The impacts of the ETD proposals on shipping and bunkering

CE Delft

Committed to the Environment

The impacts of the ETD proposals on shipping and bunkering

This report was prepared by: Jasper Faber, Roy van den Berg and Louis Leestemaker

Delft, CE Delft, November 2021

Publication code: 21.210349.155

Ships / Fuels / Prices / EU regulation / Emissions / Taxes / Effects

Client: Havenbedrijf Rotterdam

Publications of CE Delft are available from www.cedelft.eu

Further information on this study can be obtained from the contact person Jasper Faber (CE Delft)

CE Delft
Committed to the Environment

Through its independent research and consultancy work CE Delft is helping build a sustainable world. In the fields of energy, transport and resources our expertise is leading-edge. With our wealth of know-how on technologies, policies and economic issues we support government agencies, NGOs and industries in pursuit of structural change. For 40 years now, the skills and enthusiasm of CE Delft's staff have been devoted to achieving this mission.

Content

Summary

The ‘Fit for 55’ package, presented by the European Commission in July 2021, aims to achieve a 55% reduction in greenhouse gas emissions in 2030 compared to 1990. One of the proposals included in the package is a revision of the ‘Energy Taxation Directive’ (ETD), among which abolishment of the exemption of marine fuels from energy taxation. When bunker fuels face taxes in the EU, it might have disruptive effects on the competitiveness of the European bunker market as the choice of bunkering locations is very price sensitive. In practice, shipping companies choose the least expensive place to bunker. This study evaluates the potential impact of the proposed energy tax on liner and tramp shipping in the European bunker market.

Currently, the port of Rotterdam is the largest bunker port in Europe with the lowest bunker prices in the world. Over two thirds of the vessels calling at Rotterdam bunker in Rotterdam as well, so a significant amount of the marine fuel would be taxed under the proposed ETD revision. Our analysis shows that Rotterdam would become one of the most expensive ports in the world when energy taxes are added to the bunker price. Given their large bunker capacities, vessels will simply relocate to cheaper ports. A large container vessel can take in enough fuel at one port to sail from Asia to Europe and back.

Therefore, it is reasonable to expect that due to a revision of the ETD, European ports will not be able to offer competitive bunker prices compared to many ports outside of the EU. There is a significant risk that bunkering activity will be relocated to non-EU ports. This means that the intended effects of taxation are not achieved; shipping companies are able to avoid paying tax, so the price of transport will not increase. There is no financial incentive to reduce fossil fuel use and avoid greenhouse gas emissions. In addition, enforcement turns out to be difficult in tramp shipping as the next destination of a vessel is unknown.

The potential relocating of bunker activity to ports outside of the EU, would imply: no reduction in greenhouse gas emissions, no tax revenues for European ports and a loss of associated economic activities in the EU. The risk of relocating is caused by the lack clarity of the proposed ETD, the current practise to levy energy tax and the fact that ships are able to bunker for multiple voyages. This, in combination with an absence of taxation at non-EU ports, creates an uneven playing field that negatively impacts the competitive position of the European bunker market.

We have identified six possible amendments to the current policy proposal to address the relocation risk. Out of these six, *decreasing the scope to a share of the fuels supplied* and *pay for use* seem to be most logical as it would reduce the distortion of the competitive market significantly. The downside is that these suggestions require either a complex administration or a different tax infrastructure. It is also crucial that the European Commission provides clear guidance on how tax authorities should distinguish between fuels used in intra- and extra-EU waterborne navigation to avoid market distortions *between* EU Member States that may arise due to differences in national implementation. Another option is to *completely exempt marine fuels from the tax*. It is better to avoid taxation fuels in Europe than to introduce a tax that causes the European bunker market to collapse.

1 Introduction

1.1 Proposal to revise ETD

The European Commission presented the 'Fit for 55' package earlier this year. This package includes a range of different policy proposals with the aim to achieve a 55% reduction in greenhouse gas emissions in 2030 compared to 1990. One of the proposed policies is a revision of the 'Energy Taxation Directive' (Directive 2003/96/EC) (EU, 2003), which includes a proposal to abolish the exemption of marine fuels from energy taxation. Until now, marine fuels have been excluded from taxation.

In the proposal for a revised Energy Taxation Directive (EC, 2021), a minimum rate for the tax on marine fuels is included. This minimum rate depends on the environmental performance of the fuel. For heavy fuel oil (HFO, in which low-carbon fuel oils are probably included), a minimum tax rate of 0.9 euro's per gigajoule of fuel was proposed. Since euro's per gigajoule is not a conventional way to express fuel prices, we will in this report express the prices in dollars per metric ton ($/mt). For 'Very Low Sulfur Fuel Oil' (VLSFO), the proposed tax would result in a price increase of about 43 $/mt[1].

The choice of bunkering locations is very sensitive for price differences between potential bunker locations. This has the following main reasons:

1. Fuel costs are a large share of the operational costs in shipping. Also, the profit margins are slim. Potential cost savings with respect to bunkering are therefore relevant.
2. The large vessels which are used in international shipping have a large bunker capacity with respect to their fuel use. As a result of this, ships do not need to bunker at each opportunity. Therefore, the most attractive location on the route can be chosen.

For these reasons, the effects of a taxation on bunker fuel in the EU can have disruptive effects on the competitiveness of the European bunker market.

An indication of the sensitivity of bunkering location to prices is given by the experience in California, which introduced a fuel tax on marine fuels in the 1990s which coincided with a decline in bunkering volumes. LAO ((2001), (2007)) finds that at least a part of the decline was due to the fuel tax.

The intention of the revised Energy Taxation Directive is to tax fuels used in voyages between two ports within the European Union. However, as was stated earlier in this section, the current practice is that ships bunker much more fuel than needed just to reach the next port of call. Also, since there is no need to bunker within the EU, shipping companies can make the choice to bunker elsewhere and avoid taxes.

