ReFuel, FuelEU and REDIII

Discrepancies in the proposals and potential impacts on the Dutch transport sector

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Table 1 Abbreviations and definitions

Abbreviations	(Full) description
Advanced biofuels and biogas	Advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX
AFIR	Alternative fuels infrastructure regulation recast
Domestic navigation	Domestic navigation covers the quantities delivered to vessels of all flags not engaged in international navigation. The domestic/international split is determined on the basis of port of departure and port of arrival and not by the flag or nationality of the ship. NACE Division 50. It includes consumption in inland navigation and yachting.
Energy use on-board	The amount of energy, expressed in mega joules (MJ), used by a ship for propulsion and for the operation of any on-board equipment, at sea or at berth
ESR	Effort sharing regulation
ETD	Energy Taxation Directive
ETS	Emission trading system
GHG	Greenhouse gas
International maritime	The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Excluded is: — consumption by ships engaged in domestic navigation. The domestic/international split should be determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship, — consumption by fishing vessels, — consumption by military forces.
Lay-over	Stopover made by an airline on an airport not being their final destination
LNG	Liquefied Natural Gas
Low-carbon fuel	Liquid biofuels, e-liquids, decarbonised gas (incl. bio-LNG and e-gas), decarbonised hydrogen, decarbonised hydrogen-derived fuels (including methanol, and ammonia) and electricity
RCF	Recycled carbon fuel: liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations
RED	Renewable Energy Directive
RES	Renewable energy source
RFNBO	Renewable fuels of non-biological origin: liquid or gaseous fuels which are used in the transport sector other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass
RLF	Renewable and low-carbon fuel for maritime
SAF	Sustainable aviation fuels - synthetic aviation fuels, advanced biofuels, or biofuels listed in Part B of Annex IX (and comply with the RED sustainability criteria)
Synthetic aviation fuels	RFNBOs used in aviation
TEN-T	Trans-European Transport Network

1. Introduction

On 14th July 2021, the European Commission adopted the Fit for 55 (FF55) package. FF55 is a detailed set of proposals aiming to revise EU legislation to align it to the EU's 2030 and 2050 binding climate goals under the European Green Deal. Among these, various proposals concern the decarbonization of the transport sector, including aviation and maritime. Within the Renewable Energy Directive (REDIII, revision of REDII) the full transport sector is addressed, covering road, rail, aviation and maritime. The Regulation ReFuel EU Aviation specifically aims at the aviation sector, and Regulation FuelEU targets decarbonisation of the maritime sector. Although the proposals target the same overall transport sector, each proposal has its own scope, targets, timelines, and actors. This may lead to differences and potential discrepancies between the ambitions and resulting outcomes of the respective proposals.

There are concerns at the Dutch government that due to differences in the scope and set up between these proposals, they do not complement each other or might even lead to undesired impacts for certain sectors or Member States. Specifically, these potential discrepancies may impact the competitive position of Dutch transport sectors, which depend for a larger share on international activities, such as maritime and aviation. In 2020, maritime and aviation made up 72% of the greenhouse[1] gas emissions of the Dutch transport sector, of which a considerable share includes fuel bunkering.

To accurately assess the impacts and risks, the scope, targets, timeline of each proposal[2] were identified. This resulted in a comprehensive overview, as presented in Appendix A. This overview further outlines the actors responsible for complying with or carrying out the proposals, which fuels can be used to comply and details on how to calculate GHG emission reductions.

Based on this overview, potential impacts of the discrepancies on the competitive position of the international sectors (aviation and maritime) and potential risks to reaching the REDIII transport target were analysed. The data from the overview was supplemented by internal brainstorm sessions, a limited amount of targeted interviews with experts from the maritime and aviation sectors, two studies undertaken by CE Delft regarding the effects of the FF55 packages on maritime[3] and aviation sector[4] and background information/position papers from both the Port of Rotterdam as well as SkyEnergy. For each potential impact, we have indicated the likelihood of occurrence as well as severity of impact, all in qualitative high/medium/low categories (see Table 2).

Finally, we outlined possible options for alternatives based on the REDIII, ReFuel EU Aviation and FuelEU Maritime, or some alternatives to mitigate impacts outside these proposals.

[1] (Eurostat, 2021)
[2] As published on July 14th, 2021
[3] (CE Delft, 2022b)
[4] (CE Delft, 2021)

2. Discrepancies and potential impacts

2.1 Introduction and scope

In Appendix A, we present an overview of the proposals presented in the Fit for 55 packages regarding decarbonizing the aviation and maritime sector. For each we summarize: the scope, measures, targets and actors relevant to the aviation and maritime sectors. The proposals for Directives and Regulations covered are:

- Renewable Energy Directive (REDIII) (2021/0218),
- FuelEU Maritime (2021/0210),
- ReFuel EU Aviation (2021/0205),
- Alternative Fuels Infrastructure Regulation Recast (AFIR) (2021/0223),
- amendments in EU Emissions Trading System (ETS) (2021/0211, 2021/0207),
- Energy Taxation Directive (ETD) recast (2021/0213),
- amendments in the Effort Sharing Regulation (ESR) (2021/0200).

From this overview, discrepancies were identified, the main ones will be discussed below in 2.2. In this research only the discrepancies between the transport ambitions of REDIII, ReFuel EU Aviation and Fuel EU Maritime are analysed. These three proposals specifically aim to increase the use of renewable and low-carbon fuels in transport. It should be noted that these are all proposals that are still under negotiation. This analysis was done based on the status of the proposals in February 2022 not taking into account any 'rumours' / intermediary drafts of the negotiations.

We approach any potential discrepancies from the perspective of the REDIII and the REDIII transport target (including road, rail, aviation and maritime), focussing on opportunities and risks in the aviation and maritime sectors (and in particular concerning the bunkering market for maritime). Domestic navigation is included in the REDIII transport target, however as it is only 1.6% of the EU transport emissions and 0.8% of the Dutch transport emissions in 2019[5], we will limit our scope to maritime, aviation and road transport. The geographical scope is the perspective of the Dutch market.

