for the overall reduction of GHG emission in transport and, the relevant direct provisions determining the RES-T levels (through, for instance, setting mandates for specific fuel categories), or indirect ones (through the introduction of multipliers for fuel categories and/or transport modes, promoting thus the use of these fuels), will play the dominant role in the determination of the exact reduction of GHG emissions from transport. Therefore, a potential discontinuation of the Art 7A obligation is not expected to impose a major change in GHG emissions under Option 2 as compared to Option 1. Further, it is noted that the sustainability criteria provisions of RED will ensure that lifecycle effects will be considered.

Impacts of a strengthened obligation (Option 3)

Under Option 3, the implementation of a more effective mix of policies to promote the use of low carbon fuels, such as the ones discussed below, can have a positive impact on the reduction of the overall GHG emissions in transport.

The quantification of the achieved reduction in the GHG emissions in transport is not possible without implementing the specific policies into an energy-systems approach, such as the one followed in the 2030 CTP. However, some indication can already be provided by the discussion on the ALLBNK scenario of the 2030 CTP, which is the "most ambitious scenario for GHG reduction" (although overall it still results in a reduction of 55% GHG). The strict and intensive policy framework of FQD will reduce the risk of policy failures and will have positive impact in complying with the 2030 GHG reduction target.

The effect will be significant in case market policies are implemented to facilitate development, production, trade and use of low carbon fuels. Such policies include:

- Increased blending ratio of biofuels into fossil fuels and/or single market trading in the EU: establishing the utilization of fuel blends of higher biofuel content (e.g. E20) will result in GHG emissions reduction.
- More favourable financing framework at investment level: improvement of the investment attractiveness through measures as e.g. lower financing costs and access to funds, will result to the reduction of the risk of First-Of-A-Kind (FOAK) plants for low carbon fuels.
- Support during demonstration and early commercialization stages of novel low carbon fuel technologies: a potential introduction of mandates on the market update of specific fuel categories will formulate a clear framework supporting the development of the relevant technologies.
- Support the deployment of lower carbon intensity fuels through appropriate financing tools: Tailored financing mechanisms (such as feedstock premiums, feed in tariffs and premiums, can de-risk capital investment and ease uncertainties of production costs of lower carbon fuels.
- Establishment of binding intermediate targets (e.g. GHG intensity reduction, RES-T shares) in order to better monitor implementation of policies and enhance their effectiveness.
- Support the deployment of lower carbon intensity fuels through appropriate capacity building measures: enhancement of capacity building and awareness activities for SMEs and industries.
- Intervention into the tax policy: (a) carbon taxation for fossil fuels will result in their limited use, and/or (b) tax exemptions for the use of low carbon fuels will constitute a clear driver for the development of the relevant technologies.
- Broadening of use of lower carbon fuels, e.g. RFNBOs, such as e-fuels and renewable (green) hydrogen: potential establishment of sectoral uptake quotas and other relevant mandates would help commercialization of such technologies and contribute to their cost reduction.
- Establishment of a framework to support the valorisation of the potential for RCF.
- Implementation of measures contributing to the completion of the single market and to the removal of trade barrier related to low carbon fuels.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD - Option 3A

Among the policy measures that can be adopted to promote the use of low carbon fuels in transport, specific actions to enhance the uptake of gaseous fuels, in particular, would have a positive impact on the reduction of the overall GHG emissions in transport. Besides the consideration of fossil and biomass-based gaseous fuels, including novel ones such as clean gases[163], within the scope of FQD Art.7A, amendment on the 'technical' part of the FQD is also required to include these fuels. With the current EU policies on sector coupling and on hydrogen[164], it can be assumed that fuel suppliers of natural gas (which is the main gaseous fuel currently in use) will have to gradually move towards the enhancement of the gaseous fuels palette by adding low carbon gaseous fuels that might contribute to reduction of GHG emissions.

Impacts of a market-based system to trade GHG reduction obligations - Option 3B

A market-based system will provide an incentive to individual fuel suppliers to operate in such a way to ensure as much credits as possible. Depending on the exact annual GHG reduction target, fuels suppliers will act in a way to better fulfil their obligation. Therefore, fuel suppliers will try to

[163] Clean gases are gases produced through a power-to-gas process
[164] Powering a climate-neutral economy: An EU Strategy for Energy System Integration, COM(2020) 299 final, 8.7.2020; and A hydrogen strategy for a climate-neutral Europe, COM(2020) 301 final, 8.7.2020

provide the market with fuels of lower GHG emissions per supplied MJ to achieve a reduced amount of total GHG and be compliant with their set target. To ensure a positive impact, a monitoring mechanism based on appropriate tools that will enable an effective tracing of credits used by fuel suppliers to meet their annual GHG reduction target, should be in place. The mechanism can potentially offer at the same time some room for flexibility in order to allow obligated parties to mitigate part of their risks (e.g. capability for limited banking of credits).

Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C

A direct regulation on fuel suppliers will clearly (a) impose targets and GHG emission reduction obligations and (b) define enforcement and compliance. This will create the conditions for facilitating the development of a seamless market, removing the currently observed fragmentation (see also outcome of the evaluation of FQD Art7A (Section 3)). Clarity in targets and the way to achieve them will promote the uptake of fuels that will contribute to the reduction of the GHG emission from transport. The impact is positive.

Table 27 Summary of impact "Reduction in GHG emissions from transport."

Option	Impact
Continued obligation (baseline)	Baseline policies anticipate a total of 13.3% of RES share in the transport sector in 2030, resulting to a 16.3% GHG reduction in the sector.
Discontinued obligation	(o) RED II and its provisions will determine the RES-T share in transport, and therefore the overall reduction of GHG emission.
Strengthened obligation	(+) The implementation of a mix of policies to promote the deployment (development, production, trade and use) of low carbon fuels will have a positive impact on the reduction of the overall GHG emissions in transport.
Expanded FQD scope to gaseous fuels	(+) A solid framework for the use of low carbon gaseous fuels into transport will further enhance their market penetration and therefore contribute to the reduction of the total GHG.
Market-based system	(+) A market-based system building on annual GHG reduction targets would provide the incentive to fuel suppliers to secure fuels that will ensure compliance with the set reduction.
Direct regulation of fuel suppliers	(+) Clarity in targets and the way to achieve them (enforcement and compliance) will facilitate promotion of the uptake of fuels that will contribute to the reduction of the GHG emission from transport.

Reduction in GHG intensity of fuels

The implementation of the FQD Art 7A provision directly affects the GHG intensity of transport fuels. Strengthening the obligation to reduce the GHG intensity of fuels will result in a transport fuel mix with an overall lower GHG emission intensity. This can be achieved using fuels of lower Carbon Intensity (CI), as compared to the currently utilized fuels. The use of such fuels requires investments in production facilities for these fuels (including potential investments into supply chains, refinery technologies and the like), directly thus affecting European fuel suppliers.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The reduction of the CI of the fuel mix in transport can be a significant factor contributing to the overall efforts for achievement of the 2030 (and beyond) climate target. The CI of the transport fuel mix depends on the exact composition of the fuel mix and the relevant contribution (in terms of fuel volume) of those fuels offering the largest CI reduction.

Computations based on the MIX55 transport fuel mix and following the methodology of the life cycle assessment of the GHG emissions of the FQD[165] result in an overall CI of 83,2 gr CO_2 e/MJ, suggesting that there will be a 11.5% reduction of the overall CI of the transport fuel mix as compared to the baseline of 94 gr CO_2 eq/MJ (almost doubling the 6% reduction target of 2020).

Impacts of a discontinued obligation (Option 2)

Under Option 2, RED II will largely determine the overall transport fuel mix. In particular (a) the overall RES-T target and the quotas/caps of specific fuel categories will determine the relevant contribution of the different fuels in the final transport fuel mix, while (b) the provisions of RED II related to the sustainability criteria of biofuels and low carbon fuels will determine the eligibility of those fuels to contribute towards the RES-T target.

RED II does not target reduction of the CI of the overall fuel mix and only sets a threshold of minimum GHG savings that eligible fuels must have to contribute to the RES-T target. However, it is the combination of (a) eligibility of fuels with low CI and (b) the promotion of the market deployment and the penetration of those fuels, that will determine the overall CI reduction in the transport fuel mix.

Therefore, the lack of a specific requirement for an explicit reduction of the CI of the fuel mix that is used to cover the transport demand (as this is set by the FDQ Art 7A), will let RED II being the only policy instrument that will, indirectly, lead to the formulation of the total CI of the fuel mix. Based on the experience of the parallel implementation of RED and FQD up to 2020, a system that will be exclusively based on RED II (and the specificities of its implementation in the various MS), is expected to constitute a weaker driving force towards reduction of the overall CI, since RED II only indirectly promotes the uptake of the best performing (in terms of GHG intensity) fuel options (which is largely achieved through FQD Art.7A).

Impacts of a strengthened obligation (Option 3)

The implementation of a mix of policies to promote the use of low carbon fuels (see also the analysis of the previous environmental impact "Reduction in GHG emissions from transport"), which feature lower CI than the fossil fuels largely used at present, can have a positive impact on the reduction of the overall CI in transport, because there will be more quantities of fuels with lower CI, including gaseous fuels. On the other hand, it should be noted that due to the expected gradual electrification of the passenger cars fleet (mainly), an enlarged share of renewables in the electricity mix would also directly contribute to the reduction of the CI of the fuel mix in the transport sector. However, this evolution should not influence the effort to further use lower carbon fuels that could be pursued by a strengthened FQD Art.7A policy and all available means contributing to greener transport should be considered.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD - Option 3A

Addition of gaseous fuels to the scope of the fuel quality requirements under the FQD will result in a more solid regulatory framework that will allow for the expansion of the range of the available options and therefore further promoting the use of these fuels; consequently, it is possible that the share of renewable gaseous fuels will increase. Further, specific categories of gaseous fuels, such as e-gases, feature a very low CI and depending on the extent of their deployment in the market there is a significant potential of CI reduction of the overall fuel mix. However, it should be noted that policies supporting the development of technologies that can contribute to greening the gaseous fuels sub-mix (e.g. increased hydrogen blending on the natural gas grid, promotion of biogas and bio-methane, promotion of e-gases) are needed in that case.

Based on the calculations carried out for this study (see Appendix F), the CI of the gaseous fuel mix in the MIX scenario of the 2030 CTP is 22.4% lower than the resulting CI of the overall transport fuel mix. At the moment (baseline), gaseous fuels contribute 8% of the total quantities and therefore any increase of their share under Option 3A will result in a relative reduction of the overall fuel mix CI.

Impacts of a market-based system to trade GHG reduction obligations - Option 3B

[165] Which is also reflected in RED II

A market-based system will provide an incentive for individual fuel suppliers to operate in such a way to ensure as much credits as possible. Depending on their market share (i.e. the quantities), and on the basis of the yearly reduction target set, fuel suppliers will eventually possess a specific amount of credits that they would be able to either use to cover their obligation, or to trade. This directly provides the incentive for fuel suppliers to supply low CI fuels in the market; then, also by trying to maximize the share of those low CI fuel, fuel supplier will over-achieve the GHG reduction targets. Further, the overall cost per avoided CO_2 e will be reduced as suppliers with lower abatement costs will, proportionally, contribute more to the overall emissions reduction. Overall, the greater the amount of low CI fuels, as well as the lower the CI of the individual fuels, the more will be the reduction of the overall CI of the transport fuel mix. The impact is positive.

Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C

A regulation that will clearly set CI targets and the relative enforcement mechanisms to the obligated parties directly, will also provide a firm frame of action. A uniform regulation can help big fuel suppliers to benefit from uniform compliance requirements and reduced administrative burdens. The solid framework resulting from the implementation of a uniform regulation at pan-EU level, can possibly also promote the larger scale production for fuels with lower carbon intensity.

Table 28 Summary of impact "Reduction in GHG intensity of fuels."

Option	Impact
Continued obligation (baseline)	Considering the MIX scenario of the 2030CTP, a 11.5% reduction of the overall CI of the transport fuel mix as compared to the base line of 94 gr CO_2 eg/MJ.
Discontinued obligation	(o) RED II and its provisions will determine the overall fuel mix in the transport sector, and therefore the overall GHG emission intensity. Therefore, evolution of RED II will determine if there will be a positive or a negative impact.
Strengthened obligation	(+) Strengthened obligation supported by the implementation of a mix of policies primarily aiming at de-risking investment and upscaling production of low carbon fuels, which feature lower CI than the fossil fuels largely used currently, will have a positive impact on the reduction of the overall CI in transport.
Expanded FQD scope to gaseous fuels	(+) Addition of gaseous fuels to the scope of the FQD will expand the range of transport decarbonization options, therefore providing favourable conditions for the further deployment of those fuels, which in general feature a lower carbon intensity than other relevant liquid fuels.
Market-based system	(+) A market-based system would provide an incentive for individual fuel suppliers that are able to supply low CI fuels to over-achieve and therefore enhanced quantities of such fuels can be expected.
Direct regulation of fuel suppliers	(+) A regulation that will clearly set CI targets and the relative enforcement mechanisms to the obligated parties directly, would also provide a firm frame of action.

Impact on feedstock supply

The demand for biomass-based fuels requires the supply of feedstock to biofuel producers. In the case of 1st generation biofuels, which are currently the dominating type of biofuel, the production of feedstock requires agricultural area, the demand of which varies by the different types of feedstocks consumed. With the rise of second-generation biofuels as well as other alternative fuels however, the need for agricultural area can be expected to decrease. The underlying impact quantifies, how the land requirement can be expected to evolve by 2030 and 2050.

Methodology behind measuring the impact

The feedstock supply takes outset in the fuel demand according to the MIX55 scenario. The feedstock supply is determined through an assumed feedstock distribution that rests on the '2017' and '2025+' scenarios in the JEC v5 study, as also elaborated more detailed in section 0 above.[166] The share of FAME and HVO in the consumption of biodiesel is assumed at respectively 80% and 20% in 2020 and 45% and 55% in 2030 and beyond.[167] Based on the fuel demand and feedstock distribution, the required land area is calculated in two steps. First, using the energy densities of respectively gasoline, diesel, biodiesel, bioethanol, and HVO provided in RED II, the fuel volume is calculated.[168] Second, the land area is determined with biofuel yields for the different feedstocks, building on a 2015 EU Commission study.[169] The assessment does not account for annual gains in yield efficiency. The projected land area demands are therefore overestimated for 2030 and 2050. The origin of the feedstocks is dissected between EU and non-EU countries using 2018 data provided in the European Commission's 2020 Renewable Energy Progress Report.[170] In some cases, the study classified the origin as "unknown", which this study classifies as non-EU. The origin of the feedstock is assumed as fixed for 2020, 2030, and 2050.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

According to the simulations of the MIX55 scenario (provided by the European Commission), the bioethanol demand in 2020 requires about 2.3 million ha of land, of which 73% originates in the EU (see Table 20). According to the baseline, which projects a -11.5% reduction of the GHG intensity by 2030, the demand for 1st generation bioethanol feedstocks will significantly decrease until 2030, with a reduction of about 1.7 million ha (-73%), owing to a reduced energy demand for bioethanol. Since the projected origin of the feedstock is assumed to be fixed, most of this decrease is projected to occur in the EU.

Table 29 Option 1: Land area demand for bioethanol feedstocks in the EU and non-EU in 2020, 2030, 2050 and the change since 2020.

Bioethanol Feedstocks	EU/ Non-EU	2020	2030	2050	2030 - 2020	2050 - 2020
		1,000 ha				
Wheat	EU	900	200	10	-700	-900
	Non-EU	80	20	0	-60	-80
Maize	EU	600	200	10	-400	-600
	Non-EU	200	70	0	-200	-200
Sugars (beet, cane)	EU	200	50	0	-100	-200
	Non-EU	50	20	0	-40	-50
other cereals (barley, rye)	EU	0	0	0	0	0
	Non-EU	300	70	0	-200	-300
Total	EU	1,700	400	20	-1,200	-1,700
	Non-EU	600	200	10	-500	-600

[166] JEC (2020), JEC Well-To-Wheels report v5, https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/jec-well-wheels-report-v5
[167] 2020: Based on reported shares of 84% and 16% in 2018 in EEA (2020). Greenhouse gas intensities of road transport fuels in the EU in 2018; 2030: Ricardo (2018). Europe's Clean Mobility Outlook: Scenarios for the EU light-duty vehicle fleet, associated energy needs and emissions, 2020-2050
[168] Directive 2018/2001, Annex III
[169] European Commission (2015), The Land Use Change Impact of Biofuels Consumed in the EU Quantification of Area and Greenhouse Gas Impacts, https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf
[170] COM (2020) 952, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf

Bioethanol Feedstocks	EU/ Non-EU	2020	2030	2050	2030 - 2020	2050 - 2020
		1,000 ha				
Grand Total		**2,300**	**600**	**20**	**-1,700**	**-2,300**

Source: authors' own calculation

In terms of the specific bioethanol feedstocks, wheat will continue to account for the largest land use associated with bioethanol production. Partially, this is due to its low biofuel yield per ha (compared to maize and sugars).[171] The land use associated with wheat will nevertheless experience a strong decrease in the order of 75% until 2030. As also elaborated in the options description in section 0 above, the contribution of wheat to bioethanol demand will decrease (from 30% in 2020 to 26% in 2030), at the expense of advanced bioethanol (i.e. Annex IX-A bioethanol).