1.2 Scope and aim of the study

The aim of this project is first of all to identify the effects of the proposed revision of the ETD on the European bunker market. The second aim is to analyse which amendments to the current policy proposal would address some of the risks associated with the current policy proposal.

[1] This calculation was made by assuming an energy density of 41.6 MJ/kg and an exchange rate of 1.16 USD/Euro (October 27, 2021).

The analysis in this study is largely focussed on the Port of Rotterdam, which is the largest bunker port in Europe. However, the risks which are identified in this study also apply to other ports within the European Union.

Interpretation of the ETD revision

The proposed revision of the ETD (EC, 2021) states a minimum price for marine fuels for intra-EU waterborne navigation. This is defined as follows:

- *"For the purposes of this Article, 'intra-EU waterborne navigation' shall mean navigation between two ports located in the Union, including domestic navigation." (Article 15).*

This leaves room for different interpretation. For example, it is not clear when bunkered fuel should be taxed: does the tax apply to all bunkered fuel if the next port of call is within the EU, or is only to the amount of fuel which is needed to reach the next port(s) subject to the tax? This ambiguity could lead to issues. For example, when national tax authorities, which are responsible for charging the taxes, have a different interpretation of when the tax should be charged. This could harm the level playing field in the European Union. For the purpose of this study we needed to base our analysis on a certain interpretation of the policy proposal. We assume, in line with the current practice of fuel taxation, that the taxation in the European Union is implemented in every member state as follows:

- *Whenever a vessel bunkers in an EU port and the next port of call is within the EU, the tax applies to the full amount of fuel which is bunkered.*

The common practice in energy taxation is to levy energy taxes on liquid fuels at tax warehouses. When the fuels are brought into circulation, i.e. when they leave the warehouse, energy taxes are levied (CE Delft et al., 2014). Bunker fuels, in contrast, are kept in bunkers and not subject to energy taxes. When Tax Authorities would implement the energy taxation directive, it is possible that they use a similar structure for taxing fuels used in waterborne transport. They would then need to make a distinction between intra-EU and extra-EU waterborne transport. Possible parameters for such a distinction could be the location of the next port of call.

1.3 Outline of the report

This study first of all provides an overview of the current bunkering choices in maritime shipping (Chapter 2). The differences between the two main types of shipping (container and bulk) are identified, and the current bunkering choices are analysed in detail with the use of data supplied by the Port of Rotterdam. Chapter 3 provides an analysis of the impact of the proposed revision of the ETD. For container shipping, this analysis is done based on the sailing pattern of two actual vessels. For bulk shipping, where regular sailing patterns are uncommon, different scenarios are identified and analysed. Chapter 4 includes concrete advice on how to reduce the negative effects which would result from the current proposal for the revision of the ETD.

2 Where & when do ships bunker?

2.1 Introduction

In this chapter, the current practice of bunkering in maritime shipping is analysed in some detail. The chapter focusses on bunkering in ports. It is also possible to bunker at sea, but this is less common. An important aspect for the bunkering choices of shipping companies is the amount of distance which can be sailed without bunkering. A short analysis of the bunker capacities, and corresponding distances that can be sailed, is included in Paragraph 2.2.

When discussing bunkering choices in maritime shipping, a distinction between two types of shipping exist: liner shipping and tramp shipping. Paragraph 2.3 contains a definition of these two categories. Paragraph 2.4 focusses on the bunkering choices in container shipping (container ships are always liners). Paragraph 2.5 focusses on the bunkering choices in bulk shipping (most bulk ships are tramps).

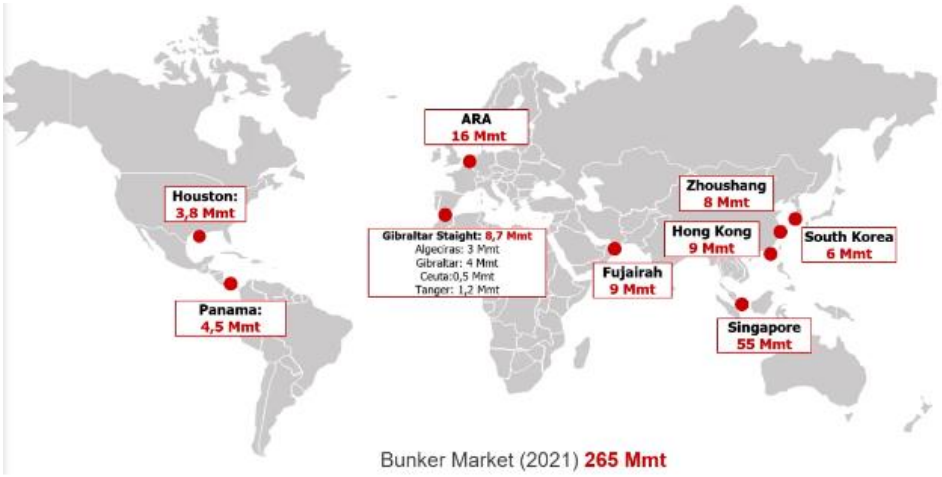
2.2 Bunker capacities in maritime shipping

The ships used in international shipping have large bunker capacities, which means that they can call a significant amount of ports without bunkering.

Table 1 contains an overview of the distance that can be sailed without bunkering per ship and size category. From this table, it is clear that the distances that can be covered when a ship is fully fuelled are larger than the distances between main bunker ports:
- Rotterdam-Fujairah: 7,000 nm;
- Rotterdam-Singapore: 9,300 nm;
- Rotterdam-Houston: 6,200 nm.

Resulting from the distances that can be sailed, shipping companies have a large flexibility to choose the most convenient location to bunker; whenever one bunker port is expensive, they will usually pass by one or more less expensive bunker ports before they need to bunker. In practice, this results in the ships bunkering at the least expensive location.

Figure 1 – Main bunker hubs worldwide



Source: (Repsol, 2021).