2.2 Discrepancies

The main mismatches between the proposals can be categorised across three levels, i) the **size** of the targets, ii) the **types of energy carriers and their allowed feedstocks** included in the targets, and iii) the **actors** responsible for reaching the targets. Regarding the timeline, the scope is 2030 which is the scope of REDIII, although it should be noted that ReFuel EU Aviation and FuelEU Maritime include targets from 2025 until 2050. A full detailed overview of the scope, measures and targets can be found in Appendix A.

[5] (Eurostat, 2021)

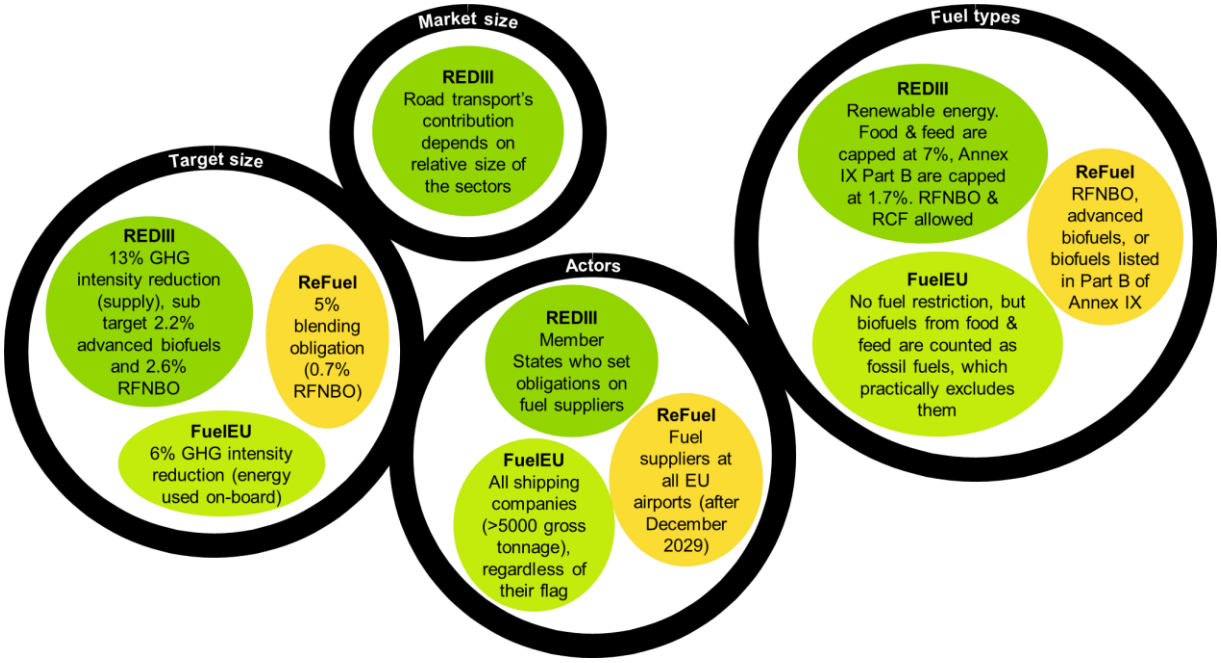

Figure 2-1 Main discrepancies between REDIII, FuelEU Maritime and ReFuel EU Aviation

Regarding the **size of the target**, the REDIII requires a 13% GHG intensity reduction by 2030 of the energy supplied to the transport sector, including maritime and aviation. The REDIII includes a sub target for advanced biofuels of 2.2% (Annex IX Part A) and for renewable fuels of non-biological origin (RFNBOs)[6] of 2.6%. Member States may apply a multiplier of 1.2 for the energy content of advanced biofuels[7] and RFNBO supplied in the aviation and maritime sectors to reach these sub targets. Since REDIII is a directive, Member States can choose how to implement this target across the transport sectors. FuelEU Maritime has a lower target of 6% GHG intensity reduction of the energy used on board of ships by 2030. The GHG intensity reduction in the REDIII is based on a fossil fuel comparator of 94 g CO_2 eq/MJ, whereas the GHG intensity reduction in FuelEU Maritime is based on the fleet average GHG intensity of energy used on-board, which will be determined at a later legislative stage. ReFuel EU Aviation does not have a GHG intensity reduction target but a blending obligation (based on volume), which is set at 5% in 2030 including a 0.7% sub target for synthetic fuels.

There are two interpretations for the REDIII transport target of 13% GHG intensity reduction by 2030. The first scenario is that all fuel suppliers need to adhere to the 13% reduction target. This would mean that the costs are spread across the sectors, leading to higher price increases in maritime and aviation (compared to the lower ReFuel EU Aviation and FuelEU Maritime targets). In the maritime sector, this would cause for a greater mismatch between supply (13% reduction) and demand (6% reduction). However, this allows fuel suppliers and the market to use the most cost-efficient option (especially with the required implementation of a credit-exchange mechanisms). This also creates a level playing field within the EU, as all sectors are impacted equally across borders. The second scenario is that there is an overall 13% target and Member States can balance the allocation of this target between between the fuel suppliers of different sectors. The contribution of the road transport sector

[6] Liquid or gaseous fuels which are used in the transport sector other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass
[7] Biofuels that are produced from the feedstock listed in Part A of Annex IX. The multiplier may only be used to reach the sub target

is dependent on the relative **market size** of the aviation and maritime sectors. Member States with large aviation or maritime sectors may decide to adhere to the lower ReFuel EU Aviation and FuelEU Maritime targets, with higher reductions (and thus higher costs) in road transport. This decreases the chance of leakage, as the Dutch government could allocate a lower target and therefore have less of a cost impact on the maritime sector. Since there will still be a market mechanism, cost effective options can still be chosen, but the costs for these will then for a larger part be borne by the road transport sector. Additionally, this does/could introduce intra-EU competition as some Member States can decide to set lower targets for specific sectors, which could thus cause lower prices for fuel supply in those sectors than in the same sectors in other Member States.