Maize will remain the largest feedstock when measured by its share in the energy demand for bioethanol (38% in 2020 to 34% in 2030). Owing to a considerably higher biofuel yield per hectare than wheat however, it requires less land use.

Although sugars will only have a limitedly lower share in the feedstock distribution (21% in both 2020 and 2030) than wheat, sugars have a substantially lower land use impact. This can be traced back to the fact that sugars have a three-fold higher biofuel yield per ha (than wheat), making these the most efficient bioethanol feedstock in terms of land use.[172]

The views of stakeholders during the second workshop somewhat deviate from the above projection: Most stakeholders (30%) believe that maize will be the dominant bioethanol feedstock by 2030, while respectively 21% and 14% believe that sugars and wheat will be the dominant feedstock. When it comes to Annex IX-A feedstocks, 20% of stakeholders expect this feedstock to be the dominant one by 2030. It is worth mentioning that none of the represented industry stakeholders assess Annex IX-A as the dominant feedstock, while 62% of in that category judge maize to dominate (compared to an average of 30% across all stakeholders). This could indicate that the fuel industry has more conservative views as regards the potential of Annex IX-A feedstocks by 2030.

First generation bioethanol is projected to be virtually phased out by 2050, resulting in a decrease of about 2.3 million ha (-99%) compared to 2020. Accordingly, there is a limited land use associated with the production of bioethanol in 2050.

According to the MIX55 scenario, the production of biodiesel and HVO feedstocks corresponds to a land use of 6.3 million ha in 2020 (see Table 21 below). A slight majority (57%) originates from outside the EU, with palm oil as the dominating feedstock. The demand for biodiesel is projected to increase in the order of 12% by 2030. The associated land use for biodiesel will however decrease by 0.8 million ha (-12%). The origin for this difference is that palm oil is expected to be phased out as a crop-based feedstock by 2030 due to its associated high ILUC risk. In line with the calculation carried out for this study, it is assumed that palm oil will instead be sourced from POME, counting hence as an Annex IX-A feedstock, and no associated land use.

Table 30 Option 1: Land area demand for biodiesel and HVO feedstocks in the EU and non-EU in 2020, 2030, 2050 and the change since 2020

Biodiesel Feedstocks	EU/ Non-EU	2020	2030	2050	2030-2020	2050-2020
		1,000 ha				
Rapeseed	EU	3,700	2,800	1,400	-900	-2,300

[171] European Commission (2015), The Land Use Change Impact of Biofuels Consumed in the EU Quantification of Area and Greenhouse Gas Impacts
[172] ibid

Biodiesel Feedstocks	EU/ Non-EU	2020	2030	2050	2030-2020	2050-2020
		1,000 ha				
	Non-EU	900	600	300	-200	-500
Palm oil	EU	0	0	0	0	0
	Non-EU	1,500	0	0	-1,500	-1,500
Soybean	EU	90	80	40	-10	-50
	Non-EU	1,200	1,100	500	-200	-700
Sunflower	EU	30	100	60	90	30
	Non-EU	200	600	300	400	100
Total	EU	3,800	3,000	1,500	-800	-2,400
	Non-EU	3,700	2,300	1,100	-1,400	-2,600
Grand Total		**7,500**	**5,300**	**2,600**	**-2,200**	**-4,900**

Source: authors' own calculation

In terms of the specific feedstocks, the use of POME means that no land use will be associated with biofuel production, leading to a reduction of 1.5 Mha. POME share in the feedstock distribution is projected to remain limitedly stable: with 20% for biodiesel in 2020 and 2030, and respectively 45% and 40% for HVO in 2020 and 2030.

Rapeseed oil will continue to be the dominant biodiesel feedstock in 2030, accounting for 47% of the feedstock distribution. Rapeseed oil will however continue to play a less important role as an HVO feedstock (16% in 2030). Overall, the reduction in land use associated with rapeseed will account for the largest reduction in the EU. Soybean and sunflower will continue playing a limited role. Sunflower will however gain an increased share in the feedstock distribution for biodiesel (going from 1% in 2020 to 6% in 2030).

The role of 1st generation biodiesel feedstocks is projected to further decrease by 2050, with an associated decrease of 4.0 million ha (-64%) compared to 2020.

Impacts of a discontinued obligation - (Option 2)

The option will not lead to significant differences to the baseline, as the baseline year of 2020 corresponds to the compliance deadline of Art.7A. Whereas evaluation of FQD Art7A (Section 4) concludes that most Member States have not met the non-binding intermediate target for 2017, it does not conclude that there is a significant risk that the majority of Member States will not achieve their 2020 targets. It is therefore difficult to derive a sound assumption of the biofuel demand or feedstock distribution that significantly differs from the baseline.

Impacts of a strengthened obligation - (Option 3)

According to the calculations, Option 3 will lead to a higher demand for biofuels with low GHG intensity, which results in an increased substitution of crop-based biofuels with advanced biofuels. For bioethanol, this leads to an increased share of 2nd generation bioethanol (i.e. a share in the feedstock distribution of 20% versus 13% in the baseline). The associated impacts presented in Table 22 below show small changes compared to the baseline. The change in land use associated in 2030 will decrease by an additional 100,000 ha compared to the baseline, resulting hence in a marginally smaller reduction of land use. In terms of the specific feedstocks, only maize will make a significant decrease. The impact is identical for 2050, as bioethanol is projected to be nearly fully phased out by then.

Table 31 Option 3: Land area demand for bioethanol feedstocks in the EU and non-EU in 2020, 2030, 2050 and the change since 2020

Bioethanol Feedstocks	EU/ Non-EU	2020	2030	2050	2030 - 2020	2050 - 2020
		1,000 ha				
Wheat	EU	900	200	10	-700	-900
	Non-EU	80	20	0	-60	-80
Maize	EU	600	100	10	-500	-600
	Non-EU	200	60	0	-200	-200
Sugars (beet, cane)	EU	200	50	0	-100	-200
	Non-EU	50	10	0	-40	-50
other cereals (barley, rye)	EU	0	0	0	0	0
	Non-EU	300	70	0	-200	-300
Total	EU	1,700	400	20	-1,300	-1,700
	Non-EU	600	200	10	-500	-600
Grand Total		**2,300**	**600**	**20**	**-1,800**	**-2,300**

Source: authors' own calculation

Regarding biodiesel, Option 3 leads to a stronger reduction in land use compared to the baseline: 1 Mha less land use will be associated with the production of 1st generation biofuel feedstocks in 2030. This strong impact can be explained by the fact, that Option 3 assumes a 50% increase in the feedstock share of POME biodiesel and HVO (as also elaborated in the options description above). Accordingly, POME biodiesel will also substitute the production from other oil crops (e.g. rapeseed and soybean). Especially for rapeseed, which has the second highest share in the feedstock distribution among crop-based feedstocks, the reduction in associated land use is significant. Compared to the baseline, the land use associated with rapeseed will decrease by 1.7 Mha between 2030 and 2020 (compared to 1.1 Mha in the baseline).

Table 32 Option 3: Land area demand for biodiesel feedstocks in the EU and non-EU in 2020, 2030, 2050 and the change since 2020.

Biodiesel Feedstocks	EU/ Non-EU	2020	2030	2050	2030-2020	2050-2020
		1,000 ha				
Rapeseed	EU	3,700	2,300	1,100	-1,400	-2,600
	Non-EU	900	500	300	-300	-600
Palm oil	EU	0	0	0	0	0
	Non-EU	1,500	0	0	-1,500	-1,500
Soybean	EU	90	60	30	-20	-60
	Non-EU	1,200	900	400	-300	-800
Sunflower	EU	30	100	50	70	20

Biodiesel Feedstocks	EU/ Non-EU	2020	2030	2050	2030-2020	2050-2020
		1,000 ha				
	Non-EU	200	500	200	300	90
Total	EU	3,800	2,500	1,200	-1,400	-2,600
	Non-EU	3,700	1,900	900	-1,800	-2,800
Grand Total		**7,500**	**4,400**	**2,200**	**-3,200**	**-5,400**

Source: authors' own calculation

<u>*Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD Option 3A*</u>

As the impact on the GHG intensity above concludes, Option 3A can provide an improved framework to promote the use of gaseous fuels. The GHG intensity projections of the calculations carried out for this study for bio-gaseous fuels show that 40% of biomethane originates from energy crops, of which primarily maize, and that 60% of biomethane is based on waste feedstocks. The 2030CTP projects that biomethane will gain in importance for gaseous transport fuels. Gaseous fuels in the transport sector (incl. road transport, aviation and maritime) are expected to increase from 3 Mtoe in 2015 to 11 Mtoe in 2030 (almost a four-fold increase), in which biomethane will play an important role.

Accordingly, to the extent that Option 3A effectively promotes an increased use of gaseous transport fuels, it will also lead to an increased feedstock demand. The strengthened GHG obligation will however also lead to a change in the feedstock distribution in favour of residual/waste-based feedstocks (owing to their favourable GHG performance).

With respect to hydrogen, the MIX55 scenario projects commercial-scale supply of hydrogen from 2040 on. Option 3A can accelerate the market-uptake uptake of hydrogen, and therewith accelerate the transition away from crop-based transport feedstocks.

As compared to the baseline, the impact of Option 3A is influenced by two factors. 1) The increased demand for gaseous fuels will lead to a higher demand of feedstocks. 2) Option 3A will lead to a transition away from crop-based feedstock. If the second factor dominates the first, a positive impact can be expected (and vice-versa).

<u>*Impacts of a market-based instrument to trade GHG reduction obligations - Option 3B*</u>

The market-based instrument will have a positive impact on the feedstock demand, as the system rewards higher GHG savings of fuels. Therefore, more GHG efficient biofuels will be consumed, requiring less land use.

<u>*Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C*</u>

Option 3C has a similar impact as Option 3, as advanced biofuels will represent a higher share in the feedstock distribution of bioethanol and biodiesel, leading to less land use. Compared to the baseline, the impact will therefore be positive.

Table 33 Summary of impact "Impact on feedstock supply."

Option	Impact
Continued obligation (baseline)	There will be a significant reduction in land use, due to the decreasing importance of crop-based biofuels. By 2030 and 2050, the associated land use will reduce by respectively 3.9 and 7.2 million ha.
Discontinued obligation	(o) There is no change to the baseline.

Option	Impact
Strengthened obligation	(+) The land use will decrease by an additional 1.1 and 0.5 million ha by respectively 2030 and 2050, as compared to the baseline.
Expanded FQD scope to gaseous fuels	(-/+) An increased demand for gaseous fuels can be expected, leading to higher demand for all feedstocks. However, the increased GHG obligation will incentivise transitioning away from crop-based feedstocks. Faster scale up of hydrogen will further support transition away from crop-based feedstocks.
Market-based instrument	(+) More GHG efficient biofuels will be consumed, leading to less land use.
Direct regulation of fuel suppliers	(+) As for option 3 above

Displacement of agricultural and other products

Displacement of agricultural and other products occur when the demand for biofuel encourages a diversion of feedstocks away from existing uses (e.g. food and feed production), which in turn needs to be substituted, inducing an indirect land use change (ILUC). [173] Also for residual products like used cooking oil, displacement effects have been observed – however not in an EU context.[174]

The diversion of food- and feed-based (i.e. 1st generation) feedstocks from food and feed production to biofuels can have two types of effects:

- Increased prices for food and feed products,
- Increased cultivation of land with negative environmental impacts on GHG emissions, water quality and soil quality.

The mechanism is largely driven by increased prices for feedstocks, leading to more land being cultivated. Higher prices mean that more marginal land becomes profitable for cultivation. These effects can occur both in the EU and third countries. Impacts on third countries are assessed as a separate impact category under the social impacts. Gains in yield efficiency over time may limitedly reduce the increase of cultivated land. These gains are not accounted for in the quantification of the land requirement in the previous and underlying impact. Therefore, quantifications of the land requirement in 2030 and 2050 are overestimated.

<u>Methodology behind measuring the impact</u>

The assessment draws on the estimation of the land use requirement described under the impact category of Impact on feedstock supply. Based on the estimated need for land area, it is possible to infer whether the options lead to significant changes in the land area requirement.

For 1st generation biofuels, the displacement can be assessed through ILUC approach, while there is no consensus on how to assess the impacts of displacement for non-food biofuel feedstock.

Overall, the assessment of the land area requirement will provide an indication of the magnitude of the impacts.

<u>Impacts of changes to the GHG reduction obligation</u>

<u>*Impacts of a continued obligation – baseline - (Option 1)*</u>

[173] https://theicct.org/sites/default/files/publications/Biofuels-displacement-emissions-oct2020.pdf
[174] Ibid.

The EU's biofuel policy addresses displacement risks through the sustainability architecture of the FQD, RED I and RED II.[175] In particular, RED II caps high ILUC-risk feedstocks at the 2019 consumption level, followed by a phase out by 2030. The RED I further caps the share of food and feed-based feedstocks, as well as used cooking oils and animal fats.[176] The EU regulatory framework will thus gradually reduce any displacement effects by 2030.

The fifth Renewable Energy Progress Report (2020) observed further no correlation between food prices and the demand for biofuels in recent years.[177] Any potential impact on food prices is considered small compared to other factors affecting the prices. Taking into account that the use of biofuels based on food crops will be reducing, the impact on food prices is expected to be limited.

The comparison of the land use requirements (see Tables 20-23), to the overall areas of cultivated land (see Table 46), shows that the land areas required for biofuel feedstock represents only a little share of the total area used for each crop except for rapeseed used for biodiesel. Out of the total cultivated area, the land required for biofuel feedstock will represent in the order of 3-4% in 2030. By 2050, it will represent less than 1%. As noted above, this estimate does not account for gains in yield efficiency, which likely overestimates the land requirement in 2030 and 2050.

While marginal effects on food prices and on additional cultivation cannot be ruled out, overall, the displacement impacts are very small.

Impacts of a discontinued obligation - (Option 2)

The discontinuation of the obligation will have limited effects on the actual use of feedstock. As explained, the use of biofuels is also governed by the RED II and other national and EU legislation. The discontinuation will therefore not change the demand of different types of biofuels. Compared to the baseline, Option 2 will therefore have only negligible effects.

Impacts of a strengthened obligation - (Option 3)

The strengthened obligation assumes an increase in the share of advanced biofuels (i.e. Annex IX-A) by 50% by 2030, leading to an increased substitution of 1st generation biofuels with wheat straw ethanol and POME biodiesel. In terms of land use, this leads to a 3% (or 50,000 ha) higher reduction of land use for ethanol and a 59% (or 1.1 Mha) higher reduction for biodiesel. [178] It is important to underline in this respect that this change is the result of an illustrative scenario that reflects an ambitious switch to Annex IX-A feedstocks. A strengthened obligation, which is met by an increased switch towards advanced biofuels, will thus lead to a strong reduction in the demand of, particularly, biodiesel crop feedstocks. As the overall assessment points to a low risk of displacement under the baseline, Option 3 further reduces this small risk.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD - Option 3A

The limited volumes of gaseous fuels compared to the liquid fuels means that adding gaseous fuels will have no additional risk of displacement. The impacts will be as described under the baseline.

Impacts of a market-based instrument to trade GHG reduction obligations - Option 3B

As for the impact on the feedstock supply, the market-based instrument will incentivise the supply of more GHG efficient biofuels, leading to less land use and therefore also less displacement.

Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C

Changing the FQD to be an EU regulation is not assessed to lead to any change in the risk of a displacement effects compared to the baseline assessment.

Table 25 summarises the assessment of each option.

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[175] https://ec.europa.eu/jrc/en/jec/renewable-energy-recast-2030-red-ii
[176] Article 3(4)d, Directive 2009/28/EC as amended by Directive (EU) 2015/1513
[177] COM (2020) 952 final, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf
[178] See Table 20 and 22 for bioethanol; Table 21; 23 for biodiesel

Table 34 Summary of impact "Displacement of agricultural and other products"

Option	Impact
Continued obligation (baseline)	The risk of displacement effects have been assessed as very small given the demand for crop-based biofuels are gradually decreasing. Also, the land requirements are small compared to the available land areas.
Discontinued obligation	(o) There is no change compared to the baseline, meaning that the displacement risk is very low.
Strengthened obligation	(+) There is a lower risk as it is assumed that strengthened obligation is achieved by an increased in advanced biofuels and a further reduction of the crop-based biofuels.
Expanded FQD scope to gaseous fuels	(o) There is no change compared to the baseline, meaning that the displacement risk is very low.
Market-based instrument	(+) In addition to the impact of from the strengthened GHG obligation above, the market-based instrument incentivises the use of more GHG efficient feedstocks, leading to less land use and displacement.
Direct regulation of fuel suppliers	(o) There is no change compared to the baseline, meaning that the displacement risk is very low.

Economic impacts

Administrative burden for public administrations

Member State authorities incur an administrative burden for the GHG reduction obligation, composed of among others:

- Annual reporting to the EU (i.e. EEA),
- Cost for collecting data and reports from companies,
- Cost of calculation of GHG emissions on MS level, and
- Online system management.