Table 1 – Distance that can be sailed on a full bunker fuel tank

Ship type		Unit	Distance on one fuel tank (1,000 nm)
Bulk carrier	0-9,999	dwt	51
Bulk carrier	10,000-34,999	dwt	33
Bulk carrier	35,000-59,999	dwt	31
Bulk carrier	60,000-99,999	dwt	31
Bulk carrier	100,000-199,999	dwt	33
Bulk carrier	200,000-+	dwt	35
Container	0-999	teu	38
Container	1,000-1,999	teu	32
Container	2,000-2,999	teu	33
Container	3,000-4,999	teu	31
Container	5,000-7,999	teu	30
Container	8,000-11,999	teu	33
Container	12,000-14,499	teu	38
Container	14,500-19,999	teu	46
Container	20,000-+	teu	50
Oil tanker	0-4,999	dwt	16
Oil tanker	5,000-9,999	dwt	13
Oil tanker	10,000-19,999	dwt	10
Oil tanker	20,000-59,999	dwt	11
Oil tanker	60,000-79,999	dwt	14
Oil tanker	80,000-119,999	dwt	17
Oil tanker	120,000-199,999	dwt	19
Oil tanker	200,000-+	dwt	28

Source: CE Delft&Ecorys, (2020).

2.2.1 Position Rotterdam

With a volume of 9.6 million tonnes of bunker fuel in 2020, Rotterdam is the largest bunker port in Europe and part of the largest bunker cluster in Europe (ARA region as included in Figure 1). On a global level Rotterdam had a market share of around 4%[2] in 2020, lagging far behind market leader Singapore with a market share of roughly 20%. Another 20% is bunkered in the United Stated of America, United Arab Emirates and Russia.[3]

2.3 Difference between liner shipping and tramp shipping

In shipping, a distinction between two types of sailing can be made (Stopford, 2009):

1. Liners, which are ships which sail between a number of ports in a repeating pattern.
2. Tramp shipping, which means that the next port of call is chosen based on the current demand. These ships therefore sail in unpredictable patterns and do not always know what their next port of call will be.

Because of the significant differences between these two types of shipping, the analysis of the impacts of the proposed bunker fuel tax is presented separately for both categories.

All container ships are liners. On the other hand, 60% of bulk vessels are used for tramp shipping (Robertshaw, forthcoming). Other ship types, such as cruise ships, can be either liners or tramps.

2.4 Bunkering choices for container shipping

All container ships are liners, as are most RoRo and RoPax ships. Liners offer predictable timing to their customers and therefore bunker at the ports in their schedule, i.e. ports where they load or unload cargo. Over time a sailing schedule can also be adjusted to include a port where it is cheap(er) to bunker and where there is a demand to tranship cargo.

2.4.1 Data Rotterdam

The Port of Rotterdam provided us with statistical information of container feeder and deep sea operators which visited the Port of Rotterdam between 1 January and 30 September 2021. For all of these voyages, it was registered whether:

- The next port of call was within the EU, within Europe but outside the EU[4] or outside of the EU[5].
- Whether the ship bunkered in Rotterdam.

Table 2 - Bunker behaviour and the next port of call for containerships visiting the Port of Rotterdam

	Visits	Visits with bunker activity	Percentage of visits with bunker activity
Within Europe, outside EU	1,197	779	65%
Outside EU	575	339	59%
In EU	2,854	1,841	65%
No data	611	199	33%

2 Market share is calculated based on Ship and Bunker: Welcome to the 229 Million Metric Ton Global Bunker Market!.

3 WoodMackenzie, (2021) not published.

4 These are voyages to the UK, Albania, Norway, Montenegro, Ukraine and Moldavia.

5 Russia and Turkey were labelled as outside of Europe.

From this data, it first of all becomes clear that a significant percentage of the vessels which called at Rotterdam had a next port of call within the EU (62% of visits with a known next destination). Depending on the interpretation of 'intra-EU waterborne navigation' by the Netherlands Tax Administration, fuels bunkered on these voyages could be taxed under the proposed revision of the ETD. Of these voyages, 65% currently bunkers in Rotterdam. Therefore, the proposed tax would potentially apply to a significant amount of the bunker fuel.

2.5 Bunkering choices for bulk shipping

An estimated sixty percent of bulk vessel are used for tramp shipping. Therefore, the analysis of these vessels gives an indication of the bunkering choices of tramps. However, since the available data does not distinguish between tramp bulk vessels and liner bulk vessels, the analysis of these vessels cannot make a clear distinction between those two categories. For tramp shipping the choice for bunker location is dependent on the contract. In case of time charters; the charterer pays for the fuel and decides where to bunker. In case of a voyage charter; the shipping company pays for the fuel and decides where to bunker.

2.5.1 Data Rotterdam

Port of Rotterdam supplied us with data for different vessel types. For this analysis, the data of four types of bulk ships is presented:

- bulk carriers;
- chemical tankers;
- general Dry Cargo;
- tankers.

Table 3 shows the next port of call and bunkering behaviour for these ship types from January 1 to September 1, 2021.

Table 3 - Bunker behaviour and the next port of call for bulk carriers visiting the Port of Rotterdam.

		Bulk Carriers	Chemical Tankers	General Dry Cargo	Tankers	Total
Visits	Within Europe, outside EU	42	223	274	137	676
	Outside EU	78	60	56	157	351
	In EU	137	887	670	298	1,992
	No data	478	1,502	1,250	1,245	4,475
Visits with bunker activity	Within Europe, outside EU	40	146	186	104	476
	Outside EU	75	53	36	124	288
	In EU	125	595	496	220	1,436
	No data	435	1,049	831	981	3,296
Percentage of visits with bunker activity	Within Europe, outside EU	95%	65%	68%	76%	70%
	Outside EU	96%	88%	64%	79%	82%
	In EU	91%	67%	74%	74%	72%
	No data	91%	70%	66%	79%	74%

It is apparent from Table 3 that most bulk carriers, general cargo ships and tankers, do not report their next port of call. The ships that did report their next port of call often sailed to an EU port. Of these, 72% bunkered in Rotterdam. Therefore, it can be concluded that the

proposed revision of the ETD could apply to a large amount of bunker activities for these ship types.