There are also differences in the **types of energy carriers and their allowed feedstocks** that can comply with the targets in each of the proposals. To meet the overall Member State GHG intensity reduction target of the REDIII transport target, renewable energy[8], RFNBO and recycled carbon fuels (RCF)[9] may be used in the REDIII transport target. The share of biofuels and electricity that come from Part B Annex IX feedstocks are capped at 1.7%, based on energy content. A cap on Part B Annex IX feedstocks is not applied in ReFuel EU Aviation or FuelEU Maritime, there is a risk that either sector may increase these biofuels to reach their respective targets and thereby contribute less to the RED target. The ReFuel EU Aviation blending obligation is more restrictive, as it only allows synthetic aviation fuels[10], advanced biofuels (Part A of Annex IX), or biofuels listed in Part B of Annex IX (and comply with the RED sustainability criteria) to count. Biofuels and biomass fuels from feedstocks not listed in Annex IX (such as food/feed crops), as well as recycled carbon fuels, do not count towards the blending obligation. The GHG intensity reduction target of FuelEU Maritime can be met using any energy source, not limited to renewable energy. It is however proposed that biofuels that do not comply with the REDIII sustainability and GHG saving criteria, or biofuels produced from food/feed crops, shall be considered to have an emission factor of the least favourable fossil fuel pathway for this type of fuel, which disincentivises their use. An additional difference in the GHG intensity calculation is that in in FuelEU Maritime, shore-side electricity is assigned a zero GHG intensity irrespective of the type of electricity used, similar to zero-emission technology. In REDIII only the renewable share of electricity consumed can be counted, not all electricity consumed. Furthermore, it is uncertain if shore side electricity is included in the actual calculation of REDIII achievement, since electricity supplied/used in the harbour was previously not in the same statistics as fuel supplied to shipping.

The last main discrepancy are the **actors** responsible for complying with the regulation and reaching the targets. REDIII aims to stimulate the supply of renewable fuels and renewable electricity available in the transport sector per Member State. ReFuel EU Aviation has a similar aim to increase the supply but puts the obligation directly onto the fuel supplier. It cannot be averaged out over the Member States (after the transition period) or compensated between airports; the minimal obligation must be supplied to each airport[11]. FuelEU Maritime targets the demand side of the market by setting targets for ship owners, however the ships may fulfil their target at any port as long as there is adequate certification (not restricted to a EU-port). All ships above 5,000 tonnes (with a few exceptions) will have to adhere to the regulation, regardless of their flag. There is, however, a gap between the *demand* target of the ship owners and the *supply* target of the fuel suppliers, as the REDIII target is not only

[8] Energy from renewable non-fossil sources namely wind, solar (solar thermal and solar photovoltaic), biomass (when complying with the sustainability criteria), geothermal energy, ambient energy, tide, wave and other (Directive 2018/2001)
[9] liquid and gaseous fuels that are produced from liquid or solid waste streams of nonrenewable origin which are not suitable for material recovery or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations
[10] RFNBOs used in aviation
[11] Airport where passenger traffic was higher than 1 million passengers or where the freight traffic was higher than 100000 tons in the reporting period, and is not situated in an outermost region, as listed in Article 349 of the Treaty on the Functioning of the European Union

more ambitious in size (includes all energy supplied to ships, not only ships above 5000 GT) but also limits the fuel types (compared to FuelEU Maritime) that can be used. The potential impacts of the gaps will be discussed in the following section.

2.3 Potential impacts

In Table 2 we present the potential risks and impacts of the previously discussed discrepancies. These are assessed in a qualitative manner and discussed further in detail below. The three main potential risks are regarding achieving the REDIII transport target and the competitive positions of the international sectors such as maritime and aviation.

Table 2 Potential risks and impacts of the discrepancies

Potential risk for	Risk	Likelihood	Impact
Achieving RED Transport target	Road/rail transport will have to compensate in countries with large maritime and aviation sectors	Scenario 1: low Scenario 2: high	Scenario 1: low Scenario 2: medium /high
	LNG (fossil) becomes dominant fuel type in maritime to 2030; no contribution in REDIII	Low	High
	Lower demand due to scope differences (fleet <5000 tonnage excluded from FuelEU Maritime but included REDIII)	High	Low
	ReFuel EU Aviation transition period (until 31 December 2029), fuel obligation is fulfilled outside of Dutch airports	Scenario 1: low Scenario 2: high	Scenario 1: low Scenario 2: medium /high
	Maritime uses higher amounts of Annex IX Part B fuels (REDIII has 1.7% cap)	High	Low
Competitive position: maritime sector	Ships bunker outside EU to avoid higher fuel prices	Medium	Medium/ High
	Non-EU ships avoid EU ports to bypass compliance	Low	Medium
Competitive position: aviation sector	Costs for RED target will be placed on aviation to prevent leakage in maritime	Low	High
	Long-haul flights will 'lay-over' outside of EU to by-pass anti-tankering measures	Low	Medium
	Inflexible sub-mandates hamper investments in the market for advanced biofuels	High	Medium

2.3.1 Potential risks for achieving the REDIII transport target

As shown in the figures below (Figure 2-2), the distribution of greenhouse gas emissions over the sectors in the Netherlands is not the 'typical' distribution of the emissions at EU level. This is mostly due to the size of the maritime sector compared to the road sector. France and Germany have a similar distribution to the EU average, while for example, Belgium resembles the distribution of emissions of the Netherlands (assumed to relate to the major port of Antwerp coupled with a relatively small road transport sector).

There are several other Member States which see a similar distribution to the Netherlands, such as Malta, Greece, Sweden, and to a lesser extent Norway, Cyprus and Latvia. Note that the shares below are based on the 2019 distribution between the sectors (to avoid any distortion to the data caused by the pandemic from 2020 onwards).