Methodology behind measuring the impact

No literature evidence was identified on the administrative burden. Therefore, this impact relies on the information provided by Member State authorities during the interviews. It has further not been possible to disentangle the costs specifically associated with the reporting and the monitoring. The underlying impact therefore also presents the impact of costs on reporting and monitoring.

The initial list of impacts entailed 1) administrative burden, 2) cost of monitoring, and 3) cost of reporting. Since these costs could not be disentangled, and the costs further could not be disentangled between the RED and FQD, all of these three impacts are reported as one impact.

The evaluation of FQD Art7A (Section 4) has elicited unit values on the administrative burden in the range of 1-2 FTEs per Member State. Based on labour cost data, this corresponds to an annual cost of about EUR 42,000-83,000 per year, per Member State.[179] These figures represent however, both the cost associated with the GHG reduction obligation as well as the obligations under the RED. During the interviews in this study, stakeholders commonly pointed to an inability to disentangle the administrative cost of both Directives (i.e. the FQD Art.7A and the RED).

As a key example of higher administrative burden, the Netherlands has stated that 15 FTEs are employed when it comes to the administrative activities as well as the enforcement costs, corresponding to a cost of about EUR 620,000 per year.

[179] The estimate assumes a labour cost according to Eurostat data: 37.1 average hours per week, 56 weeks in a year, €20 average hourly labour cost levels (plus taxes minus subsidies) in the EU-27 for administrative and support service activities [lc_lci_lev]

Given that the study is not able to disentangle the administrative costs into more detailed elements and can neither be disentangled from those imposed by the RED, the standard cost model has not been applied.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

Since the administrative burden for the RED and Art.7A cannot be disentangled, the impacts of all three options on the GHG reduction obligation entail no additional administrative burden.

A continued GHG obligation leads to no changes, keeping the administrative burden at 1-2 FTEs per Member State (except for the Netherlands). On the EU27 scale, this corresponds to 27-54 FTEs - an equivalent of EUR 1.7-2.9 million per year.

Impacts of a discontinued obligation - (Option 2)

A discontinued GHG reduction obligation does not change the administrative burden. The reason being that Member State authorities still need to use resources on i) the reporting to the EU Commission and ii) the monitoring of life cycle GHG emissions as part of the RED.

Impacts of a strengthened obligation - (Option 3)

There is no evidence that a strengthened GHG reduction obligation changes the administrative burden, as the reporting and monitoring framework does not change. Given that stakeholders have difficulties in disentangling the administrative cost and generally identify 1-2 FTEs for both the RED and FQD, any potential increase administrative burden can be expected to be minimal in the absence of changes to the monitoring framework.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD - Option 3A

Based on the indications provided stakeholders, it is unlikely that an expanded scope leads to additional cost if the reporting remains similar, and that a broad range of fuels is already included. Therefore, the impact is assessed to be neutral.

Impacts of a market-based instrument to trade GHG reduction obligations - Option 3B

For a market-based instrument there will be additional administrative costs compared to the current situation. The suggested market-based instrument is defined with as simple requirements as possible. Still for the public authorities, there will be the following types of administrative costs:

- Start-up costs
    - Technical preparation of the system (cost of the EC and Member States depending on the distribution of work)
- Recurrent costs
    - Annual running costs of the trading platform
    - Administration of participants
    - Enforcement costs

The start-up costs will include efforts to define the specific fuel benchmarks, the trading rules, and the set-up of a trading platform. Much of the needed data and information are already available for the current system. The fuel suppliers are registered, the fuels are defined, but there might be additional participants such as providers of electrical charging or hydrogen station providers, which needs to be registered.

The annual administrative costs will include costs of running the trading mechanism and enforcement activities.

The available data on administrative costs are all on annual costs. Hence, the assessment will provide an estimate that includes both the start-up and recurrent costs as annualised costs.

As stated above, data from the Netherlands indicate annual costs of 15 FTE or about 600,000 EUR per year. While the specific use of the resources is unclear, the Netherlands have a trading system, which could be main reason for having higher costs than reported from other Member States.

Another source of information is the impact assessment done for similar trading schemes for example the recent Canadian Carbon Fuel Standard (CFS). The impact assessment of the Canadian CFS presents annual administrative costs over a period from start-up in 2021 to 2040. The average annual costs for the first five years amount to about 5.5 million CAD. This is around 3.7 million EUR per year. By 2030, the annual administrative costs are estimated to be 4.1 million CAD – 2.7 million EUR[180].

It is difficult to extrapolate from the Canadian system as it includes more complexities than what is suggested for the EU trading mechanism. Making a scheme operational across 27 EU Member States will, however, require resources. A large share of the costs will be similar no matter the size of the trading scheme, for example setting up and running a digital trading platform. Other administrative costs would depend on the number of participants and volume of credit trading.

Extrapolating the costs from the Netherlands assuming the same level of costs per Member State would give annual costs of around 16 million EUR. This could be considered a high-end estimate. Some of the administrative costs would not need to be replicated in all Member States, while other costs might be proportional to the number of parties in the market in each of the Member States.

A low-end estimate could be based on the administrative costs for the Canadian system. Though the Canadian system is more complex as it includes requirement for additionality and have multiple pathways for achieving credits, which all needs to be checked, running an EU system across 27 Member States also adds complexity. The number of participants and trades in EU system will be higher as the EU27 has many more participants in the market than Canada. Hence, the level of 4-5 million EUR would be a low-end estimate of the annual administrative costs at the start-up phase.

The administrative costs at EU level are therefore estimated to be 4-16 million EUR per year.

Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C

The option does not alter the administrative processes for Member States authorities as the monitoring and reporting framework towards the Commission does not change. The impact is therefore assessed to be neutral in comparison to the baseline.

Table 35 Summary of impact "administrative burden for public administrations"

Option	Impact
Continued obligation (baseline)	The current level of 1-2 FTEs per Member State persists, and the burden between RED and Art.7A cannot be disentangled.
Discontinued obligation	(o) As above.
Strengthened obligation	(o) As above.
Expanded FQD scope to gaseous fuels	(o) No significant changes.
Market-based instrument	(-) A market-based instrument would require administrative costs in the order of 4 – 16 million per year in the start-up phase.
Direct regulation of fuel suppliers	(o) No changes to the administrative framework.

Administrative burden for fuel suppliers

[180] https://canadagazette.gc.ca/rp-pr/p1/2020/2020-12-19/html/reg2-eng.html

Fuel suppliers incur an administrative burden that consists of:

- Annual reports to the national authorities on fuel supplies,
- Monitoring system for tracking various fuels, and
- Costs of calculation of GHG emissions.

Methodology behind measuring the impact

As the case for the administrative burden for public authorities, no literature evidence was identified that quantifies the administrative burden for fuel suppliers. Therefore, this impact relies on the information provided by stakeholders during the interviews.

The evaluation of Art.7A (i.e. See Section 3) has elicited unit values on the administrative burden in the range of one to two FTEs per fuel supplier, where the higher figure includes resources on monitoring regulatory trends for FQD Art.7A and RED as an administrative cost. On average, most companies name a figure of one FTE for the administrative costs.

Based on the same labour cost assumption as for the administrative burden for public administrations above, the range of one-two FTEs corresponds to an annual cost of about EUR 42,000-83,000 per year.[181] These figures represent both the cost associated with the GHG reduction obligation as well as the obligations under the RED. During the interviews in this study, stakeholders commonly pointed to an inability to disentangle the administrative cost of both Directives (i.e. the FQD Art.7A and the RED).

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

Since the administrative burden for the RED and Art.7A cannot be disentangled, the impacts of all three options on the GHG reduction obligation entail no additional administrative burden.

A continued GHG obligation leads to no changes, keeping the administrative burden at 1-2 FTEs per fuel supplier. On the EU27 scale, this corresponds to 27-54 FTEs - an equivalent of EUR 1.7-2.9 million per year.

Impacts of a discontinued obligation - (Option 2)

A discontinued GHG reduction obligation does not change the administrative burden. The reason being that fuel suppliers still need to use resources on i) the reporting to the EU Commission and ii) the monitoring of life cycle GHG emissions as part of the RED.

Impacts of a strengthened obligation - (Option 3)

There is no evidence that a strengthened GHG reduction obligation changes the administrative burden, as the reporting and monitoring framework does not change. Given that stakeholders have difficulties in disentangling the administrative cost and generally identify 1-2 FTEs for both the RED and FQD, any potential increase administrative burden can be expected to be minimal in the absence of changes to the monitoring framework.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD – (Option 3A)

Based on the indications provided by stakeholders under the evaluation of FQD Art7A (Section 4) above, it is unlikely that an expanded scope leads to additional cost if the reporting remains similar, and that a broad range of fuels is already included. Therefore, the impact is assessed to be neutral.

Impacts of a market-based instrument to trade GHG reduction obligations – (Option 3B)

[181] The estimate assumes a labour cost according to Eurostat data: 37.1 average hours per week, 56 weeks in a year, €20 average hourly labour cost levels (plus taxes minus subsidies) in the EU-27 for administrative and support service activities [lc_lci_lev]

The market-based trading system could generate administrative costs for the fuels suppliers that would be subject to the market system. The administrative costs additionally to their current administrative costs include:

- One-off costs
  - Understanding the market-based instrument, decide whether to enter or not
- Recurrent costs
  - Observing the market price and trading credits

These additional costs are not substantial, as most of the administrative burden can already be attributed to the baseline. The trading system will replace the current obligation and therefore generate only minor additional administrative costs for fuel suppliers.

Already under the current obligation, fuel suppliers have to follow the price of biofuels that they need for blending. Having to follow the price of credit will therefore not add to the recurrent costs.

The administrative costs for fuel suppliers are estimated to be similar to the baseline costs. The additional administrative costs associated with a market-based instrument thus fall nearly exclusively on public administrations.

Impacts of directly regulating fuel suppliers with an EU Regulation – (Option 3C)

The option does not alter the administrative processes for fuel suppliers as the monitoring and reporting framework does not change. Fuel suppliers will furthermore still have to report to each Member State authority. The impact is therefore assessed to be neutral in comparison to the baseline.

Table 36 Summary of impact "administrative burden for public administrations"

Option	Impact
Continued obligation (baseline)	The current level of 1-2 FTEs per fuel supplier persists, and the burden between RED and Art.7A cannot be disentangled.
Discontinued obligation	(o) As above.
Strengthened obligation	(o) As above.
Expanded FQD scope to gaseous fuels	(o) As above.
Market-based instrument	(o) As above.
Direct regulation of fuel suppliers	(o) As above.

Substantive cost for fuel suppliers

The GHG reduction obligation entails a cost for the purchase of biofuels to achieve a reduced GHG intensity of transport fuels. As indicated under Section 4 above, this is the only substantive cost for fuel suppliers.

The substantive cost added to the administrative burden sums up to the total compliance cost for fuel suppliers.

Methodology behind measuring the impact

The substantive cost is calculated as the production price associated with the supply of blended gasoline and diesel. The change in the price is determined by i) the cost of the biofuel (and its underlying feedstock), and ii) the blending ratio of biofuel and fossil fuel (as measured by energy content).

The fuel demand for transport and the distribution of the feedstock are the same as observed in the calculations carried out for this study: The fuel demand is from the PRIMES modelling underlying the 2030 CTP IA and the feedstock distribution corresponds to the 2025+ scenario in the JEC v5 study.[182]

The calculation methodology is similar to the calculation of the substantive costs under the evaluation of FQD Art7A (Section 4): the weighted average of the biofuel and fossil fuel cost, where the blending ratio is the weighing factor. However, the underlying calculation is distinct from the evaluation of FQD Art7A (Section 4) by accounting for the following aspects:

1 The expected distribution of the biofuel feedstock in 2030, which builds on the 2025+ scenario in the JEC v5 study referred to above,

2 The expected price development of biofuels, as projected by an IEA study on the cost reduction potential for advanced biofuels, [183] and

3 The introduction of increased carbon pricing for road transport. The PRIMES MIX scenario assumes the introduction of carbon pricing in road transport, with a price of EUR 44 per ton CO_2 in 2030.[184] When applied to the GHG emissions associated with combustion and gasoline, the carbon price corresponds to EUR 11.4 per MWh for gasoline and EUR 11.6 per MWh for diesel. The calculation assumes that biofuels will be exempted from this carbon price.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

Table 28 presents the estimated production costs for respectively gasoline and diesel fuel blends, plus carbon pricing. Other taxes and fees are not accounted for in this calculation. The table further presents the production cost with and without a carbon price to illustrate the effect of biofuels on the production price.

Table 37 Estimated production cost of fuel blends in 2020 and 2030, based on a medium estimate of production costs, in EUR/litre and percentage changes in parenthesis

Fuel	Carbon price	2020	2030	Change
Gasoline	Yes	0.362	0.490	0.128 (35%)
	No	0.362	0.398	0.037 (10%)
Diesel	Yes	0.427	0.540	0.112 (26%)
	No	0.427	0.435	0.008 (2%)

It is evident that a carbon price has a substantial impact on the production cost, leading to an increase of 35% and 26% for respectively gasoline and diesel. When a carbon price is excluded, the production costs change significantly less.

The costs for gasoline increase by 10%. This change is explained by the following factors. The blending ratio of gasoline, as modelled by the MIX55 scenario, corresponds to 6% in 2020 and increases to 10% by 2030.[185] This drives up the production costs, as all biofuels are projected to cost more than gasoline. If a carbon price is accounted for, biofuels are still more expensive, but to

[182] SWD (2020) 176 final;
Prussi et al., 2020, JEC Well-To-Wheels report v5, https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/jec-well-wheels-report-v5
[183] IEA Bioenergy, 2020, Advanced Biofuels – Potential for Cost Reduction, https://www.ieabioenergy.com/wp-content/uploads/2020/02/T41_CostReductionBiofuels-11_02_19-final.pdf
[184] SWD(2020) 176 final, table 11
[185] The blending ratio for gasoline is calculated as the share of 1st and 2nd generation ethanol (incl. fungible gasoline) out of the blended gasoline demand. Synthetic gasoline derived through Power-to-X processes is not included in the share.

a lesser degree (as the relative cost difference is smaller). Furthermore, the MIX55 scenario assumes that the share of advanced bioethanol fuels will increase substantially from 2020 to 2030. The production cost of which is projected to be 35% more expensive than ethanol.

The picture on the costs for diesel is however different. The production costs increase by 2%. The blending ratio of diesel increases from 8% in 2020 to 10% in 2030, which increases the production costs.[186] Even with a carbon price for fossil fuels, the production cost of biodiesel and HVO are still higher in 2030. The biofuel mix assumes that all palm oil is derived from an industrial processing waste feedstock (i.e. POME) listed in RED II Annex IX-A in 2030. 2nd generation biofuels are therefore included in the cost calculation. In contrast to the case of gasoline however, the production cost for 1st generation and 2nd generation is assumed to be the same because the IEA study on the production cost does not make such a distinction.

It is important to underline that the resulting production costs are both attributable to FQD Art.7A and RED, as both drive the uptake of biofuels. It is further relevant to consider that the main substantive cost has already been incurred through the initial introduction of FQD Art.7A and RED, which incentivised fuel suppliers to blend fuels in the first place. The evaluation of FQD Art7A (Section 4) has identified that the costs for fuel increased to about 6% compared to a baseline with no fuel blend. The study's survey responses further indicate a range of 3% to 5%.

The above findings lead to the preliminary conclusion that the substantive cost per litre has little significance, particularly in light of the typically inelastic demand for fuel, which enables fuel suppliers to pass these costs directly on to the consumer.

Impacts of a discontinued obligation - (Option 2)

If the GHG reduction obligation is discontinued, the RED will remain as the main driver behind the blending of fuels. In the absence of a GHG intensity reduction target, fuel suppliers will still achieve life cycle GHG reductions. Article 29 of the RED II sets a minimum GHG reduction threshold of 65% for newly established biofuel production facilities from 2021 onwards.[187] Combined with the RED II caps on food-based and Annex IX-B feedstocks, fuel suppliers will be incentivised to supply more advanced and more costly biofuels. Finally, as also projected in the MIX55 scenario, road transport will become progressively electrified. The underlying calculations carried out for this study on the GHG intensity of road transport, anticipate a GHG savings for electric road transport of 68% by 2030 (and up to 93% by 2050).

The interviews among stakeholders indicate it as likely that for example Germany and Sweden will continue with a GHG intensity reduction target in the absence of Art.7A. At least two Member States can therefore be expected to continue national initiatives – further driving the take up of more advanced biofuels.

The baseline year of 2020 corresponds to the compliance deadline of Art.7A and the evaluation of FQD Art7A (Section 4) do not conclude that there is a significant risk that the majority of Member States will not achieve their 2020 targets. Option 2 will therefore have a similar impact on the production costs as the baseline.