3 Impact of the ETD on bunkering choices

3.1 Introduction

In this chapter, the impact of the proposed revision of the ETD on bunkering choices is analysed for both liners and tramps. Since liners sail in predictable patterns, we chose to base the analyses on two existing container ships. For tramp shipping, it is not possible to make a similar analysis (because the ships do not sail in predictable patterns). For this reason the analysis for tramp shipping consists of a number of hypothetical but realistic scenario's in which there might be undesired effects due to the proposed fuel tax.

3.2 Fuel choices of liners

Liner ships sail between a number of ports in a fixed loop. For this reason, these are useful cases to demonstrate the potential impacts of price increases on bunkering behaviour. We have chosen two existing example loops:

1. A large container vessel in a loop between Rotterdam and Qingdao (Asia).
2. A smaller container vessel in a loop between Rotterdam and Natal (South America).

3.2.1 Rotterdam - Qingdao

The first case which we considered is the loop between Rotterdam (Netherlands) and Qingdao (China) which is sailed by *CMA CGM Benjamin Franklin*. This is a large container vessel with a load capacity of 18,000 TEU (1,400 Reefers) and a bunker capacity of 16,500 tonnes of VLSFO (Freight Waves, 2020). Figure 2 is a picture of this vessel. The loop which is sailed by this vessel is summarized in Table 4 and Figure 3.

Since the bunker capacity of 16,500 tonnes is larger than the estimated required 7,827 tonnes of VLSFO required for the round trip, it is clear that CMA CGM Benjamin Franklin is comfortably able to complete a loop with a single bunkering (or even less than one bunkering per loop). Therefore, the choice can be made to bunker at the least expensive location. The current bunker prices as well as the bunker prices with the proposed VLSFO tax are shown in Table 5. This information shows first of all that in the current situation Rotterdam is, at 524 $/mt, the least expensive place to bunker. Therefore, it is very likely that the vessel would currently choose to bunker all of its fuel in Rotterdam. However, since the destination after Rotterdam is Antwerp, the fuel bunkered in Rotterdam could be taxed under the proposed revision of the Energy Tax Directive when applied as indicated in Chapter 1. When adding the tax to the bunker price, Rotterdam becomes the least attractive bunker port on the loop. In this situation, according to our dataset Jeddah would be the least expensive port to bunker (527 $/mt). It is therefore very likely that, in this scenario, the vessel would choose not to bunker in Rotterdam anymore.

Figure 2 – CMA CGM Benjamin Franklin

Source: (Vesselfinder, 2021).

Table 4 – The loop between Rotterdam and Qingdao

From	To	Distance (nm)	Sailing time (days, 15 knots)[6]	Estimated fuel use (tonnes)[7]
Rotterdam	Antwerp	144	0.4	45
Antwerp	Le Havre	224	0.7	70
Le Havre	Jeddah	4,403	12.2	1,368
Jeddah	Qingdao	7,693	21.4	2,390
Qingdao	Ningbo	439	1.3	136
Ningbo	Shanghai	87	0.3	27
Shanghai	Yantian	968	2.7	301
Yantian	Singapore	1,851	5.2	575
Singapore	Tanger Med	7,720	21.4	2,399
Tanger Med	Southampton	1,367	3.8	425
Southampton	Rotterdam	293	0.8	91
Totals		**25,189**	**70**	**7,827**

6 The estimated sailing time is excluding time spent at berth.

7 The estimated fuel use is based on the average fuel use of a container vessel in the category 14,500-19,999 TEU (CE Delft & et al, 2020). This average fuel use, which includes time spent at berth, is 311 kg VLSFO/nm.

Figure 3 - The loop between Rotterdam and Qingdao, with VLSFO bunker prices indicated at bunker ports