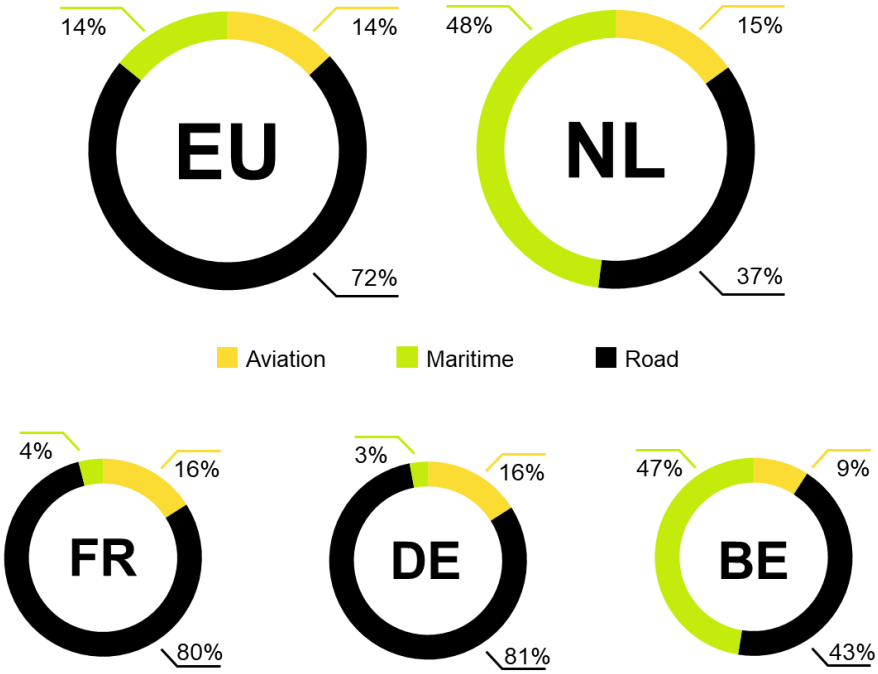

Figure 2-2 Emissions per sector in 2019 (Eurostat, 2021)[12]

For the countries with a higher relative share of emissions and fuel consumption in the maritime or aviation sector compared to the road transport sector, the lower target setting in ReFuel EU Aviation and FuelEU Maritime has a considerable impact if Member States can balance the obligation between sectors (in case of scenario 2). If the aviation and maritime sector would follow the targets in the ReFuel EU Aviation and FuelEU Maritime, the resulting 'burden' on the road sector can become quite high. See Figure 2-3, where based on the estimated contributions of aviation and maritime as indicated in ReFuel EU Aviation and FuelEU Maritime , an estimate is made of what the GHG intensity reduction in the road and rail sectors would need to be to in order for the transport sector overall to reach a 13% GHG intensity reduction. For the EU as a whole, this would require a contribution of 16% from the road and rail sectors, but for example for the Netherlands this would imply a 26% GHG intensity reduction in road and rail to reach the transport target. As comparison this would require a blending of almost 30% of biofuels in road transport (compared to the RED 2020

[12] Aviation includes domestic and international aviation, due to the small size (1.6% of EU emissions and 0.8% of Dutch emissions) domestic navigation is left out of this chart.

10% volume target and to the 14% REDII target).[13] Of course, this GHG intensity reduction does not have to be fulfilled fully by blending of biofuels in road transport but can also be filled through e-mobility or actions in rail transport, but the numbers provided are only intended for comparison. E-mobility could have a high impact if the electricity comes from renewable resources (or for the share of the electricity that comes from renewable sources). The Netherlands is projected to have a 20% share of electric vehicles by 2030.[14]

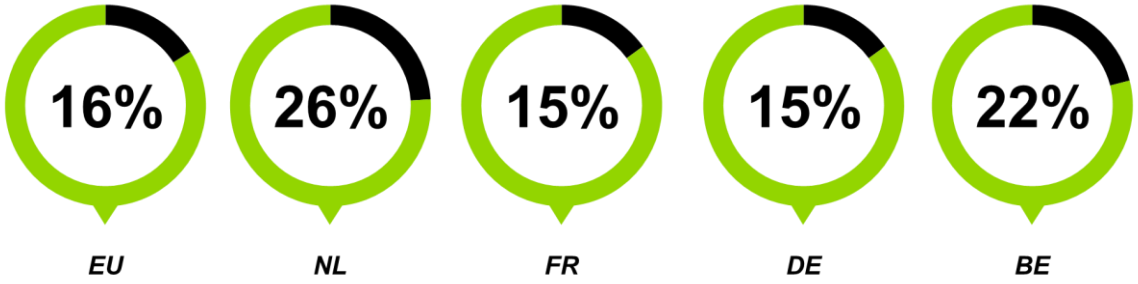

Figure 2-3 GHG reduction contribution for road sector to reach REDIII[15]

The misalignments on allowed energy carriers and feedstocks may provide another risk to the REDIII target. To reach the GHG intensity reduction target of the RED, Member States must use renewable energy (RCFs are allowed to reach the transport target). Within FuelEU Maritime non-renewable sources with a lower GHG intensity could be used to reach that target, such as LNG. LNG is seen as a transition fuel in the impact assessment performed as part of FuelEU Maritime, as the technology is mature, and it would lead to short-term air pollution reduction. The likeliness of the maritime sector reaching the FuelEU Maritime target with only LNG is low. The GHG savings of LNG compared to the widely used heavy fuel oil (HFO) are low; considering methane slip the European Maritime Safety Agency estimate that the savings would be around 10% (EMSA, 2018). A study by CE Delft shows that 100% of fossil LNG would need to be used to meet the FuelEU Maritime target (CE Delft, 2022a). The impact assessment of FuelEU Maritime projects that the savings are expected to come through renewable and low carbon fuels (RLF); 7.2% of the fuels in 2030 are estimated to be biofuels and biogas, of which 76-77% is expected to come from Annex IX Part A feedstocks.[16] According to this projection, the share of biofuels from Annex IX Part B feedstocks are 1.7%, probably based on the overall maximum amount of Part B based biofuels allowed to count towards the overall REDIII transport target. Based on the FuelEU Maritime scenarios, it would not be likely that LNG in the maritime sector will be a large threat to the achievability of the REDIII transport target.
Furthermore, neither ReFuel EU Aviation nor FuelEU Maritime has a limit on the amount of Annex IX Part B feedstock that may be used for biofuels, while there is a 1.7% cap in REDIII. These fuels would not contribute towards the REDIII transport target, beyond the cap. Nevertheless, due to the lower price and availability of Annex IX Part B fuels we deem it likely that the ship owners bunker these types of fuels. It is important to note that ship owners comply with the FuelEU targets and do not have an obligation towards the REDIII transport target and may fulfil this FuelEU target at any port (inside or outside of the EU).