Impacts of a strengthened obligation - (Option 3)

An increased GHG reduction obligation can provide additional incentives for fuel suppliers to purchase biofuels with high GHG reductions. Analogue to the illustration in Table 28 above, the impact of a strengthened obligation is presented. As also elaborated in the options description above in section 4, option 3 assumes a more substantial increase in the share of advanced bioethanol and biodiesel (i.e. Annex IX-A feedstocks). Please see Table 12 and Table 13 for the specific feedstock distribution of respectively bioethanol and biodiesel.

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[186] The blending ratio for diesel is calculated as the share of biodiesel out of the blended diesel demand. Synthetic diesel through Power-to-X processes is not included in the share.
[187] Directive (EU) 2018/2001

The table shows that the increase in advanced bioethanol leads to only a marginal increase in the cost of gasoline, which can be traced back to the small share of advanced bioethanol in the blended gasoline production. There is further no change projected for the substantive cost of diesel production, which can be traced back to the fact that the same production cost is assumed for POME biodiesel.

Table 38 Estimated production cost of fuel blends in 2020 and 2030, assuming a doubled consumption of bioethanol, based on a medium estimate of production costs, in EUR/litre and percentage changes in parenthesis

Fuel	Carbon price	2020	2030	Change	Change, rel. to Option 1
Gasoline	Yes	0.362	0.490	0.129 (36%)	0.001 (1%)
	No	0.362	0.399	0.037 (10%)	0.000 (>0%)
Diesel	Yes	0.427	0.540	0.112 (26%)	0.000 (0%)
	No	0.427	0.435	0.008 (2%)	0.000 (0%)

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD – (Option 3A)

The option harmonises the technical parameters for gaseous transport fuels. The description of option 3A highlights that there is no need to develop new technical specifications, as standards for the use of gaseous fuels in transport already exist (EN standards) – these are however not legally binding. Specific fuel suppliers who currently do not follow the existing EN standards would incur costs to follow the standard but information on the extent of this issue is not available.

Impacts of a market-based instrument to trade GHG reduction obligations – (Option 3B)

The market-based instrument will provide additional flexibility for fuel suppliers and therefore potentially reduces the substantive costs. If the price of credits is lower than the costs of reducing intensity for the supplied fuels, fuel suppliers can buy credits and save on the compliance costs.

The important question is how much can be saved and whether the income from selling credits can support and increase the provision of alternative low carbon fuels. As mentioned in the options-description in section 4 above, all low carbon fuels currently eligible for compliance with Art.7A of the FQD are relevant, including RFNBOs (e.g. electricity and hydrogen), gaseous fuels, and advanced biofuels.

As an illustrative example, the saving potential and the effects on provision of electricity charging has been assessed. Electricity is an example, but relevant given that the transition to EV is a key part of the path to achieve the overall GHG reduction objectives.

To assess whether a market-based instrument will provide incentives for more electricity in transport, several indicators are estimated:

- An estimate of the number of credits that the FQD would require, and the amounts of credits generated by electricity charging.
- An estimate of the implicit carbon price based on the production costs of biofuels and their carbon intensity effects.
- Assessment of the value stream to suppliers of electricity as an indicator for the magnitude of the incentive to provide additional charging infrastructure.

The demand for the credits can be assessed by calculating the number of credits required to meet a given reduction target for carbon intensity. As gasoline and diesel comprise the majority of the fuels, the assessment is done for these fuels.

The baseline intensity is 94.1 g CO_2 e /MJ and assuming a target of 11.5% reduction by 2030, the demand can be calculated as illustrated in Table 30. This illustrative estimation is not done for 2050. By then there will be no fossil fuels left and therefore not need for credits. The trading mechanism will therefore only be considered for the period up to 2050.

Table 39 Estimated demand for credits by 2030 with target of 10% CI reduction

Fuel	Target CI g $CO_{2\ e}$ /MJ	CI by fuel gCO_{2e} /MJ	Total fuel demand 2030 in GeJ	Demand for credits in tons CO_{2e}
Gasoline	83.3	93.3	1,977,495	19,817,464
Diesel	83.3	95.1	6,006,132	71,001,486
			Total	**90,818,950**

Source: PRIMES scenario MIX55 and Eionet Report (ETC/CME 2/2020) Greenhouse gas intensities of road transport fuels in the EU in 2018

The supply of credits will mainly come from the use of biofuels and other low carbon energy such as electricity.

Using biofuels in blends is similar to how the obligation works today. The costs of providing biofuels are similar to what is the case under the Option 3.

What is assessed here is whether the market-based instrument would have an additional benefit of providing financing of an increase in the provision of electricity changing infrastructure.

The supply of credits from electricity supplied to electric vehicles could be roughly assessed considering the PRIMES MIX55 scenario for the total electricity provided for road transport. It is about 3.1% of the total energy for road transport. It can be calculated to about 275,000 GJ. The average CI intensity for electricity in 2030 is not known, but the projections under the overall energy and climate policy objectives means a level around 25 g CO_{2e} /MJ compared to the 2015 level of 88 CO_{2e} /MJ[188]. Using the adjustment for powertrain efficiency of electrical vehicles of 0.4, the total generated credits from electricity will be in the order of 20 million tons $CO_{2e.}$

When fuel suppliers use biofuels in blends, their demand for credits are reduced. Over-compliance by using more biofuels and the least carbon intensive biofuels could lead to generation of credits. The choice for fuel suppliers will ultimately be determined by the price of alternative biofuels compared to the price of the credits.

Biofuels are generally more expensive, but the price difference varies as both the oil price (determining the price of fossil fuels) and agricultural commodity prices (determining the price of some biofuels) are subject to large market variations.

It means that the implicit carbon price – the extra costs of reducing the carbon intensity – varies. Using the best estimate of the fuel prices, the implicit carbon price can be calculated. In IEA Bioenergy (2020), a projected range of the prices for biofuels are provided. The low- and high-end projection are respectively in the range of 60 to 80 EUR/MWh – compared to current costs of fossil fuels in the order of 40 EUR/MWh. For the low- and high-end projection, this corresponds respectively to a production cost difference of +20 and +40 EUR/MWh for biofuels. Converted to a cost difference per GJ, the range is respectively about 6 and 11 EUR/GJ.

The costs of reducing the CI of fossil fuels thus vary with this cost difference and how much reduction a given biofuel can provide. This is illustrated in Table 40 below. For the three types of biofuels investigated, the costs per mitigated ton of carbon are presented. Considering the

[188] See https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_1&format=PDF and https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment

difference in carbon intensity, the resulting implicit cost per mitigated ton of carbon is between 70 and 160 EUR per tons CO_{2e}.

Table 40 Estimated implicit carbon prices for different biofuels

Bio-fuel	CI g CO_2 e/MJ	CI difference g CO_2 e/MJ	IEA Biofuel price projection	Cost difference to fossil fuel EUR/GJ	Cost per mitigated ton of carbon EUR/tons CO_2 e
Bioethanol	24.3	69.0	High	11	161
			Low	6	80
Biodiesel	26.4	68.7	High	11	162
			Low	6	81
HVO	15.6	79.5	High	11	140
			Low	6	70

Source: IEA Bioenergy, 2020, Advanced Biofuels – Potential for Cost Reduction and Eionet Report - ETC/CME 2/2020 Greenhouse gas intensities of road transport fuels in the EU in 2018

The above calculation does not include any potential carbon price on fossil fuels. If there will be an additional carbon price on fossil fuels, the cost difference to biofuels will be reduced. The cost per mitigated ton of carbon would therefore be lower.

The market price of GHG credits will be below the above cost per mitigated ton of carbon as fuel suppliers will only purchase credits to the extent these provide an economic advantage over the use of more biofuels to ensure compliance. The cost per mitigated ton of carbon prices can therefore be seen as the maximum price for the traded credits. This can be used to estimate the maximum possible revenue for the suppliers of electric charging.

The level of income from selling GHG credits would determine the interest of providers of electrical charging for road vehicles of entering the market mechanism and supply credits.

By estimating the cost per mitigated ton of carbon and the carbon savings provided by supplied electricity, the revenue to a charging station can be estimated. The larger the share of the costs of establishing a charging station that could be covered by the revenue from sales of credits, the more additional charging would be provided.

Based on the projected CI of electricity and the adjustment for powertrain efficiency, one MJ of electricity provided would save 74.7 g CO_2 e. With the estimated cost per mitigated ton of carbon of between 70 and 160 EUR/tons CO_{2e}, the maximum revenue from GHG credits can be estimated and compared to the costs of providing a charging point. This can illustrate the size of the incentive and whether it is likely to increase the provision of electrical changing points.

The key assumptions and calculations are included in Table 41. This is an example illustrating the level of income.

Table 41 Revenue for electricity charging point provider and coverage of costs

Element	**Value**	**Unit**
Charging station capacity	100	kWh
Investment costs	100,000	EUR
Lifetime	10	Years
Annual costs	12,329	EUR
Maximum annual charging	84000	kWh
Utilisation	50	%

Element	Value	Unit
Annual charging	42000	kWh
Breakeven price	28.1	EUR per MWh
CO_2 saved per kWh	20.75	Kg CO_2 e/ MWh
'High-end' Biofuel price projection		
Maximum price of GHG credit	0.160	EUR/ kg CO_2 e
Revenue from GHG credits	3.3	EUR/MWh
Revenue in % of breakeven price	12	%
'Low-end' Biofuel price projection		
Maximum price of GHG credit	0.070	EUR/ kg CO_2 e
Revenue from GHG credits	1.5	EUR/MWh
Revenue in % of breakeven price	5	%

As elaborated above, the maximum GHG credit price is equal to the estimated costs of complying with biofuels. It means that the maximum revenue that suppliers of electrical energy for road transport could receive from selling credits amounts to 5-10% of the breakeven revenue for establishing a charging infrastructure.

The above is an illustrative example. If the investment costs of a charging station would be lower, then the contribution from credits would cover a larger share of the investment costs. But even with investment costs only half the size, the contribution would still only be a maximum of 10-20%.

Therefore, it is not expected that the income from GHG credits will increase the provision of charging infrastructure.

For provision of other low carbon fuels for example gaseous biofuels or hydrogen, the sales of GHG credits could provide financing of the infrastructure. For gaseous fuel, there are already charging stations so here a lower contribution might have an impact and support the uptake of such fuels.

Based on the above indicators, the impact on the substantive costs for the fuel suppliers can be assessed. How much will fuel suppliers save with the market mechanism compared to a situation without a trading mechanism?

The assessment of the substantive costs for Option 3 on the strengthened obligation option has indicated relatively small additional costs. This is mainly because of other legislation such as RED II, which require use of biofuels and this no independent impact from FQD Art.7A.

If the amount of the credits generated by suppliers of electricity comprises 25% of the needed credits, fuel suppliers to use credits and avoid the 25% most expensive fuels. Assuming furthermore that the most expensive biofuels cost twice the price of the cheaper biofuels[189], and that the credit price would be similar to less expensive biofuel, the savings on the total costs could be in the order of 20%.

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[189] See for example IEA Bioenergy 2020 Advanced Biofuels – Potential for Cost Reduction

Given that the incentive for electricity providers is relatively small, there might be a lower level of credits generated if only few electricity suppliers enter the market. In that case, the costs savings would be smaller.

The assessment of the costs of the strengthened obligation indicates a price difference for gasoline of 0.399-0.398 Euro between the costs at the strengthened obligation in 2030 and the baseline.

Using these differences and the total volume of gasoline and diesel, the total substantive costs would be as illustrated below.

Table 42 Estimated total production cost of fuel blends in 2030, based on a medium estimate of production costs, in EUR/litre

Fuel	Costs in baseline FQD	Cost with strengthened FQD	Diff	Total consumption Mio litre	Total costs Mio EUR
Gasoline	0.398	0.399	0.001	61,975	75
Diesel	0.435	0.435	0.000	163,792	-

With a cost saving in the order of 20%, the substantive costs would be about 15 million EUR lower than the estimate for Option 3 of about 75 million.

There could also be an impact of a market mechanism on the distribution of costs. As the prices of all fuels vary, there might be a saving from having the alternative of purchasing credits when the prices of biofuels are very high.

There are limited data on the savings in existing market trading systems. It will require an analysis of what would have happened without the trading system. Such assessments have generally not been carried out apart from a few research studies as outlined below.

A research article by Rubin, J and Leiby, P N (2013)[190] has for example simulated the impacts of having trading versus no trading. This research indicates that savings can vary significantly depending on the price of biofuels, which is determined by demand and supply. Rubin and Leiby (2013) indicate that the savings could be from almost nothing to more 90% compared to non-trading.

The impact assessment of the Canadian CFS proposal does not estimate the benefit as compared to a non-trading regulation.

Impacts of directly regulating fuel suppliers with an EU Regulation – (Option 3C

Compared to the baseline, the option will not lead to additional impacts on the substantive costs, as the option does not alter the final GHG reduction target.

Table 43 Summary of impact "substantive cost for fuel suppliers"

Option	Impact
Continued obligation (baseline)	Production cost increase between 2020 and 2030: Gasoline: 0.037 (10%) EUR/litre Diesel: 0.008 (2%) EUR/litre
Discontinued obligation	(o) The costs will be comparable to those of the baseline.
Strengthened obligation	(o) Compared to baseline, the cost increase is negligible. Gasoline: 0.037 (10%) EUR/litre Diesel: 0.008 (2%) EUR/litre

[190] Rubin, J and Leiby, P N (2013) Tradable credits system design and cost savings for a national low carbon fuel standard for road transport

Expanded FQD scope to gaseous fuels	(-) Some substantive costs can be expected, as some fuel suppliers will have to adjust. Given however that standards already exist, the substantive costs are assessed to be limited.
Market-based instrument	(+) A market-based instrument might reduce the substantive costs. Savings could be up to level of 20%.
Direct regulation of fuel suppliers	(o) Same impact as under baseline

Fragmentation of EU fuel markets

As described in the problem definition above, the GHG reduction obligation in Art.7A has led to a fragmentation of the EU fuel market, which has contributed to limiting the availability of low and zero carbon fuels. There is further a fragmentation in terms of the available biofuel blends that are supplied across Member States under national mandates to suppliers. These blends are not the same in the MS, thus theoretically disturbing trade even among neighbouring countries.

However, this study has not succeeded in quantifying the extent to which these types of fragmentation hinder Member States or fuel suppliers in implementing Art.7A.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

The evaluation of FQD Art7A (Section 4) has concluded that the non-harmonious transposition, including enforcement of the GHG reduction obligation has contributed to the market fragmentation across Member States. The baseline scenario will therefore not lead to any changes of the fragmentation up until the point that Member States achieve their targets.

The fragmentation can be expected to further increase even after Member States achieved the target, as at least two national initiatives are known to be underway: As highlighted in the problem definition above, Germany and Sweden, have already determined GHG reduction quotas towards 2030, corresponding to a reduction of respectively 22% and 40%.[191] One stakeholder further verified during the interviews that Germany will continue pursuing a GHG reduction obligation past the 2020 target of Art.7A.

Both targets are substantially higher than the baseline projections of the calculated GHG intensity reduction through the MIX55 scenario of 2030CTP by 2030 (see the calculations carried out for this study above, 11.5%). Both countries moreover accounted for 26% of the biofuel consumption and had some of the EU's lowest GHG intensity of biofuels in 2018. It can therefore be concluded that the fragmentation will continue, and even further increase due to national initiatives of different ambition.

This is somewhat consistent with stakeholders' views during the second workshop, in which option 1 was ranked fifth (out of the six options) in terms of its effectiveness in eliminating the alternative fuel market fragmentation. [192]

Impacts of a discontinued obligation - (Option 2)

A removal of the GHG obligation releases Member States from their duty of ensuring a reduction in the GHG intensity of transport fuels. Therefore, it can be expected that Member States will focus efforts on implementing the RED targets and withdrawing the compliance requirements introduced by Art.7A.

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[191] ICCT (2018), Advanced Biofuel Policies in Selected EU Member States: 2018 update; https://www.cleanenergywire.org/news/german-ministries-agree-emission-reduction-quota-transport-fuels

[192] During the second workshop, stakeholders were asked to rank the different policy options. The raking was on a six-point scale, with 1 = the best and 6= the worst. The following average scores were given: Option 1, 3.3; Option 2, 4.2; Option 3, 2.6; Option 3A, 2.7; Option 3B, 2.7; Option 3C, 2.4.

As the assessment of the baseline above shows, even if the GHG reduction obligation is withdrawn, the market fragmentation might persist. The drivers behind this fragmentation might be eliminated, but for sure not disappear, due to the approach that will be followed in national RED II transpositions.

Some of the implementation options of RED II that could be selected by MS and might create conditions of fragmentation are, indicatively:

- use of national market-based instruments for GHG credit transactions among suppliers
- national decisions of mandated fuel blends for all suppliers as national measures
- selection of multiplier different than the proposed ones in RED II
- various cases of distinguishing fuel suppliers and energy carriers.

Therefore, under Option 2, the fact that in view of the absence of Art 7A there will not be different blending mandates across the EU (which has been proved to be the main cause of market fragmentation under Option 1), might result in a positive effect. However, as mentioned, the extend of the positive effects are depended on the degree of harmonization of RED II implementation in the MS.

Stakeholders expressed similar views during the second stakeholder workshop: Stakeholders ranked option 2 as worst (out of six policy options) in terms of the effectiveness of eliminating the alternative fuel market fragmentation.