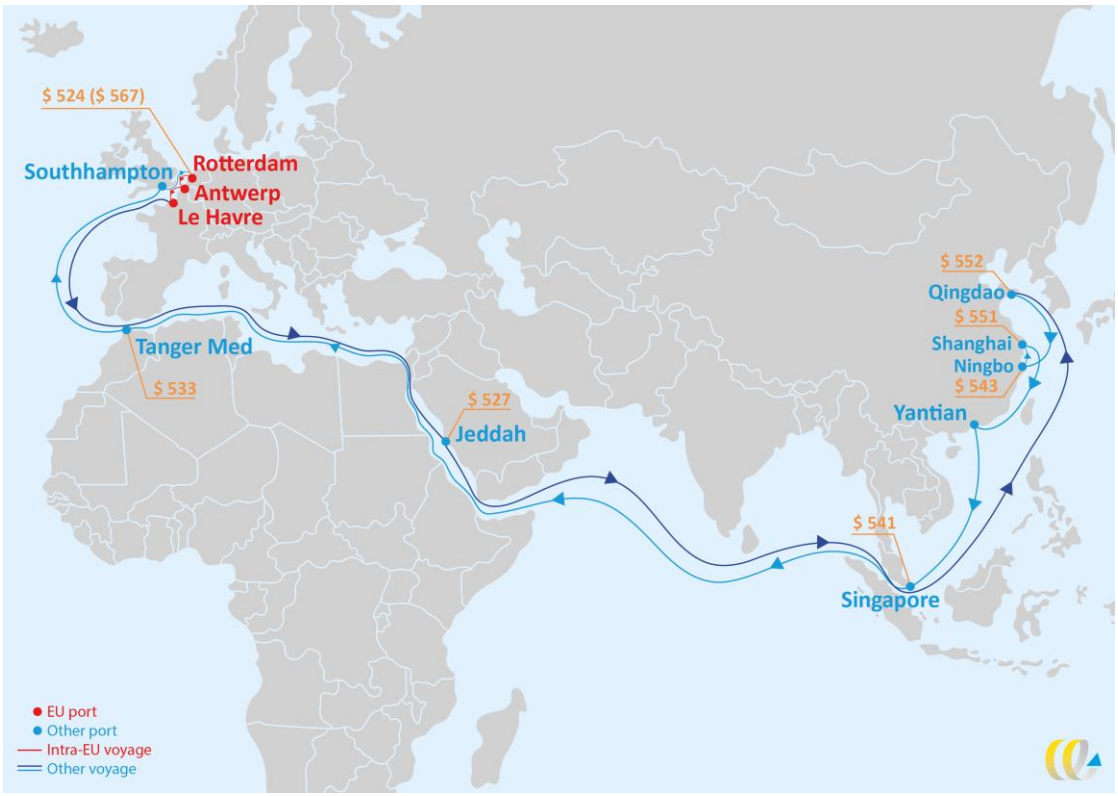


Table 5 - Possible bunker ports on the loop

Bunker port	Current bunker price VLSFO ($/mt)[a]	Price with revised ETD ($/mt)
Rotterdam	524	567
Jeddah	527	527
Qingdao	552	552
Ningbo	543	543
Shanghai	551	551
Singapore	541	541
Tanger Med	533	533

[a] The current bunker prices are half-year average prices for the period April 27-October 26, 2021 (Ship and Bunker, 2021). A complete overview of bunker prices is included in Appendix A.

3.2.2 Rotterdam – Natal

The second case which we considered is the loop between Rotterdam (Netherlands) and Natal (Brazil) sailed by *CMA CGM Cayenne*. This is a smaller size container vessel with a load capacity of 2,140 TEU (530 Reefers). The bunkering capacity of this vessel is estimated to be 3,300 tonnes of VLSFO[8]. Figure 24 is a picture of this vessel. The loop which is sailed by this vessel is summarized in Table 6 and Figure 5.

[8] For this specific vessel, the bunker capacity was not available in the Clarksons Fleet Register. Therefore, the bunker capacity was estimated based on the bunker capacity of seventeen container ships of similar size which did have bunker capacity information in the register.

Since the bunker capacity of 3,300 tonnes is larger than the required 1,857 tonnes of VLSFO, it is clear that also CMA CGM Cayenne can complete an entire loop without bunkering. Therefore, the choice can be made to bunker at the least expensive location. The current bunker prices as well as the bunker prices with the proposed VLSFO tax are shown in Table 7. This information shows first of all that in the current situation Rotterdam is, at 524 $/mt, the least expensive port on the loop to bunker. When adding the proposed tax, Rotterdam is no longer the least expensive bunkering port: this now is Algeciras.
The reason why Algeciras can offer competitive bunker prices is that, unlike Rotterdam, the next destination on the loop (London) is outside of the EU.

Figure 4 – CMA CGM Cayenne

Source: (Vesselfinder, 2021).

Table 6 - The loop between Rotterdam and Natal

From	To	Distance (nm)	Sailing time (days, 15 knots)[9]	Estimated fuel use (tonne)[10]
Rotterdam	Le Havre	335	1.0	44
Le Havre	Philipsburg	5,051	14.5	670
Philipsburg	Port of Spain	535	1.5	71
Port of Spain	Degrad des Cannes	765	2.2	101
Degrad des Cannes	Vila do Conde	619	1.8	82
Lia do Conde	Fortaleza	792	2.3	105
Fortaleza	Natal	245	0.7	33
Natal	Algeciras	3,887	11.2	516
Algeciras	London gateway port	1,519	4.4	202
London gateway port	Rotterdam	253	0.7	34
Totals		**14,001**	**40**	**1,857**

Figure 5 - The loop between Rotterdam and Natal, with VLSFO bunker prices indicated at bunker ports

[9] The estimated sailing time is excluding time spent at berth.

[10] The estimated fuel use is based on the average fuel use of a container vessel in the category 14,500-19,999 TEU (CE Delft & et al, 2020). This average fuel use, which includes time spent at berth, is 311 kg VLSFO/nm.

Table 7 - Possible bunker ports on the loop

Bunker port	Current bunker price VLSFO ($/mt)[a]	Price with revised ETD ($/mt)
Rotterdam	524	567
Port of Spain	620	620
Fortaleza	554	554
Algeciras[11]	535	535

[a] The current bunker prices are half-year average prices for the period April 27-October 26, 2021 (Ship and Bunker, 2021). A complete overview of bunker prices is included in Appendix A.

3.3 Fuel choices for tramp shipping

The activity of the majority of bulk ships is not defined by a regular pattern of port calls: they sail to specific ports depending on the demand at a certain moment. This is called 'tramp shipping'. Because of the lack of regularity, it is not possible for this category of shipping to present scenario's comparable to the two scenario's for container vessels above.

For this reason, another approach was chosen to illustrate the effects of the proposed revision of the EDT on tramp shipping: the effects of the proposed tax are illustrated with the use of three scenario's which reflect situations in which the fuel tax causes negative effects for the European bunker market or confusion about whether the fuel should be taxed or not. The following scenarios were defined:

1. A bulk ship visits the Port of Rotterdam and afterwards continues to sail to Hamburg. Afterwards, it expects to continue sailing to a destination outside of the EU.
2. A bulk ship visits the Port of Rotterdam expecting to continue sailing to Singapore. After leaving the Port of Rotterdam, where it bunkered, it changes its course towards Hamburg.
3. A bulk ship visits the Port of Rotterdam and expects to continue its journey to Hamburg. After leaving the Port of Rotterdam, where it bunkered, it changes its course towards Singapore.
4. A bulk ship calls at Port of Rotterdam and does not know what the next port of call will be.

3.3.1 Case 1: To Hamburg and then out of the EU

In the first case, in which the vessel continues sailing to Hamburg after leaving the Port of Rotterdam, fuel bunkered in Rotterdam would be taxed. If the vessel bunkers in Hamburg instead, the fuel would not be taxed, since it plans to call at a port outside of the EU afterwards. Therefore, it is likely that the vessel bunkers in Hamburg.