[13] The Dutch implementation of REDII (Besluit energie vervoer 2022-2030) does include a share of renewables in road/rail of 28% but in this also allows for a share of 10% of Part B Annex IX fuels.
[14] https://www.pwc.nl/nl/assets/documents/pwc-onderzoek-elektrisch-rijden.pdf
[15] Assuming that maritime and aviation only contribute sufficient to reach FuelEU and ReFuel targets, including multipliers for advanced biofuel share in maritime and aviation (shares and fuel mix projections are taken from the impact assessments of ReFuel and FuelEU).
[16] Impact Assessment Accompanying the Proposal for a Regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport, p. 126-127

There are two additional scope related gaps between the FuelEU Maritime and REDIII that may impact the achievability of the REDIII transport target. Firstly, FuelEU Maritime addresses ships over 5,000 gross tonnage, which is currently 55% of the ships calling at EU ports and account for 90% of the CO_2 emissions. That means that 55% of the existing fleet has an incentive to consume RLF, the remaining fleet consisting of smaller ships do not have a demand incentive and thus will likely contribute less to the RED target. However, as the remaining 45% of the fleet is only responsible for 10% of the CO_2 emissions, the impact on the RED target is minimal. Secondly, FuelEU Maritime includes the demand of all ships that call to an EU harbour, regardless of their flag, regardless of where they bunker RLF to reach the target. There is a risk that ship owners will bunker outside of the EU for their renewables and reach their FuelEU Maritime target, without contributing to the overall REDIII target. So ensuring competitive supply of renewable fuels in Rotterdam (e.g., through scaling, support in infrastructure or alignment with ship owners on the types of fuels offer) could reduce the risk of ship owners filling their demand on a different location and thus the supply share not contributing sufficiently to the overall REDIII target.

2.3.2 Competitive position of the Dutch maritime sector

The Netherlands has a substantial maritime sector with a strong international focus; for example, the Port of Rotterdam is the largest port of Europe. Member States put the REDIII GHG intensity reduction transport target on fuel suppliers, which means the fuel suppliers are responsible for supplying renewable fuels at the port and blending to a certain degree. This will increase the fuel prices at ports in the Netherlands and might make non-EU ports seem more attractive for bunkering, see Figure 2-4. Relative to the other sectors, the prices of renewable alternatives are lower in the maritime sector due to less strict quality requirements for maritime fuels and the absence of blending walls. This relative price difference is not likely to change soon in the future.

CE Delft calculated the financial impacts of all FF55 packages[17]; between 2024-2029 the annual fuel costs are projected to increase between 61% and 73% for Dutch ships. The majority of these additional costs relate to EU ETS, see Figure 2-4 below. The figure shows the additional costs that the FF55 packages bring, presenting a low and high biofuel price scenario (no high/low fossil price scenario). The figure further shows the total share of the additional costs of the REDIII and FuelEU targets. In a low price scenario, the total share for the 6% GHG reduction target (scenario 2) would be 7%, in a high price scenario 34%. For the 13% GHG reduction target (scenario 1), this would be 16% and 54% respectively. In case that biofuel prices are similar to current, there is only a 2% difference in price increase between a 6% GHG reduction target and 13% GHG reduction target. In the high biofuel price scenario this difference in price could increase to 24% compared to the 6% GHG reduction target in a high price scenario. When increasing the blending target to 13%, the costs for EU ETS decline with 9%, as an increase of renewables leads to lesser emissions thus lower EU ETS costs.

[17] EU-ETS, FuelEU Maritime, ETD, RED and AFIR.

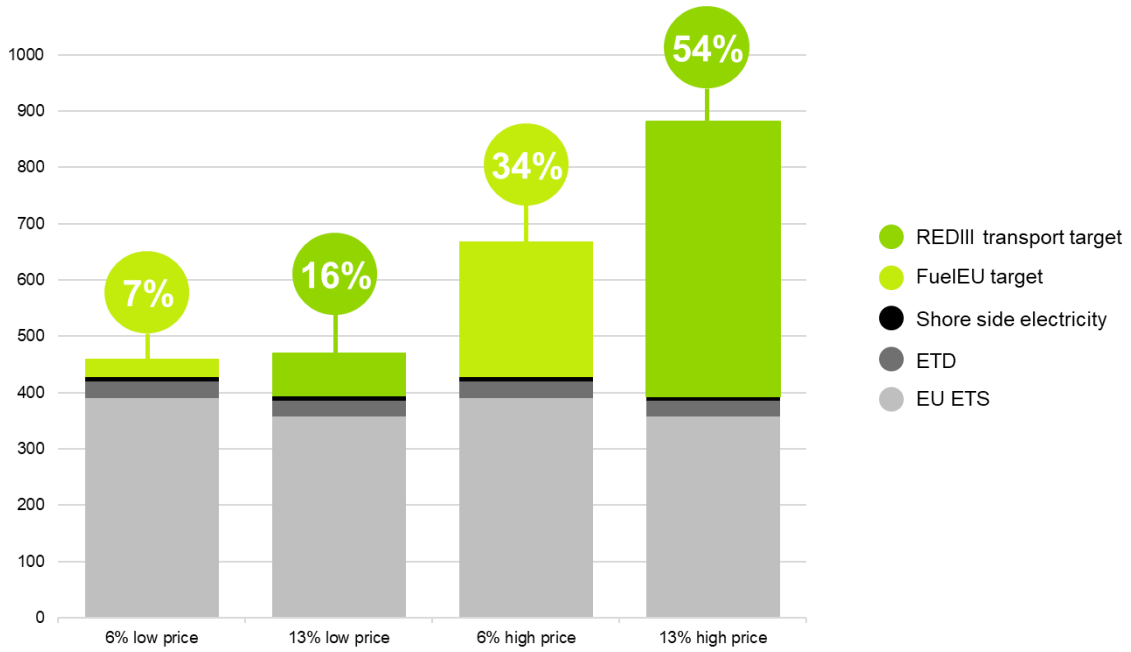

Figure 2-4 Additional costs maritime sector FF55 packages, in million € (CE Delft 2022b)

FuelEU Maritime partly addresses the risk of carbon leakage (as a result of price increases at EU bunkering locations) by setting demand obligations for all ship-owners who call at an EU port, regardless of their flag. The demand obligation could have unwanted side-effects, as the obligation could potentially be fulfilled anywhere. Ships may bunker renewables at a non-EU port, and it would count towards their FuelEU Maritime demand target. Additionally, non-EU shipowners may avoid EU ports altogether to bypass compliance with FuelEU Maritime. When considering costs at ports and travel time, the savings of fuel costs would not be sufficient for shipowners calling to an EU port to re-route and bunker elsewhere according to the impact assessment of FuelEU Maritime. There is therefore a minimal risk of re-routing to bypass the FuelEU Maritime.