Impacts of a strengthened obligation - (Option 3)

Under a strengthened obligation, a number of market policies could significantly facilitate the development, production and trade of low carbon fuels and national initiatives may have to follow a strict timeline of policies supporting elimination of market fragmentation, strengthening of financing conditions, enhancing innovation and technology development activities, etc., as mentioned above.

However, the main fragmentation driver of non-harmonized FQD and RED transpositions among MS will not be affected and most probably similar or less significant fragmentation issues will be experienced, as far as implementation of FQD is strengthened.

Stakeholders ranked Option 3 as the second-best option. The resulting score (2.6) is however still close to the medium ranking value (3.0) This points to a similar view by stakeholders that a strengthened obligation may lead to similar or less significant fragmentation.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD – (Option 3A)

As described in the policy options above, relevant gaseous fuels in the transport sector (incl. road transport, aviation and maritime) are expected to increase from 3 Mtoe in 2015 to 11 Mtoe in 2030 (almost a four-fold increase). Based on the MIX55 projections, this growth can be particularly attributed to a very high increase of natural gas and high increase of biomethane. The 2030 CTP also reports that gaseous fuels are expected to remain an important contributor to total energy needs.[193] The role of gaseous fuels will therefore further increase in the future, which makes their harmonious consideration in the FQD increasingly relevant. The experience of successful and considerable low carbon gaseous fuels implementation in MS indicates that there is a need for a regulatory framework providing conditions of natural gas grid use and collective effort from farmers and other feedstock producers (Italy and the Biogas Done Right scheme constitutes a Best Practice example). In case the regulatory frameworks of MS comply with each other, then market fragmentation could be alleviated for the case of gaseous fuels. However, this fact cannot change market fragmentation conditions in transport fuels in general.

Therefore, the impacts do not change significantly on the aggregate level as low carbon gaseous fuels are only supplied in comparatively small amounts till 2030.

Stakeholders ranked option 3A as marginally worse than option 3 above (third out of six). The scoring of 2.7 indicates that the views among stakeholders were diverse.

[193] Section 9.4.2.4 of Annex 2 of the 2030 Climate Target Plan

Impacts of a market-based system to trade GHG reduction obligations – (Option 3B)

The specification of the market-based system in this study entails that fuel suppliers are directly regulated with a harmonious penalty system. Option 3B will therefore contribute to reducing the market fragmentation, by establishing uniform market conditions for low carbon fuels.

Stakeholders ranked option 3B as marginally worse than option 3 above (fourth out of six).

Impacts of directly regulating fuel suppliers with an EU Regulation – (Option 3C)

Option 3C strengthens the GHG intensity reduction and enforces uniform implementation across the EU territory. It thus removes the main identified cause for fuel market fragmentation. MS with national initiatives will therefore also need to align their transposition policies accordingly, and in some cases, motivations for higher ambition targets at national level to co-exist with EU targets might be launched. This evolution might be combined with exploitation of additional production capacity in EU regions with low cost of low carbon fuels and with smoothening the differences of low carbon fuel prices in the EU.

Stakeholders ranked this option as best in eliminating the alternative fuel market fragmentation. Albeit being ranked best, the overall score of 2.4 indicates that a significant share of stakeholders, even within the respective stakeholder categories, did not rank this option as best.

The impact is judged positive since it relaxes the main reason of market fragmentation.

Table 44 Summary of impact "Fragmentation of EU fuel markets"

Option	Impact
Continued obligation (baseline)	The fragmentation will continue and further increase due to foreseen national initiatives in major biofuel markets (i.e. Germany and Sweden).
Discontinued obligation	(o/+) Compared to the baseline, the market fragmentation will be probably reduced but continue existing, because the relevant policy measures will continue due to RED II implementation but be not based on FQD/ 7A.
Strengthened obligation	(o/+) Compared to the baseline, the market fragmentation will reduce due to a more harmonised demand across Member States. However, the main driver of non-harmonized transposition will persist.
Expanded FQD scope to gaseous fuels	(o/+) The gaseous fuel market, which is projected to grow significantly, might be more harmonised.
Market-based system	(+) The GHG reduction obligation will be eliminated as a driver behind low carbon fuel market fragmentation.
Direct regulation of fuel suppliers	(+) The main driver of market fragmentation will be tackled, and the increased ambitions of a number of MS will be incorporated in a way of uniform implementation and of harmonizing the low carbon price differences within the EU.

Increase in innovation and cost-savings of low carbon fuels

The wider deployment of innovative low carbon fuels is a prerequisite for the reduction of the transport sector GHG emissions. Such fuels require extensive research and innovation for their development, and at present they tend to be significantly more expensive than the fossil fuels they aim to replace, hindering therefore their way to be competitive fuels on the market.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The evolution of fuel mix as projected in the 2030 CTP implies the development of the technologies that can deliver the specified therein fuels, and in particular advanced biofuels and other low carbon fuels. The latest complete information on the costs of such fuels for transport is provided by the IEA "Advanced Biofuels – Potential for Cost Reduction" report published in November 2020.[194]

In particular, low carbon fuels[195] either based on crop feedstocks or based on waste and residues have been considered therein. Current costs lie in the range of 65 to 158 EUR/MWh (17-44 EUR/GJ) for production based on crop feedstocks and 48 to 104 EUR/MWh (13-29 EUR/GJ) for waste-based production, illustrating the cost advantages of using waste feedstocks. This compares with a range of fossil fuel prices of 30-50 EUR/MWh (8–14 EUR/GJ) in 2020. Comparison of the estimates of the current costs of production of the range of low carbon fuels with the prices of the fossil fuels that they aim to replace, indicates a significant cost gap of between 12 and 128 EUR/MWh (3-36 EUR/GJ).

However, it has been recognized in the analysis of the IEA report that if a number of additional commercial plants are built, capital and operating costs could be significantly reduced, while scope for feedstock cost reduction is judged to be more limited. Overall production costs could be reduced by between 5-27%. The report analyses the factors that determine the potential for cost reduction of the respective technologies, e.g. learning rate increase due to increased cumulative production, improved financing terms that can support investment realization, carbon price needed to close the price gap from fossils, etc. Large scale deployment of the technologies, in line with the patterns needed to meet the ambitions for advanced biofuels (RED II Annex IX Part A) could lead to additional significant cost reductions in capital and operating costs. Such reductions could be significant given largescale roll-out of the technologies and potentially reach up to -50% in the most optimistic cases.

While the costs of low carbon fuels are an important factor, a broader range of issues also need to be considered like the potential availability of feedstocks and the life cycle GHG emissions and other sustainability criteria associated with particular routes. Large scale deployment will depend on continuing policy support. First, industry will need support during the risky and costly demonstration and early commercialisation phases of the technologies, so as to bridge the "valley of death". Continuing strong support will also be needed to offset the differences between low carbon fuel and fossil fuel prices, i.e. by internalising external costs associated with GHG emissions related to fossil fuel use.

Impacts of a discontinued obligation (Option 2)

Discontinuing the FQD 7A, the main driving force of the deployment of road transport fuels would be RED II and its potential revision (that is likely to increase the overall ambition for the share of RES in transport), as well as the other EU instruments (such as EU ETS, CO_2 standards, Effort Sharing Regulation, etc.) including components that determine the cost reduction potential that is required in order to be able to clearly depict the respective impacts.

In principle, an increase of the overall share of RES in transport would lead to additional demand for (the eligible within RED II) low carbon fuels. This will then be a signal for also scaling-up the existing production via e.g. project optimization or plants of larger scale, but also the development of new projects to contribute to additional volumes needed.

However, the set targets of RED II, especially under the concept of multiple counting, incentivize certain feedstocks and relevant technologies that do not explicitly pursue the substantial best performing solutions for GHG emissions reduction on a life-cycle basis, as in the FQD/7A.

Further, in case the expected scale-up of production of low carbon fuels currently available in the market, there will be room for other, novel technologies to come into the market and contribute to the production of fuels towards meeting the demand in line with the (updated) RED II target. The

[194] https://www.ieabioenergy.com/blog/publications/new-publication-advanced-biofuels-potential-for-cost-reduction/
[195] The following pathways were considered: Synthetic fuels via gasification, Pyrolysis and upgrading, HTL, Lignin to fuels, HVO and UCOME, Lignocellulosic ethanol via fermentation, Lignocellulosic ethanol by co-fermentation of starch, Fermentation and sugars to hydrocarbons, Alcohols to hydrocarbons, Biogas and biomethane, Other aviation fuels, Power to X

intensity of research and innovation activity will be positively affected; however, as mentioned above, the selection of optimal GHG reduction solutions under economic criteria is not ensured.

Impacts of a strengthened obligation (Option 3)

A strengthened FQD Art. 7A approach would generate the implementation of a series of policies that will promote transport decarbonization and accelerate the uptake of additional fuels with low carbon intensity. Such policies will require the additional support of R&D and innovation resulting to more competitive solutions and cost savings.

The aforementioned IEA report on the cost reduction potential estimates that an intensive effort to reduce GHG emissions will demand additional innovation activity which is expected to impact positively the (reduction) of the costs of low carbon fuels.

Such strengthening policies will include measures directly addressing mainly the low carbon fuels producers to allow for (a) more favourable financing framework at investment level (e.g. lower financing rate and/or longer financing term/period), (b) capitalization of the experiences gained and therefore CAPEX and OPEX reductions in line with a learning curve, (c) support during early commercialization and demonstration stages of novel low carbon fuel technologies.

In addition, policies favouring cost-efficient and high GHG emission reduction pathways might be considered. This can be particularly beneficial to the utilization of RCF, which also constitute a feedstock category with a large untapped so far potential and reasonable needs for innovation effort, as it is mentioned in the findings of the survey conducted within the IEA cost reduction potential report.

In a frame where a wider deployment of low carbon fuels is needed (so as to support the implementation of a strengthened FQD) policies to support the production of lower cost advanced biofuels from wastes, as well as policies that allow the integration of advanced biofuel production with existing biofuels processing plants, are needed.

Finally, it is noted that tax policies supporting the wider scale use of low carbon fuels from the side of consumer will be also needed (e.g. availability of price competitive transport fuels of higher blend ratios of biocomponents that could be utilized by specifically developed vehicles' engines).

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD – (Option 3A)

The impacts do not change significantly on the aggregate level as the main individual fuels that will drive the expansion of gaseous fuels volumes is biomethane, and production is based on a mature technology of reasonable production cost. Any innovation activity for new or upgraded gaseous fuels production pathways is not easily distinguished from the broader innovation effort for low carbon fuels. Thus, the expected specific innovation impact due to incorporation of gaseous fuels is rather neutral.

Impacts of a market-based system to trade GHG reduction obligations (Option 3B)

Existence of a marketplace anticipates that GHG credits might also provide an additional revenue stream. This can be crucial for the financial situation of small innovative fuel suppliers/producers who supply low and zero carbon fuels, as these latter increase the frequency of cash flows from GHG credits. Although a market-based system is not directly related to innovation activity development, it sounds reasonable that implementation of Option 3B will help in the development of a friendlier investment environment that can potentially enhance innovation activity and the effort to reduce production cost of biofuels, since. Overall the impact is neutral to positive.

Impacts of directly regulating fuel suppliers with an EU Regulation (Option 3C)

An EU regulation will increase the level-playing field in Europe, and although a direct impact on innovation activities for cost saving could not be justified, indirect effects stemming from increase of competition will make the impact of Option 3C neutral to positive.

Table 45 Summary of impact "Increase in innovation"

Option	Impact
Continued obligation (baseline)	Based on the current status of the expected evolution of costs of biomass-based biofuels and waste-based low carbon fuels, there is a significant cost gap of between 12 and 128 EUR/MWh (3-36 EUR/GJ) hindering thus the market uptake of such fuels. Innovation activity will increase under baseline scenario.
Discontinued obligation	(o) The specific life-cycle approach of the FQD and its relevant targets, are not generally linked with additional effort in innovation of low carbon fuels.
Strengthened obligation	(+) The implementation of a series of policies that will create an overall positive framework for the deployment of low carbon fuel can also positively contribute to the realization of innovation increase and production cost reduction.
Expanded FQD scope to gaseous fuels	(o) The impacts do not change on the aggregate level as gaseous fuels are only supplied in insignificant amounts. So, the specific impact due to incorporation of gaseous fuels is neutral.
Market-based instrument	(o/+) A credit-based trading system is not directly related to an enhance of the innovation activity but can support in the development of the appropriate market conditions that will eventually allow for a reduction of production costs of low carbon fuels.
Direct regulation of fuel suppliers	(o) A regulation will increase the level-playing field in Europe, however, the impact on innovation activities for cost saving is not justified.

Competition between fuel suppliers on fuel price and feedstock supply and availability

Considering the current policy framework, feedstock supply and its availability can be limited due to relevant restrictions in FQD and RED II on categories of eligible feedstock and sustainability criteria. This situation will directly affect the available volumes of some low carbon fuels (mainly the capped categories of waste-based biofuels which are included in Annex IX part B of RED II, as well as the targeted volumes of advanced biofuels of Annex IX part A). Suppliers might compete to each other to secure fuel volumes of RED II eligible biofuels, which will be produced by scarce feedstock. This trend will be more evident in case the national transposition of EU directives is founded on suppliers' responsibility (i.e. RED II targets are imposed to fuel suppliers as obligated parties) to meet certain quotas for various categories of low carbon fuels (e.g. advanced biofuels, RCF, RFNBO) and other mandatory requirements for specific transport demand sectors (e.g. sub-sectoral mandates for maritime, aviation).

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The achievement of the FQD targets under Option 1 is influenced by the RED II specifications for biofuels contributing to the RED II targets because the same low carbon fuels will be used, in principle, for accomplishing both obligations. The FQD approach focuses on the compliance with a carbon intensity reduction target; whereas a RED II approach is based on the obligation to comply with a volume-based target of renewable energy (minimising GHG intensity of volumes provided is secondary). This difference of approaches lies under the same objective that is the reduction of GHG emissions of transport and at the end it is achieved by the same physical means and measures. For this reason, there is no difference between solutions that are based on one of the two rationales although inducing different economic behaviours.

The provisions of FQD Art. 7A might contribute to relaxing low carbon fuel market uptake obstacles (low carbon fuel blending standards, high prices of low carbon fuels, feedstocks, etc.) that are subject to RED II provisions. Thus, supply competition might increase at EU level and contribute to biofuel price reductions in regions of high price.

The potential expansion of mandatory use of low carbon fuels to other transport sectors (maritime, aviation) might increase fuel supply competition, especially under conditions of restricted feedstock availability and of alternative use of the same feedstock for new uses, e.g. HEFA for aviation instead of HVO as biodiesel. In this case the FQD targets need the contribution of additional streams of low carbon fuels that are not evident at present; thus, competition on fuel price is expected to increase in case increased demand could be not met by existing production capacity and additional feedstocks.

Impacts of a discontinued obligation (Option 2)

Double regulation (FQD, RED) is most likely inefficient, although in earlier sections of this report, it has been stated that disentangling costs of implementation between the two Directives was not feasible and that no additional costs would have been incurred by national authorities or fuel suppliers due to the implementation of the FQD Art 7A.

Without having the life cycle and fuel market considerations of the FQD, driving the competition for feedstock might be simplified and made clearer, and therefore it is expected that competition among fuel suppliers might attract involvement of more market players and suppliers who will contribute to lowering of fuel prices.

Impacts of a strengthened obligation (Option 3)

Policies on opening of low carbon fuel market, entrance of new low carbon fuels and provisions with stricter implementation of GHG emission savings are expected in Option 3, thus increasing the competition, impacting fuel prices and the interest of fuel suppliers for safeguarding the necessary and cheaper volumes of low carbon fuels. Theoretically, this development could create appropriate conditions for competition increase and a tendency for lower prices and faster entrance of low carbon fuels in the market. Theoretically, this development could create appropriate conditions for competition increase and a tendency for lower prices and faster entrance of low carbon fuels in the market.

There is need for new supply chains for largely untapped potential of waste/residue-based fuels. In case this development is not activated, then an increased competition under a constrained feedstock situation will conclude to the opposite result, i.e. higher prices, and slower entrance of low carbon fuels due to scarce feedstock supply. In that case, the CI reduction target will either be more difficult to meet, and/or more aggressive implementation of complementary policies (e.g. electrification in transport) will be needed (to achieve the target).

Therefore, strengthened FQD policies supporting in parallel the increase of required available feedstock are necessary. These policies should consider the RED II provisions and focus on facilitating stable market developments for necessary feedstock and new pathways of supply of low carbon fuels. Indicative policies that would foster feedstock availability increase may include[196]:

- Uniform definition and classification of degraded land in relevant regulations
- Financial support for flagship & demonstration initiatives with industrial lead focusing on options for domestic biomass supply
- Regional infrastructure for biomass supply hubs to deal with logistics related to waste and residue collection, as well as large scale energy crop production

Market stability and continuity will reasonably attract involvement of more low carbon fuel suppliers.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD (Option 3A)

Biomethane is the fuel that drives the development of gaseous biofuels volumes until 2030. Fuel suppliers who provide natural gas, will incur additional costs and be able to justify GHG reduction. The production of green hydrogen and the exploitation of feedstock convenient for biomethane production will relax the competition for eligible feedstock under RED II and probably relax the competition of suppliers to ensure compliance to GHG targets. So, the impact will be positive.