3.3.2 Case 2: Changing course to Hamburg

In this case, the vessel did not need to pay taxes over the fuel bunkered in Rotterdam (since the indicated next destination was Singapore). However, the ship changed course to Hamburg, which means that in hindsight the fuel should have been taxed. This creates a difficult situation for the administrations, where the right approach is not clear: should the ship still pay the tax after anchoring in Hamburg? If so, who's responsibility is it to claim the tax after the ship arrived at a port outside the EU?

[11] Even though Algeciras is an EU port, any fuel bunkered here by CMA GCM Cayenne would not be taxed, since the next destination (London Gateway Port) is not part of the EU.

3.3.3 Case 3: Changing course to Singapore

In this case, the vessel needs to pay taxes over the fuel bunkered in Rotterdam (since the indicated next destination was Hamburg). However, the ship changed course to Singapore, which means that in hindsight the fuel shouldn't been taxed. This creates a difficult situation for the administrations, where the right approach is not clear: should taxes be refunded after anchoring in Singapore? If so, who's responsibility is it to check whether the ship arrived from an EU port?

3.3.4 Case 4: Unknown next port of call

In this scenario, which does occur in practice, it is unclear whether the fuel should be taxed.

When choosing not to tax the fuel, the risk is that the ship continues to sail to an EU port (in which case the fuel should have been taxed). Also, this would provide an incentive for ship owners to purposefully not indicate the next port of call, as a way to evade the tax.

If the choice is made to tax the fuel instead, the risk is that the ship continues to sail out of the EU (in which case the fuel should not have been taxed). Also, this would motivate ship owners to bunker outside of the EU if possible.

3.4 Conclusion

In this chapter, the potential impacts of the proposed revision of the ETD were analysed for both liner and tramps. We can conclude for both types of shipping, due to the large bunker capacities of vessels, there is a significant risk that bunkering activity will simply relocate outside of the EU. In practice, shipping companies choose the least expensive place to bunker. We showed that, with the expected execution of the proposed revision of the ETD, European ports will not be able to offer competitive bunker prices compared to many ports outside of the EU. If this is the case, the intended effects of the tax would not be achieved: the shipping companies are able to avoid paying the taxes and therefore the price of transport does not increase.

In tramp shipping, a number of additional problems were identified. These problems arise from the fact that tramps do not always know their next destination and sometimes change course to another port. The following four situations could be problematic:

1. The vessel sails from an EU port to a next EU port after which is it leaves the EU. *In this case, the risk is that instead of bunkering in the first EU port, fuel will be bunkered in the second EU port as it will not be taxed.*
2. During a port call, a vessel might have a next port call in the EU scheduled. After leaving the EU port, the destination might change to a port outside the EU. *In this case, the risk is that bunkered fuel is taxed. However, since the actual destination is not in the EU, the fuel should not have been taxed.*
3. During a port call, a vessel might have a next port call outside the EU scheduled. After leaving the EU port, the destination might change to a port inside the EU. *In this case, the risk is that bunkered fuel is not taxed. However, since the actual destination is not in the EU, the fuel should have been taxed.*
4. During a port call, the next destination might be unknown. *In this situation it is unclear whether the fuel should be taxed.*

In the first case, the problem is similar to liner shipping: bunkering will move to another port where taxes don't need to be paid. The problems identified in the next three cases will make the enforcement of the tax even more difficult for tramps in comparison to liners due to the fact that the next destination of a vessel is not fixed an therefore unknown.

This chapter has focussed on changing the bunkering location to other ports. It is also possible that ships increase bunkering at sea in response to the ETD.

4 Mitigating risks of ETD

The main risk associated with the proposed revision of the ETD is that bunker activity would relocate to ports outside of the EU. If this were to happen, there would be no positive impact on the greenhouse gas emissions, no tax revenues for European ports and a loss of associated economic activities in the EU.

The causes for the risks are:
- the lack of definition of 'intra-EU waterborne navigation' in the proposed ETD;
- the practice of European Tax Authorities to levy energy taxes at tax warehouses;
- the fact that ships bunker for multiple voyages.

Six different approaches were identified which could reduce this risk:
1. **Decreasing the scope to ship that tend to stay in the EU.** First of all, the scope of the tax could be narrowed such that only the bunker activity of ships which tend to stay in the EU and ferries[12] would be taxed. This would significantly decrease the damage to the EU bunker market, whereas it would achieve its goal for the ship types that remain under the scope. For cargo ships, limiting the tax to ships under 5,000 GT would be an option. These ships tend to be engaged in coastal trade, and they are excluded from several other EU measures such as the EU ETS and FuelEU maritime. However, the downside of this option is that the majority of the bunker fuels is no longer taxed. Therefore, the impact of this tax would be limited.
2. **Decreasing the scope to container shipping.** A second option to reduce some of the risks specific to bulk carriers is to narrow the scope of the taxation to containerships. Because container vessels are liners, the issues related to de unpredictability of port calls in tramp shipping are not present. This would make it considerably easier to determine what voyages should be taxed. However, the risk of bunkering activities relocating outside of the EU is still present.
3. **Decreasing the scope to a share of the fuels supplied.** A third option is to change the nature of the tax, such that only the share of fuels that is estimated to be used on voyages between EU ports would be taxed. For example, when a liner vessel arrives in Rotterdam (first port of call in the EU), continues to Antwerp where it bunkers and finally visits Le Havre (as last port of call in the EU) only the amount of fuel used between the last two ports (e.g. 70 tonnes in case of the *CMA CGM Benjamin Franklin*) will be taxed. Based on the minimum tax rate of 43 USD per tonne this would result in a tax of 3,010 USD. The advantage of this option is that it would reduce the distortion of the competitive market significantly, the disadvantage that it would be administratively complex.
4. **Pay for use.** A fourth option is to apply the tax to the fuel used while navigating between EU ports, rather than to fuel bunkered in Europe. In this case, it does not matter where the bunker activity happens: what matters is the sailing pattern. With the EU-MRV regulation (Regulation (EU) 2015/757) (EU, 2015) in place, the fuel use between EU ports is already monitored on a vessel basis. When we would consider the example from the previous option this would mean that the amount of tax levied would be 4,945 USD (based on a fuel consumption of 115 tonnes between Rotterdam-Antwerp-Le Havre for *Benjamin Franklin*). The advantage of this option is that there is no

[12] Ferries which navigate between two fixed ports always either stay in the EU (in which case the tax applies) or have one destination outside of the EU (in which the tax does not apply). For this reason, no competitive disadvantage for the EU bunker market occurs.

distortion of the bunker fuel market; the disadvantage that the existing tax infrastructure cannot be used and that the tax would partially overlap with the EU ETS.