It is essential to match the supply of the alternative fuels with the compatible engines in the existing fleet, as multiple fuel types are used in maritime. The impact assessment of FuelEU Maritime assumes that nearly all the RLF on the market will be biofuels and bio-LNG in 2030. It is important to note that ship owners need to obtain permission from the engine manufacturer before bunkering alternative fuels to guarantee the warranty of the engine.

There are limitations on the type of fuels that can count towards the FuelEU target, most notably biofuels from food and feed crops are counted with the same emission factor as fossil fuels, practically excluding them, and an indirect limitation on Annex IX B fuels through REDIII (until 2030; FuelEU Maritime has targets until 2050). These limitations could be a risk to supply at a commercially competitive price.

Lastly, the gap between supply and demand targets could increase the price of renewables. Since the target for supply is higher than demand [18], the consumption is not guaranteed which increases risks for the supplier. Certain REDIII eligible fuels (such as food and feed crops) do not count towards the FuelEU Maritime target and therefore will not likely have a demand in the maritime sector. Furthermore, the demand side obligation from FuelEU Maritime can be spread by ship owners over their fleet – not all ships will have to obtain a certain reduction, but the fleet of a ship owner would need to obtain it overall (e.g., so in

[18] Note that ships may fulfil the FuelEU target both in EU ports as outside of the EU.

case they have 10 ships, they could potential have only one running on renewables to meet their target). This would mean that not all ships calling at the Rotterdam port will be interested in RLF, but it will be essential to reach those which are (to sell you 'obligatory' supply). The current award in the Netherlands of HBEs in maritime for all fuels ends in 2025, creating an uncertain and risky environment for the consumption and development of the renewables in maritime after 2025. This risk would be eliminated if the HBE system would be altered to include maritime after 2025 (with their own obligation).

However, it could also be a huge opportunity for the Dutch ports in becoming frontrunners, mainly for the Port of Rotterdam. In 2018, the Netherlands was the third largest biofuel producer in Europe (PBL, 2020), and there are currently five biofuel production facilities in Rotterdam. This port is already part of one of the largest renewable industrial clusters, laying the foundation for a biofuel hub by using their existing infrastructure.

2.3.3 Competitive position of the Dutch aviation sector

The aviation sector represented about 15% of the emissions of the Dutch transport sector in 2019. ReFuel EU Aviation, similar to the REDIII, puts in place a supply 'push'. Additionally, ReFuel EU Aviation requires aircraft operators to uplift 90% of the yearly quantity of aviation fuel when departing from an EU airport as to reduce the risk of leakage to outside EU airports. As the maritime sector does not have this obligation for ships calling at ports to bunker, the aviation sector has concerns that they will carry the costs for the REDIII target to keep the fuel prices low in the maritime sector. ReFuel EU Aviation requires the obligation for fuel suppliers to supply renewable fuels at each airport. This limits the ability of the Dutch aviation sector to concentrate their efforts on the largest airport, Schiphol. When fuel suppliers would be able to concentrate their efforts, this could create efficiency effects in terms of infrastructure and scaling.

The risk of 'leakage' is also present in the aviation sector, but to a less extent than in the maritime sector. The only risk for leakage is with long-haul flights which might re-route their lay overs outside of the EU (e.g., Istanbul or London). CE Delft (2021)[19] estimated that about 22% of the transfer flights at Schiphol would be prone to the risk of losing market share to alternative hubs, but over 16% of these had a destination or starting point in Europe. Since ReFuel EU Aviation requires the same targets for each European airport to be met, the relative competitiveness of Schiphol with other European airports would not be impacted.

ReFuel EU Aviation provides a transition period, running until December 2029[20], that allows fuel suppliers with the option to concentrate their efforts in one airport, or even across Member States. This presents a risk that capacity or infrastructure for fuel supply could be initially concentrated at an airport outside the Netherlands, and thus not allowing Schiphol to take a frontrunner position in this field. In scenario 2 this would mean that the REDIII transport target would be more difficult to reach.

According to the ReFuel EU Aviation proposal, compliance cannot be met using recycled carbon fuels (whereas this fuel type is allowed within the REDIII and FuelEU Maritime). If the aviation sector would not be able to use these fuels for the ReFuel EU Aviation target, that could mean less interest in companies, such. as LanzaTech, to develop production facilities in the Netherlands.[21] RCF could still be used in aviation to reach the REDIII transport target.

An additional element which could hamper such a frontrunner position for Dutch aviation is that ReFuel EU Aviation sets an obligation of 6% in 2030, but (unlike REDIII) does not allow

[19] Effects of the Fit for 55 Package on the Dutch Aviation Sector, December 2021

[20] Likely to be extended to December 2034, but not yet confirmed

[21] Please note that the Dutch implementation of REDII for now does not allow the use of recycled carbon fuels in the transport sector as eligible renewable fuels.

Member States to set a higher obligation. This could only be implemented through voluntary agreements, in which any additional costs would need to be borne by fuel suppliers. A higher obligation level and trajectory could serve as a positive investment signal for fuel producers, in particular for more innovative technologies. This could further reduce the risk that the mandate for 2030 is met by supplying 'less innovative' fuels, such as Annex IX Part B biofuels. With significant ongoing activities in the Dutch aviation sector, a longer-term view on more innovative technologies could be an advantage. Another element contributing to this is the relatively low sub-target of 0.7% for synthetic aviation fuels in 2030. In the Netherlands there are some initiatives looking into these. However, the low target for 2030, will not be an incentive to build up capacity on these types of fuels on the short term, especially if the overall obligation can be met with fuels produced through commercial technologies that use 'cheaper' feedstocks like Annex IX Part B. A potential increase on top of the obligation, if for example this would be fulfilled by innovative fuels, could give an additional interest and longer-term business perspective to Dutch aviation fuel suppliers.

3. Possible solutions and recommendations

Based on the discrepancies identified and the resulting risks for target achievement as well as for the competitive position of the Dutch aviation and maritime sector, several possible solutions and recommendations are formulated below.