Impacts of a market-based system to trade GHG reduction obligations (Option 3B)

A credit-based trading system will mitigate the immediate negative impacts on competitiveness. The reason being that those fuel suppliers who have high costs of compliance, incur lower costs from purchasing credits. This results to optimization of low carbon fuels use and potential development of more efficient pathways. The impact is positive.

Impacts of directly regulating fuel suppliers with an EU Regulation (Option 3C)

An EU regulation will increase the level-playing field in Europe because the compliance requirements as well as level of enforcement is unified on the EU market. This situation might increase competitiveness among suppliers, because opportunities of all suppliers to operate in a bigger market will optimize their operational costs. However, competition at feedstock supply level is not expected to change. So, the impact will be neutral to positive.

Table 46 Summary of impact "Competition between fuel suppliers"

Option	Impact
Continued obligation (baseline)	The consideration of the FQD targets is not expected to create additional impact to prices given the implementation of RED II, which remains the driving force and places constraints on production of low carbon transport fuels supply too.
Discontinued obligation	(+, i.e. increase of competition) The competition for feedstock might be simplified and made clearer, as the main reference for biofuels derived from eligible feedstocks will be Annex IX of RED II and the other provisions for RFNBO and recycled fuels. Such development might contribute to increase of competition and lowering of fuel prices
Strengthened obligation	(+, i.e. increase of competition) Fuel market opening policies, entrance of new low carbon fuels and stricter implementation of GHG emission savings provisions are expected, thus increasing the competition of fuel prices and the interest of fuel suppliers for safeguarding the necessary and cheaper volumes of low carbon fuels. This result will be opposite in case of prevailing conditions of constrained feedstock (RED II).
Expanded FQD scope to gaseous fuels	(+ i.e. increase of competition) The exploitation of feedstock convenient for biomethane production will relax the competition for eligible feedstock under RED II and probably relax the competition of suppliers to ensure compliance to GHG targets.

[196] C. Panoutsou et al., Advanced biofuels to decarbonise European transport by 2030: Markets, challenges, and policies that impact their successful market uptake, Energy Strategy Reviews 34 (2021) 100633

Option	Impact
Market-based instrument	(+, i.e. increase of competition) Fuel suppliers who have high costs of compliance, incur lower costs from purchasing credits. This results to optimization of low carbon fuels use and reasonable development of more efficient pathways.
Direct regulation of fuel suppliers	(o/+) An EU regulation will increase the level-playing field in Europe, because the compliance requirements as well as level of enforcement is comprehensive and unified on the EU market. An expanded supply baseline and supply chain opportunities are necessary and should be in parallel pursued to enhance positive effects.

Competitiveness of EU fuel suppliers on the global market

Competitiveness of EU fuel suppliers on the global market depends on transport fuel policies and the climate targets set by the rest of the world. The overall goal of the Green Deal initiative is to promote and protect effective competition in markets, delivering efficient outcomes to the benefit of consumers. Competitive markets encourage firms to produce at the lowest cost, to invest efficiently and to innovate and adopt more low carbon emissions technologies. Such competitive pressure is a powerful incentive to use our planet’s scarce resources efficiently, and it complements environmental and climate policies and regulation aimed at internalising environmental costs. In order to estimate the impact of the European Green Deal’s climate ambition on the competitiveness of the European economy, it is necessary to evaluate what the impacts would be if some of international partners do not implement ambitious climate plans. Fuel suppliers can be impacted if the implemented policies affect their competitiveness (and therefore, their place in the international market).

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline - (Option 1)

The assessment of EU suppliers’ competitiveness on the EU and the global market requires specific modelling exercises that have not been carried out at present. It is worth considering that different macro-economic models were utilized in the frame in of the 2030 CTP, each one with different level of detail, and therefore conclusions can be specific to the inputs of each model. Overall, the consistent conclusion that emerges from the macro-economic analyses of the 2030 CTP is that the reallocation of resources necessary for the transition can be seen as a modest contributor to GDP growth, or at worst a limited impediment (depending on the specific model analysis).

Furthermore, it is interesting to look at the sectoral composition of investment, i.e. investment in all fossil fuels is expected to drop, except for gas, which is assumed to play a key role in the first decade of energy transition. The reallocation of resources necessary for the transition will lead to market mobilization and Europe is expected to benefit from its prime-mover advantages.

Moreover, the modelling tools used within the 2030 CTP for macro-economic analysis do not provide direct insights on specific outcomes for SMEs. However, the macroeconomic analysis indicates a favourable outlook for such companies: a European economy that becomes more capital and technology intensive and increasingly based on the development of innovative products and solutions. Conversely, no trend was identified that would harm specifically SMEs, considering that they are typically not particular active in carbon intensive sectors.

Based on the above and given that both FQD and RED II will be implemented, it is reasonable to conclude that the operational structure of fuel suppliers will change and considering the emphasis placed by the Green Deal initiative on market development based on competition, the EU suppliers, either SMEs or big companies, will adapt to the new regime promoting the shift to low carbon fuels. Since this change, as a general implementation policy and broad extent, takes place quite early in Europe compared to other parts of the world, we could estimate that the involved suppliers will become more flexible and competitive to meet the low carbon needs of the fuels markets globally.

Impacts of a discontinued obligation - (Option 2)

In the case of Option 2 the climate targets will be achieved through RED II. The FQD concept of achieving results and formulating measures under the terms of carbon intensity and life cycle might fade but the suppliers will undertake responsibilities of similar scope. Without the FDQ in place, it is estimated that there will not be significant aspects determining the competitiveness of EU fuel suppliers.

RED II is the driving force and, without the parallel FQD implementation approach, simplification and clarification, is always beneficial to unlock investment and achieve market mobilization. A simplified system, avoiding duplication of policies, would favour investments in decarbonization solutions by creating a less complex policy framework.

Overall, the estimation is that the impact to the competitiveness of EU fuel suppliers in the global market will be marginal, compared to Option 1 perspective, in case Option 2 is followed.

Impacts of a strengthened obligation - (Option 3)

The modelling work of the 2030 CTP shows that the type of policies put in place to achieve increased GHG reductions are important factors for the overall impact on GDP growth. Implementation of policies that would support the realization of the required investments to meet the set targets, would influence costs and steer market prices, thus impacting on competitiveness of suppliers.

The assumption that a strengthened FQD implementation would have an impact to the competitiveness of EU fuel suppliers on the global market is a complex issue and needs further analysis focusing on the specific components of the policies considered. It is indicatively mentioned, here, that the exact way of a possible carbon pricing extension to the road transport and maritime sector (as a policy measure to enhance the overall transport decarbonization) will in general lead to an increase in carbon revenues, but the way these revenues will be circulated back to the economy will have a crucial impact on the competitiveness of the EU fuel suppliers. Therefore, achieving more effective low carbon fuel policies allocating significant stakeholders' budget to investment, is expected to positively affect competitiveness at supply level.

This development under strengthened FQD implementation relates to new investments and reorganizations contributing to competitiveness improvement. Thus, it is expected that the competitiveness of EU fuel suppliers on the global market of low carbon fuels will improve, since rigorous and timed obligations must be satisfied at EU level.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD Option 3A

The impacts do not change significantly on the aggregate level as low carbon gaseous fuels are only supplied in comparatively small amounts till 2030. There is no international market of biomethane at present and the international trade of green hydrogen might be developed in the last years of this decade. The impact is considered neutral.

Impacts of a market-based system to trade GHG reduction obligations - Option 3B

A credit-based trading system will rather affect positively the competitiveness of EU suppliers, since they will become more efficient and will surely be more competitive entering the market-based systems at international level. This perspective might become more likely in case such low carbon markets are linked with the relevant EU market and the exchange of any transactions are feasible.

Impacts of directly regulating fuel suppliers with an EU Regulation - Option 3C

An EU regulation will increase the level-playing field in Europe and therefore increase the competitive characteristics of the European suppliers. As mentioned above, the impact is positive as related to international markets and relevant opportunities.

Table 47 Summary of impact "Competitiveness of EU fuel suppliers"

Option	Impact
Continued obligation (baseline)	The implementation of FQD obligations will lead the involved suppliers to become more flexible and competitive to meet the low carbon needs of the fuel markets globally.
Discontinued obligation	(o) The impact to the competitiveness of EU fuel suppliers in the global market will be marginal
Strengthened obligation	(+) Overall, achieving more effective low carbon fuel policies would require a reallocation of expenditure to investment. This is expected to positively affect competitiveness at supply level.
Expanded FQD scope to gaseous fuels	(o) Gaseous fuels are not supplied in significant amounts and there is no international market of low carbon gaseous fuels.
Market-based instrument	(+) The competitiveness of EU suppliers improves, since they will become more efficient and might be more competitive entering the international markets.
Direct regulation of fuel suppliers	(+) As above

Competition between renewable and recycled fuels, incl. initiatives for alternative fuels in aviation and maritime transport modes

FuelEU Maritime and *ReFuelEU* Aviation are the two policy initiatives under elaboration for maritime and aviation fuels respectively. Consideration of recycled fuels (RCF) as a viable option for a cleaner transport fuel mix impose competition between these fuels and the currently more widely available biomass-based and RFNBO (renewable fuels like green hydrogen). It is expected that the decarbonization of these two transport sectors (which have been generally considered as difficult ones to apply electromobility solutions) will strengthen the demand for low carbon transport fuels. Moreover, the potential low carbon fuels market will change, affecting thus supply of low carbon fuels addressed to road transport thus, modifying the availability of eligible feedstocks.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

FuelEU Maritime and *ReFuelEU* Aviation are the two policy initiatives under elaboration for maritime and aviation fuels. At present FQD Art.7a focuses on land transportation modes (aviation is an opt-in). Renewable fuels (biofuels and RFNBO) are mostly regulated by the RED II. RCF that are fuels derived from non-renewable waste streams e.g. fossil waste (plastic, rubber, gaseous wastes etc.) could be promoted through transport targets and support schemes but might not be considered under the overall renewable energy target (MS option in RED II). The incorporation of RCF and RFNBO in FQD Art.7a transportation fuel emission targets is feasible in case GHG emissions are reduced under a lifecycle analysis and in compliance to the performance GHG saving criteria.

RED II has the potential to push or suffocate market development of RFNBO. It is the first regulation to require electricity fuels to meet certain standards when procuring electricity. However, the largest potential for low cost RFNBO is outside of Europe. These regions should be considered by devising regulation that can be verified in a variety of regulatory and institutional conditions, according to the report of DENA "*Renewable fuels of non-biological origin in the RED II*" of July 2020. Implementation issues are under regulation at EU level, and MS might also shape their policies in the context of RED II and the forthcoming Delegated and Implementing Acts.

The recent IEA cost report considers also that RCF and RFNBO based fuels will be highly competitive against other low carbon fuels so it is expected that they will be included (but only up to an extent) in the transportation fuel mix up to 2030 (with the potential to feature significant volumes by 2050). Innovative technological developments of RCF pathways might provide competitive low carbon solutions for maritime and aviation thus to decrease the competition of low carbon fuels between land transportation and maritime/aviation.

The emphasis of FQD Art. 7A on life cycle GHG savings encourages market penetration of RFNBO and RCF, especially in cases they are addressed to the maritime and aviation markets; consequently, the relevant impact could be considered as positive.

Impacts of a discontinued obligation (Option 2)

The use of RFNBO and their consideration in the RED II targets is absolutely related to their production from renewable electricity. Moreover, the rigorous conditions on additional demand for renewable electricity from RFNBO production should not interfere with efforts to increase the share of renewable electricity in existing electricity demand.

Implementation of RED II and other EU policies without the FQD Art 7A. in place, might reduce the use of RFNBO and RCF (optional in RED II) and consequently the low carbon fuels competition, especially since RCF's use is optional within the RED II frame and may not be eligible under a number of MS legislations for the 2030 target.

Furthermore, aviation is an opt-in to Art.7A of FQD since 2015 and maritime fuels are not considered yet. The impact towards achieving the 2030 targets might be negative due to reduction of potential RCF and RFNBO solutions based on technologies in the gate of commercialization. The result might not be so significant in case the MS jurisdictions include RCF in the RED II targets and the RCF, RFNBO solutions are mandatorily directed by MS to maritime and aviation sectors in principle; then competition conditions might be as in Option 1.

If FQD is discontinued, the relevance of revising RED II becomes more significant for incorporating RCF regulation and improving RFNBO usage in a more efficient implementable scope.

Impacts of a strengthened obligation (Option 3)

More ambitious FQD policies incorporating and strengthening the share of RCF and RFNBO in the 2030 fuel mix will possibly drive to a tougher competition among renewable fuels and RCF. This fact will result to lower costs and potentially higher demand for low carbon fuels in comparison to Options 1 and 2; increasing thus the competition for such fuels directed to the road and the other (maritime and aviation) sectors. In this case the impact will be positive in achieving the 2030 targets.

The significance of the impact in prices will always depend on feedstock volumes availability. Certainly, competition among sectors (road vs aviation and maritime) would be relevant to technological developments also, since the specifications of fuels addressed to the three transport sectors differ substantially and the relevant technological pathways do not always produce competitive fuels suitable for all sectors.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD - (Option 3A)

The impacts of gaseous fuels are not changing the overall impact assessment. Gaseous low carbon fuels might come from RCF and RFNBO as well and the expected competition is shaped as in the liquid low carbon fuels. The inclusion of maritime and aviation sectors will not affect the overall impact, since they are not mainstream users of gaseous fuels (bio-LNG for maritime could be an exemption, especially towards 2050), so impact neutrality is anticipated.

Impacts of a market-based system to trade GHG reduction obligations – (Option 3B)

A credit-based trading system will mitigate the negative impacts on competitiveness, especially in case differences in availability and competition conditions are experienced. The fuel suppliers will have more opportunities to optimize their operation by exploiting additional low carbon fuels based on different feedstocks without regional restrictions for production and transportation of low carbon fuels; thus, positive impact is estimated.

Impacts of directly regulating fuel suppliers with an EU Regulation – (Option 3C)

An EU regulation will increase the level-playing field in Europe and the common rules will relax obstacles in competition, especially if they are created from restricted availability of feedstock. RCF low carbon fuels might enter the broader EU market, including maritime and aviation, and contribute to better competition conditions for suppliers, who will increase their flexibility to achieve the targets. Thus, the impact is expected to be positive.

Table 48 Summary of impact "Competition between renewable fuels"

Option	Impact
Continued obligation (baseline)	It is expected that Recycled Carbon Fuels will become competitive against other low carbon fuels in the period up to 2030, and therefore will be included in the transport fuel mix (even if in small quantities).
Discontinued obligation	(-, i.e. reduced competition). Implementation of RED II and other EU policies without the FQD might reduce the use of RCF and consequently the low carbon fuels competition since RCF may not be eligible under a number of MS legislations for the 2030 target.
Strengthened obligation	(+, i.e. enhanced competition) More ambitious decarbonization policies promoting the use of RCF in the 2030 fuel mix will possibly drive to a tougher competition among renewable fuels and RCF
Expanded FQD scope to gaseous fuels	(o) Gaseous low carbon fuels might come from RCF as well and the expected competition is shaped as in the liquid low carbon fuels. The inclusion of maritime and aviation sectors will not affect the overall impact, since they are not users of gaseous fuels.
Market-based instrument	(+) A credit-based trading system will mitigate the negative impacts on competitiveness, especially in case differences in fuel availability and competition conditions are experienced within the EU.
Direct regulation of fuel suppliers	(+) RCF low carbon fuels will enter the broader EU fuels market, including maritime and aviation, and contribute to better competition conditions for suppliers, who will increase their flexibility to achieve the targets.

Social impacts

<u>Social equity impacts on affordability of road mobility</u>

This impact category is about the affordability of road mobility. An increase in the fuel prices might affect the affordability of households. It might furthermore affect certain households disproportionally.

Different types of households are affected differently by changes to transport costs coming from fuel price changes. The significance of the fuel prices for a given household depend on several factors. Car ownership, alternatives to car transport, taxation of cars and fuels etc. Changes to the retail fuel price will increase the variable part of the transport costs. Most of the costs of running a private car is the expenditure on fuels. The level of fixed costs depends on the price of the car (including taxation) and the cost of capital (interest rates).

The assessment focuses on the difference between rural and urban households. While any household which depends on private cars for long commutes due to limited access to public transport could be affected by increased fuel prices, rural household comprise the majority of such households. Rural households are more dependent on road transport and typically have longer distances for commuting as well as for other activities. It means that rural households spend a higher share of their income on transport[197]. The assessment therefore illustrates the significance of the affordability impact category.

It should be noted that the assessment of this impact depends heavily on assumptions on other policies. The assessment includes two versions of the baseline scenario. One where there is a carbon price element added to the price of fossil fuels and one without the carbon price element, see the above section on "Substantive costs for fuel suppliers".