5. **Lower the minimum tax level.** The minimum tax level could be lowered to a point at which the competitive disadvantages are manageable. However, this is very difficult in practice: there are many European bunker ports which all have a different competitive position. Therefore, a tax rate that is acceptable for one port is not acceptable for the other port. Also, the tax rate would have to be lowered to a point where the desired impact would be decreased significantly.
6. **Exempt marine fuels from the tax.** Another possibility would be to remove marine fuels from the list of taxed fuels. The motivation for this choice would be that, since shipping companies choose the least expensive bunker port, the tax would not result in the desired outcome. It can be argued that it is better not to tax the fuels in Europe than to introduce a tax with the effect that the European bunker market collapses.

A second risk emerges from the fact that there is no clear guidance on how tax authorities should distinguish between fuels used in intra-EU waterborne navigation and in extra-EU waterborne navigation. The risk is that different authorities implement the ETD differently, resulting in market distortions *between* EU Member States. This risk can be reduced by conferring delegated powers to the Commission to adopt delegated acts on how the distinction can be made.

5 References

CE Delft & Ecorys, 2020. Assessment of impacts from accelerating the uptake of sustainable alternative fuels in maritime transport: Presentation for the European Sustainable Shipping Forum. Delft: CE Delft.

CE Delft & et al, 2020. Fourth IMO Greenhouse Gas Study 2020, IMO GHG Study 2020 - Full report and annexes. London, International Maritime Organization (IMO).

CE Delft, SQ Consult & Cambridge Econometrics, 2014. Emissions trading for Transport and the Built environment. Analysis of the options to include transport and the built environment in the EU ETS. Delft, CE Delft.

EC. 2021. *Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity (recast)* [Online]. Brussels: European Commission (EC). Available: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0563&from=EN [Accessed].

EU, 2003. Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. *Official Journal of the European Union,* L 283, 51-70.

EU, 2015. Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC (Text with EEA relevance). *Official Journal of the European Union,* L123, 55-76.

Freight Waves. 2020. *How many gallons does a container ship carry?* [Online]. Available: https://www.freightwaves.com/news/how-many-gallons-of-fuel-does-a-container-ship-carry [Accessed October 29 2021].

LAO, 2001. SalesTaxation of Bunker Fuel. Sacramento, CA, Legislative Analyst's Office (LAO).

LAO, 2007. Tax Expenditure Reviews. Sacramento, CA, Legislative Analyst's Office (LAO).

Repsol. 2021. *Presentation on the V Med Hub Day' november 18, 2021* [Online]. Port Tarragona. Available: https://www.hubdaytarragona.com/ [Accessed november 2021].

Robertshaw, forthcoming. Shipping sector analysis made for an forthcoming thesis [provisional title]. UCL.

Ship and Bunker. 2021. *World Bunker Prices* [Online]. Available: https://shipandbunker.com/prices/ [Accessed October 27 2021].

Stopford, 2009. *Maritime Economics,* London, Taylor & Francis.

Vesselfinder. 2021. *CMA CGM B Franklin* [Online]. Available: https://www.vesselfinder.com/nl/vessels/CMA-CGM-B-FRANKLIN-IMO-9706891-MMSI-215195000 [Accessed October 21 210].

WoodMackenzie, 2021. Marine bunker sales – top ten countries (Datafile, confidencial).

A VLSFO bunker prices

The current bunker prices are an important piece of information for the analysis of the effects of the proposed revision of the ETD. Table 8 shows the half-year average bunker prices of VLSFO in ports around the world (Ship and Bunker, 2021). This table only includes ports for which the VLSFO bunker prices were available in the database. Any ports at which VLSFO can be bunkered which are not included in the 'Ship and bunker' database are not included in this study. In this table, it can be seen that Rotterdam has a very good competitive position, with only five Russian ports and Terneuzen being able to offer VLSFO for slightly lower prices.
When adding the proposed minimum tax rate of 0.9 €/MJ to the bunker price, a price of 565.5 $/mt results[13]. With these prices, Rotterdam would not be an attractive bunker port anymore. Similarly, the competitiveness of all EU ports is at risk.

Table 8 - Half-year average bunker prices of VLSFO in ports around the world

Region	Port	Half-year average bunker price[14] VLSFO ($/mt)
North and western EU	Ust-Luga	488
North and western EU	St Petersburg	500.5
Mediterranean and Black Sea	Taman	507
Mediterranean and Black Sea	Tuapse	511
Mediterranean and Black Sea	Novorossiysk	515
North and western EU	Terneuzen	521.5
North and western EU	**Rotterdam**	523.5
Mediterranean and Black Sea	Jeddah	526.5
North and western EU	Gdynia	527
Mediterranean and Black Sea	Ceuta	527.5
U.S. Gulf and Carribbean	Houston	528.5
North and western EU	Hamburg	529
Mediterranean and Black Sea	Kavkaz OPL	530
North and western EU	Kaliningrad	530.5
Mediterranean and Black Sea	Tanger Med	533
East Asia	Vladivostok	533
East Asia	Vostochny Port	533
East Asia	Nakhodka	533.5
Mediterranean and Black Sea	Algeciras	535
Mediterranean and Black Sea	Valletta (Malta)	535
Mediterranean and Black Sea	Gibraltar	536.5
North and western EU	Swinoujscie	537
North and western EU	Szczecin	537
Mediterranean and Black Sea	Sines	537.5
Mediterranean and Black Sea	Khor Al Fakkan	538
North and western EU	Lisbon	538.5
Mediterranean and Black Sea	Kalba	538.5

[13] This calculation was made by assuming an energy density of 40.2 MJ/kg and an exchange rate of 1.16 USD/Euro (October 27, 2021).