The main solutions focus on either aligning the REDIII, ReFuel EU Aviation and FuelEU Maritime targets (e.g., in terms of gap, feedstock types), working with the sectors to facilitate them reaching/going beyond (information provision, alignment with REDIII provision, taking frontrunner lead, voluntary commitments) or finding options for compensation or additional contributions from the road/rail sector.

3.1 REDIII, ReFuel EU Aviation and FuelEU Maritime

3.1.1 Target size

To address the discrepancies in the targets, the ambitions of ReFuel EU Aviation and FuelEU Maritime could be increased to match the REDIII transport target, which is relevant in scenario 2. A **higher demand target** in FuelEU Maritime that is more aligned with the supply (REDIII transport) target would decrease risks and costs for the supplier, as there is a market for the supply.[22] For aviation, the gap between REDIII transport target and ReFuel EU Aviation target could be bridged by providing **more flexibility in the sub targets** regarding synthetic aviation fuels, by allowing Member States to set obligations and potentially allowing Member States to increase the 6% mandate for aviation with an equivalent increase in the target for synthetic aviation fuels. There are several projects in the Netherlands targeting synthetic aviation fuels that could be implemented before 2030 if there is an incentive, giving the Dutch aviation market a chance of becoming front runners. Currently the level of the sub target for synthetic aviation fuels could hamper the development of the industry within the Netherlands.

3.1.2 Fuel types

Ambitions could also be increased by **limiting LNG incentives** in FuelEU Maritime and **extending the cap on biofuels and biogas from Part B of Annex IX** from REDIII to FuelEU Maritime and ReFuel EU Aviation from 2030 onwards. This allows the sectors to potentially use the cheaper Annex IX Part B fuels to reach their 2025 targets but still contribute to the REDIII transport target in 2030. It is important to note that increasing the ambitions for the sectors, especially maritime, may have implications for the competitive position due to increasing costs and fuel supply limitations. Annex IX Part A and RFNBOs are currently only available in limited supply, which could pose a risk for the maritime sector if feedstocks listed in Annex IX Part B are not allowed. On the other hand, if there is a higher demand for Annex IX Part A and RFNBOs in the aviation and maritime sector, there is a potential for faster developments in the market to make these fuels more readily available.

3.1.3 Balancing sectors

In case of scenario 2 (REDIII target), it would be good to flag the impact that the current design of the policy package (e.g., the balance between demand and supply / aviation and maritime starting on the decarbonization pathway) has on road/rail sectors in countries with relatively large share of maritime or aviation sectors.

[22] The FuelEU allows ship owners to reach their target with fuels provided anywhere, not limited to EU. Thus, an increase in the demand target does not automatically lead to a higher demand for renewable fuels in the EU.

For the aviation sector being allowed to group their supply more flexibly over the airports within one country could allow for scale effect but would thus require a change in ReFuel EU Aviation which currently sets it as mandatory supply at each airport.

3.2 Other (legislative) proposals

Other solutions beyond ReFuel EU Aviation/FuelEU Maritime/REDIII could be for the Dutch government to stimulate the impacted sectors to avoid leakage, such as facilitating investments in green infrastructure to stimulate and facilitate their positions as front runners. For the maritime sector, providing a platform will give more clarity on the pathways that the sectors can take, share insights on regulations, types of fuels and intentions more easily and work together to strengthen the sector.

The Port of Rotterdam is already an international hub with existing infrastructure and biofuels production, scaling up the biofuels production would give the Dutch maritime sector a competitive advantage over the other ports as the renewable fuels become more financially attractive. In case efforts to obtain the 'remaining' GHG intensity reduction (in scenario 2) from the road sector are hardly feasible or very costly compared to the maritime sector, a trading system (like HBEs) could be kept in place after 2025 to allow the maritime sector, where decarbonisation might then be cheaper, to benefit from additional action beyond their in FuelEU Maritime targeted share. However, this would mean that costs for decarbonising the maritime sector would end up in the road sector and hamper the decarbonisation developments of the maritime sector further. Making large efforts to decarbonise shipping would be less costly than the aviation or additional efforts in the road transport sector and compensate for the rigid aviation blending mandates. For the maritime sector it will also be important to ensure an alignment between demand and supply of the different types of fuels. Additionally, it will be essential to try and stimulate the maritime sector to opt for types of fuels which would also contribute to the REDIII transport target (as to avoid their contribution does not contribute to the overall transport obligation).

In case of scenario 2, agreeing on and incentivizing voluntary additional efforts in the aviation sector beyond the mandate could be a way forward in case the gap between the ReFuel EU Aviation and REDIII remain.