[197] See for example Eurostat HBS_STR_T226

FQD Art 7A impacts the cost of passenger transport and that affects household affordability. The requirement to reduce the GHG intensity of transport fuels increase the production costs and thereby also affects the consumer retail price. It is assumed that a higher production cost is passed on to the consumer price. How severe a given increase in fuel prices will be felt by a given household depends on:

- Annual mileage
- Availability and costs of alternative modes of transport

Methodology behind measuring the impact

The approach to the assessment is based on assessing the likely increase in transport costs for different households and compare the change to the average household income/expenditure. The assessment is based on the following data:

- Share of household income spend on transport for rural and urban households and by income levels
- Share of transport costs that depends on fuel prices
- Expected increase in retail fuel prices

Based on Eurostat data, the share of household income spend on transport can be described. However, the most updated information from Eurostat does not included details on the expenditure on fuels. The data include total transport expenditure divided on three categories: purchase of transport vehicles, operation of personal transport equipment and transport services. The fuel costs are part of the category of operation of personal transport equipment. For the assessment, we assume that fuel is a major part of this category. It means that we slightly overestimate the impacts.

The data on transport expenditure is included in Table 40 divided by urban and rural households.

Table 49 Rural and urban household expenditure on transport per 1000 EUR

Expenditure Element by household type	Urban household	Rural household
Total transport	104	128
Purchase of vehicles	32	42
Operation of personal transport equipment	52	74
Transport services	18	9

Source: Eurostat HBS_STR_T226

The data shows that rural households spend more on transport than urban households and they spend a larger share on purchasing and running vehicles.

There are no data on the share of gasoline and diesel cars in rural and urban areas. At an EU level, the latest data (2019) show that around 40% of the passenger cars are diesel driven, while about 50% are gasoline cars. The remaining 10% are other fuels including LPG and electricity[198]. Given that gasoline and diesel cars comprise more than 90% of the passenger cars, the assessment is based on the impacts of changes to the gasoline and diesel retail prices.

Impacts of changes to the GHG reduction obligation

Assessing the effects of the options on the fuel price is the next step. The production costs of petrol and diesel have been estimated above in relation to the substance costs for supplier impact category. Then, the impact on the retail price is estimated in the following way. The current retail price with and without taxes has been used to estimate an average EU level of taxes and duties on

[198] Eurostat 2019 (ROAD_EQS_CARPDA)

the fuels. Then, the retail prices are the sum of the production cost element and the average taxes and duties[199]. Table 41 shows the estimated retail prices under each of the three options.

Table 50 Estimated retail fuel prices – without the carbon price component

Gasoline	Estimated retail prices		
	2020	2030	2050
Current retail price	1.215		
Option 1		1.251	1.671
Option 2		1.251	1.671
Option 3		1.252	1.671
Diesel	**2020**	**2030**	**2050**
Current retail price	1.126		
Option 1		1.134	1.567
Option 2		1.134	1.567
Option 3		1.134	1.567

It should be noted that actual retail prices are constantly changing responding to supply and demand. All the prices are therefore estimated values based on the assumptions for production costs used in the assessment of economic impacts above.

The baseline scenario also includes the impacts of other policy measures. This is estimated by assuming that there will be a carbon price of 44 EUR/tons of CO_2. This carbon price introduces an additional price element for the conventional fossil fuels of 0.14 EUR/litre of gasoline. Table 42 illustrates the estimated retail prices with the carbon price component included.

Table 51 Estimated retail fuel prices – with the carbon price component in EUR/litre

Gasoline	Estimated retail prices		
	2020	2030	2050
Current retail price	1.215		
Option 1		1.343	1.671
Option 2		1.343	1.671
Option 3		1.343	1.671
Diesel	**2020**	**2030**	**2050**
Current retail price	1.126		
Option 1		1.239	1.567
Option 2		1.239	1.567

[199]Data on retail prises with and without tax: https://ec.europa.eu/energy/data-analysis/weekly-oil-bulletin_en

Option 3		1.239	1.567

To assess whether there could be any affordability issue, the percentage changes in the fuel prices are calculated.

Table 52 Estimated effect on the options – without the carbon price component

Price difference between	2030		2050	
	Gasoline	Diesel	Gasoline	Diesel
Current price to Option 1	3.0%	0.7%	37.5%	39.2%
Option 1 to Option 2	0.0%	0.0%	0.0%	0.0%
Option 1 to Option 3	0.1%	0.0%	0.0%	0.0%

Table 53 Estimated effect on the options – with the carbon price component

Price difference between	2030		2050	
	Gasoline	Diesel	Gasoline	Diesel
Current price to Option 1	10.5%	10.0%	37.5%	39.2%
Option 1 to Option 2	0.0%	0.0%	0.0%	0.0%
Option 1 to Option 3	0.0%	0.0%	0.0%	0.0%

What can be seen from the estimated retail prices is that there is an increase from the current 2020 level to the baseline estimate for 2030 and 2050. Without the carbon price component, the fuel costs increase would be less than 2% (weighting the price increase for gasoline and diesel by the share of gasoline and diesel cars). With the carbon price element, the increase in fuel costs would be 10% by 2030.

As this is the baseline effect, it is not relevant for the comparison of policy options which is between Option 1, 2 and 3.

The effects of Option 2 and Option 3 compared to Option 1 – the baseline – are marginal and negligible.

It can therefore be concluded that there is no affordability issue for households. The main change is from the current level to the baseline. The results of the assessment of affordability of road mobility are summarised in Table 45.

Table 54 Summary of impact "Affordability of road mobility"

Option	Impact on the expenditure of rural households
Continued obligation (baseline)	There could be increase in fuel costs up to about 10% by 2030. For rural households this would mean an increase in transport costs around 0.7%.
Discontinued obligation	(o) There would be no changes in the affordability of road mobility compared to the baseline (Option 1).
Strengthened obligation	(o) There would be only negligible in the affordability of road mobility compared to the baseline (Option 1).

Option	Impact on the expenditure of rural households
Expanded FQD scope to gaseous fuels	(o) There would be only negligible in the affordability of road mobility compared to the baseline (Option 1).
Market-based instrument	(o) There would be only negligible in the affordability of road mobility compared to the baseline (Option 1).
Direct regulation of fuel suppliers	(o) There would be only negligible in the affordability of road mobility compared to the baseline (Option 1).

Social impact on rural areas

Changes to the use of biofuels can impact on rural development. There are two factors or elements that could have an impact:

- Changes to value added/income generated in rural areas due to changes in the demand for bio-based feedstocks.
- Changes to value added/income resulting from changes in transport costs caused by changes to fuel prices.

Value added/income

Changes to the FQD Art.7A are likely to change the demand for biofuels. Whether the biofuels are based on crops or waste products, they derive from agricultural or forestry production. Changes in the demand could therefore affect the income of the agriculture or forestry sectors and thereby affecting the development of rural areas.

Transport costs

Changes to fuel prices could affect transport activities. For example, higher costs of road transport might affect rural areas as transport distances are typically longer than for urban areas as noted above.

The assessment above on the impact category "Affordability of road mobility" has shown that the impacts on transport costs are very minor. It means that with only minor changes to transport costs, there will be no impacts on rural activities. Hence, the changes to transport costs are assessed as not affecting rural development. This element is therefore not further assessed, and the focus is on the income element.

Impact on what?

The impacts on rural development are from changes to the demand for biofuels leading to changes to the income in rural (agricultural) areas.

Impact for whom?

This impact element affects business and citizens located in rural areas.

Methodology behind measuring the impact

The assessment considers the origin of the bio-based feedstocks and the area of agricultural land used for growing the feedstocks in EU. The changes in land use demands are indicators for the magnitude of impacts. The second-generation biofuels, which use agricultural and forestry waste products could also affect the income of rural areas. If the waste products such as wheat straw will be demanded as feedstock, it could lead to price increases and thereby generate an additional income. Additionally, through a literature review, the expected impacts on rural economy and development markets are described.

It should be noted that the markets for agricultural outputs whether crops or waste residues are affected by many factors. It is therefore difficult to single out the effect of FQD Art.7A on these markets. The results are summarised below.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The specific assessment of the impacts of the baseline will include the following elements:

- A comparison of the current land use demand and the estimated baseline demand for 2030 and 2050
- A comparison of the land use area with total agricultural area
- A review of studies on the importance of the bioeconomy

The baseline means a continued obligation at the current target. See sections above on the impact on land use under the baseline. Due to existing regulation such as REDII, there are changes away from first generation of crop-based biofuels. It means that demand for the land use for biofuel feedstocks decreases from now until 2050. This is described above in the section on impact on feedstock supply, see Section 4.

The MIX55 PRIMES scenario that simulates the overall EU energy and climate targets towards 2050 assumes that crop-based biofuels are gradually phased out. This is based on existing regulatory provisions, for example the cap on first generation biofuels, emission reduction requirements that decrease the attractiveness of crop-based biofuels and the sub-mandate on advanced biofuels.

To assess how significant the changes in demand will affect the agricultural sector, the estimated changes in demand for land for crop-based biofuels are compared to total areas of agricultural land. This is shown below, where the total areas used for the different crops are presented as well as the total agricultural area in EU.

Table 55 Biofuel feedstock by crop compared to total cultivated area in EU

EU biofuel feedstock in 1000 ha	Total area	2020	2030	2050
Wheat	25,411	920	240	10
Maize	13,832	590	160	10
Sugars	1,415	180	50	0
Rapeseed	11,235	3,710	2,800	1,380
Total UUA area	156,658	5,400	3,250	1,400
Total arable land	97,078			

Source: Eurostat and Table 20, 21, 22, 23.

The comparison shows that except for rapeseed for biodiesel, the required areas of land for biofuels comprise small shares of the land areas used for each type of crops. Compared to total available agricultural land, it is only 3-4% that is used for biofuels.

This is an indication that supports the general finding that production of biofuels has had a limited impact on for example food prices. In the section on the "displacement of agricultural and other products" we have reviewed studies on the impact of land use. There, it is explained that the evidence suggests that the demand for biofuels have had little or no impact on food prices.

The change to advanced biofuels means that there will be an increase in the other types of feedstocks than the crop based. The study IEA Bioenergy (2020)[200] lists the different feedstocks for advanced biofuels:

- Wastes - materials which have no other useful purpose, and which otherwise have to be managed, usually incurring a cost.

[200] IEA Bioenergy, 2020, Advanced Biofuels – Potential for Cost Reduction, https://www.ieabioenergy.com/wp-content/uploads/2020/02/T41_CostReductionBiofuels-11_02_19-final.pdf

- Processing residues and by products which arise part of an industrial process and are already available and pre-processed in quantity at a particular site (including for example sawdust to be used for pellet production or sugar bagasse).
- Locally collectable residues which are produced as part of a harvesting procedure, but which are dispersed, and which must be collected and brought to a central point and processed before they can be used, such as cereal straw, forestry residues or sugar cane straw.
- Internationally traded feedstocks, such as wood pellets, based on raw materials available at an industrial site, which are extensively processed to improve the energy density and then transported long distances to supply large scale conversion plants[201].

They also assess the availability and conclude that[202]:

- There are likely to be large supplies of wastes and residues from forestry and agriculture available.
- There is also scope for raw material supply from agriculture, with an emphasis on crops that can be co-produced with food crops or using contaminated or abandoned land.

It means that change to advanced biofuels is likely to increase the demand for other products or residues from agriculture or forestry. While there will be a decreasing income for crop-based feedstocks, it will be offset by the increasing demand for other feedstocks that also provide income to sectors based in rural areas.

Before drawing the conclusion on this impact category, it is useful to more broadly consider the implication of an increasing bio-economy for the development in rural areas.

For example, in Choi et al 2019[203] several scenarios for EU bioeconomy up to 2050 have been simulated. Most of the scenarios assume a use of biofuel in transport more or less similar to the current level. They also include a number of elements where the demand for biobased products for chemical and material use are assumed to increase. These are higher value products compared to biofuels. The demand for biobased products is covered by a combination of import and EU produced bioproducts. The scenarios therefore result in more substantial increase in value of land in EU as measured by land rent. Compared to a no-bioeconomy scenario, the increases in land rents are in the order of 60% to 70%. Given that biomass used as feedstock for biofuels comprises only about 10-12% of the total use of biomass, the impact from biofuels on land rent would be in order of 6-7%. This is a simplified assessment as there are many factors influencing and determining the specific effects from each type of feedstock. However, it indicates that biofuels provide an important element of income to rural areas.

Based on the assessment of land use demands and the findings from reviewed studies, we can draw the following conclusions on the impact on rural development in the baseline scenario compared to the current situation:

- The reductions in the land-use demand for the crop-based biofuels are limited when compared to the utilised agricultural area of the respective crops.
- The change to second generation biofuels might generate income for rural areas. For example, a feedstock based on straw might increase the price of straw and thereby increase the income to rural areas.

Therefore, the various elements in the baseline affect income and development in rural areas in different directions. While the phase-out of crop-based feedstock might lead to reductions in income, the increase in the demand for advanced 2nd generation biofuels might increase income. As the overall biofuel consumption is projected to increase until 2030, but the demand for crop-

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[201] Ibid page 47
[202] Ibid page 50
[203] Choi HS, Grethe H, Entenmann SK, Wiesmeth M, Blesl M, Wagner M. Potential trade-offs of employing perennial biomass crops for the bioeconomy in the EU by 2050: Impacts on agricultural markets in the EU and the world. GCB Bioenergy. 2019;11:483–504. https://doi.org/10.1111/gcbb.12596.

based biofuels to decrease, there is likely to be an overall positive impact on the development in rural areas in the EU.

Below, the assessment describes whether Option 2 or Option 3 will lead to any differences compared to the baseline in Option 1.

Impacts of a discontinued obligation (Option 2)

The assessment of the impact on feedstock supply, see 0, concluded that there is no difference to the baseline scenario. Therefore, the impact of a discontinued Art.7A obligation is likely to be very minor or negligible.

Impacts of a strengthened obligation (Option 3)

Compared to the baseline, the strengthened obligation does not alter the overall demand for biofuels in 2030 but leads to a higher share of 2nd generation biofuels. This could further offset the loss of income in rural areas associated with the reduction in crop-based biofuel demand in the baseline. This option will therefore lead to additional income the agriculture and forestry sectors and thereby provide a contribution to further growth in rural areas and regions.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD (Option 3A)

Adding gaseous fuels are likely to lead to some, though small, change to the impacts described above under the baseline. Though the volumes of gaseous fuels are limited they are projected to increase. The assessment in 0 also indicates an increased demand for biobased feedstocks for example biogas. Therefore, option 3A may lead to limitedly positive impacts as compared to the baseline.

Impacts of a market-based instrument to trade GHG reduction obligations (Option 3B)

The credit-based system could mean that a small part of the obligation is achieved through credits generated from the provision of electrical energy or from biofuels will low CI. It is therefore difficult to estimate what the impact on rural development will be. The market-based instrument could potentially further increase the positive magnitude of the impact. The trading system may generate income to biofuels will low CI and this could increase their uptake. The overall impact depends however on the extent to which electricity and hydrogen will penetrate the market as a result of the market-based instrument. If either fuel provides the main part of the credits to the market, it will further reduce the demand for biofuels. Overall, the impact is therefore positive to negative, depending on whether the instrument increases the market share of biofuels or electricity and hydrogen.

Impacts of directly regulating fuel suppliers with an EU Regulation (Option 3C)

A regulation will potentially create a more level-playing field for fuel suppliers across EU. Whether this will translate into any differences for the development in rural areas is more difficult to assess. Some agricultural products are traded across the EU, while others are only traded more locally. The direct regulation will provide similar conditions across EU and that might overall lead to an increased demand for biofuels, which will have positive impact on the rural development.

Table 56 Summary of impact "Rural development"

Option	Impact on rural development
Continued obligation (baseline)	While the phase-out of crop-based feedstock might lead to reductions in income, the increase in the demand for 2nd generation biofuels might increase income. As the overall biofuel consumption is projected to increase until 2030, but the demand for crop-based biofuels to decrease, there is likely to be an overall positive impact on the development in rural areas in the EU.
Discontinued obligation	(o) Discontinuation of the obligation is not assessed to have impacts that are different from the baseline.

Option	Impact on rural development
Strengthened obligation	(o) A strengthened obligation will change the distribution of gains and losses in favour of advanced biofuels. Compared to the baseline, this could further offset the loss of income in rural areas associated with the reduction in crop-based biofuel demand in the baseline
Expanded FQD scope to gaseous fuels	(+) Expanding the FQD scope to gaseous fuels might further increase the demand for agriculturally based biofuels and therefore have a positive impact on rural development.
Market-based instrument	(o/+) The effect of a market-based instrument depends on how many of the credits that would come from biofuels (compared to electricity and hydrogen). Except for the situation where a large share of credits would come on non-agricultural (or forestry) based feedstock, the impact will be positive.
Direct regulation of fuel suppliers	(+) Direct regulation of fuel suppliers is likely to increase the demand for agriculturally based biofuels and therefore have positive impact on rural development.

Changes in employment resulting from new compliance requirements

There are two types of employment impacts that can be associated with Art.7A. There is an impact that results from the need for human resources, which the evaluation of FQD Art.7A (Section 3) has identified as being the case for the administrative purposes for respectively public administrations and fuel suppliers. However, this effect represents both the administrative costs for the RED and Art.7A.