[14] The half-year average bunker price was calculated for the period April 27-October 26, 2021.

Region	Port	Half-year average bunker price[14] VLSFO ($/mt)
East Asia	Vanino	538.5
Mediterranean and Black Sea	Fujairah	539.5
North and western EU	Las Palmas	540
North and western EU	Tenerife	540
South America atlantic	Santos	540
East Asia	Hong Kong	540
South East Asia	Singapore	540.5
East Asia	Beilun	543
East Asia	Ningbo	543
East Asia	Slavyanka	543
North America Atlantic	New York	543.5
South East Asia	Port Klang	543.5
East Asia	Zhoushan	544.5
U.S. Gulf and Carribbean	New Orleans	546.5
U.S. Gulf and Carribbean	Balboa, Panama	547
U.S. Gulf and Carribbean	Cristobal, Panama	547
South America atlantic	Nieuw Nickerie	547
South America atlantic	Paranam	547
South America atlantic	Paramaribo	550
East Asia	Jiangyin	550
East Asia	Nantong	550
East Asia	Shanghai	550.5
East Asia	Dalian	551.5
East Asia	Nanjing	551.5
East Asia	Qingdao	552
East Asia	Xiamen	552
North America Atlantic	Philadelphia	553
South America atlantic	Niteroi	553
Mediterranean and Black Sea	Lome	554
South America atlantic	Fortaleza	554
South America atlantic	Rio de Janeiro	554
East Asia	Tianjin	554
East Asia	Xingang	554
East Asia	Lanshan	556
East Asia	Rizhao	556
East Asia	Guangzhou	556.5
Mediterranean and Black Sea	Suez	557.5
East Asia	Jingjiang	558
East Asia	Jingtang	558
East Asia	Qinhuangdao	558
East Asia	Lianyungang	559
South America atlantic	Tubarao	559.5
South America atlantic	Vitoria	559.5
Mediterranean and Black Sea	Odessa OPL	561
Mediterranean and Black Sea	Ilyichevsk	562.5
Mediterranean and Black Sea	Odessa	562.5
Mediterranean and Black Sea	Yuzhnyy	562.5
Mediterranean and Black Sea	Genoa	563
North America Pacific	LA/Long Beach	563

Region	Port	Half-year average bunker price[14] VLSFO ($/mt)
East Asia	Caofeidian	563
Mediterranean and Black Sea	Constanta	564.5
East Asia	Tokyo	565.5
South Asia	Cochin (Kochi)	565.5
Mediterranean and Black Sea	Bourgas	567
Mediterranean and Black Sea	Istanbul	567.5
North America Atlantic	Norfolk VA	567.5
East Asia	Hualien	567.5
East Asia	Kaohsiung	567.5
East Asia	Keelung (Chilung)	567.5
East Asia	Osaka	567.5
East Asia	Suao	567.5
East Asia	Taichung	567.5
Mediterranean and Black Sea	Augusta	568
South America atlantic	Paranagua	568
South America atlantic	Rio Grande	568
East Asia	Busan	568
Mediterranean and Black Sea	Varna	568.5
North and western EU	Riga	570
North and western EU	Tallinn	570
North America Pacific	Vancouver	570
U.S. Gulf and Carribbean	Santa Marta	571
South America atlantic	Buenos Aires	574.5
North America Pacific	Seattle	575
South America atlantic	Zona Comun	575
U.S. Gulf and Carribbean	Cartagena	575.5
South America atlantic	Manaus	576.5
South Asia	Mumbai	576.5
U.S. Gulf and Carribbean	Barranquilla	580.5
South Asia	Hambantota	583
Mediterranean and Black Sea	Kali Limenes	586
Mediterranean and Black Sea	Port Louis	587.5
South Asia	Colombo	587.5
North and western EU	Murmansk	588
Mediterranean and Black Sea	Durban	589
South East Asia	Ho Chi Minh City	589
Mediterranean and Black Sea	Piraeus	590
Mediterranean and Black Sea	Cape Town	596.5
South America atlantic	Belem	597
South America atlantic	Vila de Conde	597
North America Atlantic	Montreal	597.5
South America atlantic	Bahia Blanca	599
Mediterranean and Black Sea	Djibouti	599.5
South America atlantic	Itaqui	600
Mediterranean and Black Sea	Port Elizabeth (Algoa Bay)	601.5
South East Asia	Haiphong	602
U.S. Gulf and Carribbean	St Eustatius	606
U.S. Gulf and Carribbean	Curacao	618.5
U.S. Gulf and Carribbean	Aruba	620

Region	Port	Half-year average bunker price[14] VLSFO ($/mt)
U.S. Gulf and Carribbean	Port of Spain	620
U.S. Gulf and Carribbean	Kingston	632
South America pacific	Buenaventura	632
South America pacific	La Libertad	638
South America pacific	Guayaquil	646.5
South America atlantic	Montevideo	654.5
South America atlantic	Salvador	657
South America pacific	Callao	661.5
Pacific	Tauranga	689.5
Pacific	Melbourne	707
Pacific	Fremantle	712
South America pacific	Valparaiso	713
South America pacific	Quintero	714
Pacific	Brisbane	714
South America pacific	San Antonio	718
South America pacific	Coronel	720
South America pacific	Lirquen	720
South America pacific	San Vicente	720
South America pacific	Talcahuano	720
Pacific	Gladstone	722.5
South East Asia	Jakarta	755.5