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Appendix A. Overview

A.1 Table A-1 Overview of the (proposed) EU regulations

Directive/Regulation	Name measure	RES type(s)	Scope	Target(s) & timeline	Actor(s)	Notes
RED III	Article 25, 1(a)	Renewable fuels and renewable energy	Transport sector	GHG intensity reduction of 13% by 2030	Member States on fuel suppliers	-It is not defined how maritime and aviation should be counted towards the target (e.g., 100% intra-EU and 50% extra-EU, which ship, and aircraft sizes should be included etc.). -Transport (and sub-sectors included) is not defined in RED -GHG intensity reduction is calculated with fossil fuel comparator (94 g CO2eq/M as defined in REDII, for electricity is 183 g CO2eq/MJ). GHG savings calculated: for biofuel and biogas, by multiplying the amount of these fuels supplied to all transport modes by their emissions savings. For renewable fuels of non-biological origin and recycled carbon fuels, by multiplying the amount of these fuels that is supplied to all transport modes by their emissions savings. For renewable electricity, by multiplying the amount of renewable electricity that is supplied to all transport modes by the fossil fuel comparator as defined in REDII for electricity. -The share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX shall be limited to 1,7 % of the energy content of transport fuels and electricity supplied to the transport sector -Biofuels and biomass fuels produced from food and feed crops maximum 7% of the share of the final energy consumption in the transport sector -Member States have the flexibility to balance the overall reduction target between between sectors. -May take recycled carbon fuel into account if the savings are minimum 70%. -Biofuels and biomass fuels must comply with RED sustainability criteria
RED III	Article 25, 1(b)	Advanced biofuels and biogas	Transport sector	Share (based on energy content): – 0,2% in 2022; – 0,5% in 2025; – 2,2% in 2030	Fuel suppliers	Shares of advanced biofuels and biogas and of RFNBO supplied in the aviation and maritime sectors shall be considered to be 1,2 times their energy content.
RED III	Article 25, 1(b)	RFNBO	Transport sector	Share (based on energy content): 2,6 % in 2030	Fuel suppliers	Shares of advanced biofuels and biogas and of RFNBO supplied in the aviation and maritime sectors shall be considered to be 1,2 times their energy content
FuelEU Maritime	Article 4, 1-2	Energy used on-board	Maritime	GHG intensity reduction of: – 2% from 1 January 2025; – 6% from 1 January 2030; – 13% from 1 January 2035; – 26% from 1 January 2040; – 59% from 1 January 2045; – 75% from 1 January 2050	Ship owners	-LNG allowed as a transition fuel & supported in proposed AFIR regulation (Article 11). LNG consumption would not count towards RED target. -Biofuels and biogas that are produced from food and feed crops will have the same emission factors as the least favourable fossil fuel pathway for this type of fuel -GHG intensity reduction is calculated using the fleet average greenhouse gas intensity of the energy used on-board by ships in 2020 as a reference value (thus a different reference value from RED) -Ships over 5000 gross tonnage, regardless of their flag , regarding energy used within a port of a Member State, 100% of intra-EU voyages and 50% of extra-EU voyages. Excluding warships, naval auxiliaries, fish-catching or fish-processing ships, wooden ships of a primitive build, ships not propelled by mechanical means, or government ships used for non-commercial purposes. -Renewable and low carbon fuels (RLF) are not defined in the Directive -May take recycled carbon fuel into account if the savings are minimum 70%.
FuelEU Maritime	Article 5	Energy used on-board	Maritime	Obligation to use on-shore power supply or zero-emission technology in ports by 1 January 2030	Ship owners	Mandatory use of on-shore power supply by passenger and container ships unless they demonstrate the use of another zero-emission technology laid out in Annex III (e.g. fully powered by renewable and low carbon fuels). It is included in the GHG intensity formula in the Regulation, but it is set at zero (which is a different value than in RED).
ReFuel EU Aviation	Article 4	Sustainable aviation fuels	Aviation	Blending obligation (volume) of: – 2% from 1 January 2025; – 5% from 1 January 2030, of which 0.7% synthetic aviation fuels; – 20% from 1 January 2035, of which 5% synthetic aviation fuels; – 32% from 1 January 2040, of which 8% synthetic aviation fuels; – 38% from 1 January 2045, of which 11% synthetic aviation fuels; – 63% from 1 January 2050, of which 28% synthetic aviation fuels	Aviation fuel suppliers	-Obligation lower than RED value and formulated in volume (RED in GHG intensity), so for comparison this obligation would be lower than 5% in GHG intensity reduction. -90% of the expected demand of each airport within EU has to be supplied to. The supply cannot be balanced between airports, fuel suppliers have to reach the blending obligation at each airport. However, there is a transition period until 31 December 2029 where the minimum share of SAF can be a weighted average of supply across whole of EU (this could be conflicting with overall RED target per MS). -SAF includes: synthetic aviation fuels (RFNBO) and biofuels from feedstocks listed in Annex IX A or B (and comply with the RED sustainability criteria).
AFIR	Article 9, 1	Electricity	Maritime	Shore-side power output to meet at least 90% of that demand by 1 January 2030	TEN-T maritime port	
AFIR	Article 12	Electricity	Aviation	Provision of electricity supply to stationary aircraft by:	TEN-T airports	

Directive/Regulation	Name measure	RES type(s)	Scope	Target(s) & timeline	Actor(s)	Notes
				-1 January 2025, at all gates used for commercial air transport operations. -1 January 2030, at all outfield posts used for commercial air transport operations		
AFIR	Article 11	LNG	Maritime	Appropriate number of refuelling points for LNG at TEN-T core maritime ports for TEN-T core network sea going ships by 1 January 2025	Member states	
ETS Directive	Article 3, Article 9, Article 16		Maritime	Reporting target: – 20% of verified emissions reported for 2023; – 45% of verified emissions reported for 2024; – 70% of verified emissions reported for 2025; – 100% of verified emissions reported for 2026 and onwards. Emission allowances decrease 2.2% each year. Increase of 79 million allowances for maritime transport in the year the amendment follows entry	Shipping company	-100% emissions from transport intra-EU and at berth at an EU port, 50% of the extra-EU emissions, 100% of the emissions at berth. -Ships above 5000 gross tonnage, excluding warships, naval auxiliaries, fish-catching or fish-processing ships, wooden ships of a primitive build, shops not propelled by mechanical means, or government ships used for non-commercial purposes (as per Regulation (EU) 2015/757)
ETS Directive (amendments regarding aviation)	Article 3, (Article 3 and Article 9 of ETS Directive)		Aviation	Quantity of allowances that shall be auctioned: – 25% by 2024; – 50% by 2025; – 75% by 2026; – 100% by 2027 Emissions allowances decrease with a linear factor of 4.2% each year	Aircraft operators	Aircraft operators that produce annual CO2 emissions greater than 10 000 tonnes from the use of aircrafts with a maximum certified take-off mass greater than 5 700 kg conducting flights, except state flights, humanitarian flights, medical flights, military flights, and firefighting flights.
ETD	Article 14, Article 15		Aviation and Maritime	Remove tax exemptions on maritime and aviation fuel starting 1 January 2023		-Exemptions: Sustainable biofuels and biogas, low-carbon fuels and RFNBO, and advanced biofuels will have a zero rate minimum tax for transition period of 10 years. -Exemption for cargo flights. minimum tax rate of LPG, natural gas and non-renewable hydrogen will be slowly increased to match tax of other fossil fuels. Kerosine tax for aviation will slowly be increased in a linear way until it reaches the minimum tax rate.
ESR	Article 1, Article 2		Transport sector	40% below 2005 GHG emissions levels by 2030	Member states	ESR only covers what ETS does not cover. International shipping and international aviation are excluded, as they are covered by ETS

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