The second type is an effect in the sense that Art.7A is one factor among many (e.g. RED, AFD, global market development) that drive the development of alternative fuels.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

The administrative costs for public administrations and fuel suppliers amount to respectively 1-2 FTEs per Member State, except for 15 FTEs in the case of the Netherlands, 2 FTEs in Denmark and France, and 1 FTE in Belgium and one other Member State.[204] On the EU27 level, this amounts to an estimated 43-65 FTEs.[205]

The study has not been able to identify the exact number of fuel suppliers on the European market. The study identified however, 46 distinct owners of oil refineries (of which some are co-owned). Assuming this number corresponds to the number of fuel suppliers, a total of 46-92 FTEs is estimated for fuel suppliers.[206, 207]

According to the EU Renewable Energy Progress Report, the EU biofuels sector is estimated to have entailed 208,000 jobs in 2018, corresponding to being the third largest renewable energy job

[204] The interviewed stakeholder expressed the wish to remain anonymous
[205] Given that the value is expressed as a full-time equivalent, it is independent of time, representing the number of full-time staff per e.g. day, week, or year.
[206] McKinsey Refinery Capacity Database (2020), https://www.mckinseyenergyinsights.com/resources/refinery-reference-desk/european-refineries/
[207] According to Eurostat, there were 814 enterprises in the refined petroleum manufacturing sector in 2018 (NACE: 'Manufacture of refined petroleum products'). This code includes however, according to the EU Petroleum Fitness Check (2015), several manufacturing enterprises that are unrelated to refineries, such as biofuel blenders and manufacturers of hard-coal fuel briquettes, lignite fuel briquettes, peat briquettes, petroleum briquettes and various speciality products such as lubricants, greases, Vaseline, and others.

creator after wind energy and solid biomass.[208] According to a second source, 316,800 jobs are associated with the liquid biofuels and biogas sectors in 2018 (in the EU28); respectively accounting for 248,000 and 68,800 jobs.[209] The EU Petroleum Fitness Check (2015) estimates in turn that 119,000 direct jobs are associated with the EU refinery sector. The employment effect in terms of the administrative requirements is therefore assessed to be small, when compared to the total employment in the sector.

Summing up the figures for public administrations and fuel suppliers, the RED and FQD Art.7A lead to the employment of 89-157 FTEs on the EU27 level.

In terms of the second type of employment effect, the continued GHG obligation will continue to be one of several factors contributing to the development of the sectors. As stated above, 208,000-316,800 people were employed in the EU biofuels sector in 2018. As the evaluation of FQD Art7A (Section 4) concluded, Art.7A has created the conditions for the further development of markets for fuels with lower GHG intensity. For Option 1, it is therefore assessed that the obligation will continue doing so, until all Member States have achieved compliance.

Considering the recurring difficulty of disentangling the administrative and compliance costs of Art.7A and the RED, the study deems it not feasible to make a judgement on the extent to which the GHG obligation concretely contributes to employment in the liquid biofuels and biogas sectors.

Impacts of a discontinued obligation (Option 2)

The assessed impacts on the administrative burden for public administrations and fuel suppliers conclude that Option 2 does not change the administrative burden.

If the GHG obligation is discontinued, the conditions for the further development of markets for fuels with lower GHG intensity will degrade. Consequently, one factor in contributing to employment in the alternative fuels sector will diminish. As stated above, the degree of this impact is uncertain.

Impacts of a strengthened obligation (Option 3)

As for Option 2 above, the impact on employment associated with the administrative requirements is assessed to be neutral. A strengthened GHG obligation will however further strengthen the demand for low carbon fuels, and consequently contribute to more employment in the alternative fuels sector. Again, the extent of this remains unclear.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD (Option 3A)

As assessed under the administrative burden, stakeholders do not anticipate significant changes under Option 3A. The direct employment impact is therefore assessed to be neutral.

In terms of the second employment impact, the expected increase in the supply of and demand for gaseous fuels can be expected to lead to a growth in employment in petroleum-, natural gas, hydrogen, and biogas sectors. Simultaneously however, the shift towards alternative fuels may lead to a reduction of employment for liquid fossil fuels. This employment effect may hence be more of a distributional character.

Impacts of a market-based instrument to trade GHG reduction obligations (Option 3B)

The option foresees a market-based instrument with an administratively low burden. Based on the estimate of the administrative costs for public administrations however, ranging to EUR 4 – 16 million, about 3 – 15 FTEs can be expected under this option. In terms of employment in the biofuels sector, a similar effect can be expected as for option 3A above, in which alternative fuels lead to more employment, but employment for liquid fossil fuels falls.

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[208] COM (2020) 952 final, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf
[209] Czako (2020), Employment in the energy sector, https://publications.jrc.ec.europa.eu/repository/handle/JRC120302

Impacts of directly regulating fuel suppliers with an EU Regulation (Option 3C)

The assessed impact of the administrative burden on Option 3C concludes no significant changes of this option, as the reporting framework does not change. The impact in employment is assessed to be the same as for Option 3.

Table 57 Summary of impact "Changes in employment."

Option	Impact
Continued obligation (baseline)	1-2 FTEs per Member State and fuel supplier. Summing to respectively 46-92 FTEs and 43-65 FTEs. The total FTEs amount to 89-157 FTEs.
Discontinued obligation	(-) Neutral impact on employment for administrative purposes, but negative impact on employment in the alternative fuels sector.
Strengthened obligation	(+) Neutral impact on employment for administrative purposes, but positive impact on employment in the alternative fuels sector.
Expanded FQD scope to gaseous fuels	(o) Neutral impact on employment.
Market-based instrument	(+) Positive impact on employment, in the order of 3 – 15 FTEs, but neutral impact on employment for alternative- and fossil fuel sectors.
Direct regulation of fuel suppliers	(+) Neutral impact on employment for administrative purposes, but positive impact on employment in the alternative fuels sector.

Impacts on third countries

This impact category includes impacts on the environmental, economic, and social situation in third countries.

EU demand for biofuels impacts the environmental, economic, and social situation of sourcing countries outside the EU, as biofuel crop production has negative environmental impacts (as much as any other land use), leads to economic income and the development of the biofuel sector in third countries, and also contributes to employment.

Methodology behind measuring the impact

The assessment draws primarily on other impact categories and investigates these in a third country context. One impact of particular importance is the feedstock supply.

Impacts of changes to the GHG reduction obligation

Impacts of a continued obligation – baseline (Option 1)

As also described in the Impact on feedstock supply above, the land use associated with biofuel production will decrease by 2030, owing to the transition towards advanced biofuels. Table 49 presents the overall land use associated with crop-based feedstocks in third countries destined to the EU market. The land use associated with bioethanol feedstocks comprises primarily of maize and other cereals, which are primarily imported from Brazil and the Ukraine.[210] The bioethanol feedstocks will experience a reduction of about 0.5 Mha by 2030. For Brazil and Ukraine, strong reductions in land use can thus be expected.

[210] The origin of specific feedstocks and countries builds on the Renewable Energy Progress report for 2018, COM (2020) 952, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf

For biodiesel, a strong decrease in the associated land use in third countries can be expected, decreasing by 1.4 Mha. This reduction is primarily associated with palm oil, which will transition to being a residue feedstock. Indonesia and Malaysia are the only exporters of palm oil biodiesel feedstock to the EU.[211] This transition can be traced back to RED II's cap on crop-based fuels and the phase out of high-ILUC risk feedstocks, providing an incentive to transition from palm oil to POME.[212]

With respect to other oil-crops, the land use associated with rapeseed and soybean will decrease. The former is primarily produced within the EU, but Australia and Ukraine are minor third country suppliers. For soybean, the primary sourcing country is Argentina and to a latter degree the USA and Brazil. Finally, there will be increase in land use for sunflower, with primarily unknown origins.[213]

Table 58 Option 1: Land area demand for feedstocks in 3rd countries in 2020, 2030, 2050 and the change since 2020

Feedstocks	2020	2030	2050	2030 - 2020	2050 - 2020
	1,000 ha				
Bioethanol (1st gen)	600	200	10	-500	-600
Biodiesel (1st gen)	3,700	2,300	1,100	-1,400	-2,600
Total	**4,300**	**2,500**	**1,110**	**-1,900**	**-3,200**

Source: authors' own calculations

For those third countries (e.g. Argentina, Australia, Brazil, Ukraine, and the USA), where a reduced land use is projected, the negative environmental impacts associated with biofuel crop production will decrease. These negative impacts include eutrophication of water bodies, water scarcity, soil erosion, soil compaction, air pollution, habitat loss and biodiversity loss.[214] It is important to note however that these negative impacts will persist as the cultivated land will be utilised for other crops not destined for biofuel production. The reduced land use also entails that the production of biofuel crops will contribute less to the economic income in associated countries.

In the case of palm oil, the transition towards palm oil residues (i.e. POME) will contribute to making palm oil cultivation more sustainable in Indonesia and Malaysia, as methane emissions from POME are associated to be the second largest source of GHG emissions after land use change.[215]

The continued GHG obligation will contribute to the mainstreaming of advanced biofuels, which may offset the reduced demand for biofuel crops. This will particularly be the case for palm oil. From an economic perspective, the higher demand for advanced biofuel feedstocks can contribute to further innovation and cost-savings of low carbon fuels (as also shown on the impact on Increase in innovation and cost-savings of low carbon fuels above). As also mentioned on the impact on employment above, this advancement may lead to further employment in the global low carbon fuel sector.

Impacts of a discontinued obligation (Option 2)

The discontinuation of the obligation has no effects on the actual use of various feedstocks, as the sustainability requirements, which are identical for the FQD and RED II, will continue to be governed by RED II. The discontinuation will therefore not change the demand of different types of imported biofuel feedstocks.

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[211] Based on COM (2020) 952, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf
[212] https://ec.europa.eu/energy/sites/ener/files/documents/2_en_act_part1_v3.pdf
[213] Based on COM (2020) 952, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf
[214] COM (2020) 952, https://ec.europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf
[215] Chase & Henson (2010), 'A detailed greenhouse gas budget for palm oil production'. International Journal of Agricultural Sustainability 8, 199-214

Impacts of a strengthened obligation (Option 3)

The higher share of wheat straw in the feedstock distribution will lead to a stronger decrease in the share of crop-based bioethanol (see Table 50). The impact is however not significant for third countries, as about 75% of the bioethanol production occurs in the EU.

For biodiesel however, Option 3 will lead to a significant reduction in associated land use, owing to the higher share of POME as an Annex IX-A feedstock. The assumed growth of POME in the feedstock distribution also has ramifications for other feedstocks, i.e. rapeseed and soybean. Compared to the baseline thus, biofuel production will be shifted away from rapeseed and soybean producers, i.e. Argentina, Brazil, and the EU and USA, towards the two POME producing countries, Indonesia, and Malaysia.

Table 59 Option 3: Land area demand for feedstocks in 3rd countries in 2020, 2030, 2050 and the change since 2020

Feedstocks	2020	2030	2050	2030 - 2020	2050 - 2020
	1,000 ha				
Bioethanol (1st gen)	600	200	10	-500	-600
Biodiesel (1st gen)	3,700	1,900	900	-1,800	-2,800
Total	**4,300**	**2,100**	**910**	**-2,300**	**-3,400**

Source: authors' own calculations

Given the underlying assumption of option 3 that a strengthened GHG obligation leads to a stronger mainstreaming of advanced biofuels, the option will, compared to the baseline, lead to stronger impacts for third countries. From an environmental perspective, less land use will be associated with biofuel crops. From an economic perspective, the higher demand for advanced biofuels will lead to stronger innovation and cost-savings (as also shown on the Increase in innovation and cost-savings of low carbon fuels above), leading to potentially stronger employment effects in the global biofuel sector.

Even though option 3 leads to a stronger reduction in the land use for crop-based biofuels, leading in turn to a loss of production for sourcing countries, the option will provide opportunities of further developing low carbon fuels and transition away to more sustainable low carbon fuel. Compared to the baseline, the impact is therefore assessed to be positive.

Impacts of adding gaseous fuels to the scope of the fuel quality requirements under the FQD (Option 3A)

Option 3 As described on the impact on the feedstock supply above, gaseous fuels will gain a limited, but strongly increasing, importance. The limited volumes of gaseous fuels compared to liquid fuels mean however that adding gaseous fuels will have no significant impacts on third countries. For hydrogen, there will only be notable demand from 2040 on. It is however uncertain whether hydrogen will at all be produced in third countries. The impacts are therefore assessed to be neutral in comparison to the baseline.

Impacts of a market-based instrument to trade GHG reduction obligations (Option 3B)

Similar to the impact on rural development above, the credit-based system could mean that a small part of the obligation is achieved through credits generated from provision of electrical energy or from biofuels will low GHG intensity, further driving the transition away from crop-based biofuels. If the market-based instrument leads to a stronger substitution with electrical energy, there will be a negative impact for third countries. If it leads to a stronger substitution with other low carbon fuels, it could have a positive impact.

Impacts of directly regulating fuel suppliers with an EU Regulation (Option 3C)

Replacing the current Directive with an EU regulation will not have any effects on this impact category. It will not change the composition of biofuel feedstocks and therefore also have no impacts on the import of biofuel feedstocks. Hence, the impacts will be as described under the baseline.

Table 60 Summary of impact "Impacts on third countries"

Option	Impact
Continued obligation (baseline)	The substitution away from crop-based biofuels will reduce land use, leading to a positive environmental impact, but negative economic impact. However, the transition of palm oil will have positive environmental impacts in Indonesia and Malaysia, leading to an overall positive development in third countries.
Discontinued obligation	(o) There is no change compared to the baseline.
Strengthened obligation	(+) Stronger reduction in demand for biofuel crops, but stronger opportunities to transitioning to more sustainable low carbon fuels
Expanded FQD scope to gaseous fuels	(o) There is no change compared to the baseline.
Market-based instrument	(o/+) The market-based instrument will accelerate the transition from crop-based fuels. A substitution with electrical energy will lead to a negative impact, whereas a substitution with other low carbon fuels can lead to a positive impact for third countries.
Direct regulation of fuel suppliers	(o) There is no change compared to the baseline

Comparison of policy options

Table 52 provides an overview of the options and their anticipated impacts.

Table 61 Overview of the options and their anticipated impacts

	Impacts/ Options	Option 1 Continued obligation (baseline)	Option 2 Discontinued obligation	Option 3 Strengthened obligation	Option 3A Adding gaseous fuels	Option 3B Market based-system	Option 3C Obligation on fuel suppliers
ENVIRONMENTAL	Reduction in GHG emissions from transport	16.3%	o	+	+	+	+
	Reduction of GHG intensity of fuels (of overall CI)	11.5%	o	+	+	+	+
	Impact on feedstock supply	Significant reduction in land use (3.9 and 7.2 million ha by 2030 and 2050)	o	+ (decrease by additional 0.5 million ha in 2030)	-/+	+	+
	Displacement of agricultural and other products	very small given the demand for crop-based biofuels are gradually decreasing	o	+	o	+	o
ECONOMIC	Administrative burden for public administrations	1-2 FTEs per Member State persists	o	o	o	-	o
	Administrative burden for fuel suppliers	1-2 FTEs per fuel supplier	o	o	o	o	o

	Impacts/ Options	Option 1 Continued obligation (baseline)	Option 2 Discontinued obligation	Option 3 Strengthened obligation	Option 3A Adding gaseous fuels	Option 3B Market based-system	Option 3C Obligation on fuel suppliers
ECONOMIC	Substantive cost for fuel suppliers	Production cost increase between 2020 and 2030: Gasoline: 0.037 (10%) EUR/litre Diesel: 0.008 (2%)	o	o	- (limited)	+ (20% savings)	o
	Fragmentation of EU fuel markets	Negative, continue and further increase	o/+	o/+	o/+	+	+
	Increase in innovation and cost-savings of low carbon fuels	Neutral	o	+	o	o/+	o
	Competition between fuel suppliers on fuel price and feedstock supply and availability	Not expected to create additional impact to prices	+	+	+	+	o/+
	Competitiveness of EU fuel suppliers on the global market	Prime-mover advantages	o	+	o	+	+
	Competition between renewable/recycled fuels, incl. initiatives for alternative fuels in aviation and maritime transport modes	Recycled fuels competitive and included in the mix	-	+	o	+	+

	Impacts/ Options	Option 1 Continued obligation (baseline)	Option 2 Discontinued obligation	Option 3 Strengthened obligation	Option 3A Adding gaseous fuels	Option 3B Market based-system	Option 3C Obligation on fuel suppliers
SOCIAL	Social equity impacts on affordability of road mobility (expenditure of rural households)	Increase by 0.7%	o	o	o	o	o
	Social impact on rural areas (demand for agricultural biofuels)	Positive development	o	+	+	o	+
	Changes in employment resulting from new compliance requirements	89-157 FTEs	-	+	o	o/+	+
	Impacts on 3rd countries	Reduced environmental impact; economic gains from transition towards advanced biofuels	o	+	o	o/+	o

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