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Challenges Facing the Shipping Sector due to Environmental Regulations

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ABSTRACT

Due to growing international regulatory pressure, especially on environmental issues, shipping companies will have to face, in the coming years, substantial investments and significant increases in their operating costs, as well as a considerable additional workload for the crews and the need to take important strategic and investment decisions.
This paper analyses three of these already adopted new measures, and the obligations and implications their application will have on the operation of merchant transport ships. In particular, the Ballast Water Convention, the reduction of the maximum sulphur content in marine fuels and the obligation to report on fuel consumption and CO_2 emissions.

1. Introduction.

Because shipping is inherently international, it is of key importance that rules governing this industry are also adopted and enforced at global level, through the International Maritime Organization (IMO). Hence shipping is one of the most heavily regulated industries worldwide and the most sustainable transport mode.

As regards air emissions, shipping was the first economic sector to adopt global and legally binding regulations to reduce its CO_2 emissions. These regulations are applicable since 2013 to all ships worldwide, irrespectively of their flag.

Despite these facts, shipping companies will face, in the coming years, a huge pressure to further improve its environmental records, through new regulatory standards that cover a broad spectrum of the marine environment: ballast water management; sulphur content of marine fuels; monitoring and reporting of CO_2 emissions from ships; possible operational and/or market measures in relation to greenhouse gases emissions; control of nitrogen oxides emissions or how ships must be scrapped.

These new environmental standards for ships can penalise the competitiveness of maritime transport, leading to a modal shift from sea to road and increasing CO_2 emissions.

It is impossible in the space available to cover with detail each one of these new measures, and the economical obligations and implications their application will have in the operation of merchant transport ships. Therefore, this paper will analyse the first three of them, as they are the ones that will have a greater impact in the short term.

2. International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)

Besides being the last one to arrive, the BWM Convention [1] will certainly generate more than one headache to shipping companies in the short term. Some issues seem to have, from the beginning an innate tendency to the complication, and the BWM Convention is certainly one of them.

2.1. About the Convention.

As it is well known, the purpose of the BWM Convention is to prevent ships from introducing, through the discharge of ballast water taken at ports of origin, living organisms that may

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be harmful to the ecosystem of the port of discharge. It entered into force on 8 September 2017. Consequently, from that day on, ships must carry on board:

- A Ballast Water Management Plan approved by its flag Administration, which must be ship specific;
- A Ballast Water Record Book, in which the crew must register every ballast water operation;
- A Ballast Water Management Certificate issued by its flag Administration or a recognized Classification Society.

In addition, in order to comply with the requirements of this Convention, vessels shall:

- Until the date of renewal of their International Oil Pollution Prevention Certificate (IOPP Certificate): Exchange the ballast water while at sea, prior to their arrival to port, in accordance with rules B-4 and D-1 of the Convention. [3]
- From that date on, vessels will have to install an approved ballast water treatment system and treat the ballast water prior to its discharge, as set forth in rule D-2 of the Convention.

2.2. The Ballast Water Management Plan.

Ships are required to carry on board a Ballast Water Management Plan (BWMP), which must be ship specific and must be approved by its flag Administration. The BWMP must describe in detail the vessel's ballast handling system (tanks, pumps, piping systems, sampling points...); the operation of the ballast water management system (either the method or methods for the exchange of ballast water or the equipment installed on board for treatment); ship and crew safety procedures; officer in charge on board; crew training; etc.

To assist shipping companies in meeting this obligation, the Spanish Shipowners' Association (ANAVE) developed a model of Ballast Water Management Plan, which was agreed with the Spanish administration to facilitate its approval.

2.3. About Ballast Water Treatment Systems.

The ballast water treatment systems must be type-approved in accordance with IMO Guidelines for approval of Ballast Water Management Systems [2] (known as G8), amended by MEPC 70 [(4)] in October 2016. By the time of writing (February 2018) there is only one system formally approved according to them [(5)].

The IMO has agreed that those shipowners that have already installed treatment systems on board approved in accordance with the old G8, but which do not meet the requirements of the new Guidelines, will not be penalized. On the contrary, the United States, that has not ratified this Convention and has adopted and implemented its own specific standards, has made it clear that they will not accept any treatment system that does not get a final type approval by their own standards.

In addition, even though a system has obtained final type approval, this can include certain limitations, which could make a specific system not adequate for a certain ship type. For example, if the ship's ballast water is very murky, ultraviolet-light based systems might not work properly; some chemical treatments require several days to be effective, so they are not appropriate for ships which operate in short distance voyages; others require a minimum water salinity; oil and chemical tankers will normally have to install systems approved as "explosion proof"... Therefore, a system may be valid on a ship but not in its twin, depending on the areas it operates, voyage time or distance, etc.

2.4. Main uncertainties in the Short Term.

After being adopted in 2004, the difficulties for its entry into force were so large that in December 2013 its compliance schedule had to be modified, to make it more gradual.

Moreover, to "clarify" its implementation, the IMO has been adopting a set of no less than 14 groups of guidelines (each of which is a complex document in itself), of which, even before the entry into force of the Convention, the IMO MEPC 70 (October 2016) already modified the so called G8, on approval of ballast water management systems. As it has been said, as of February 2018, there is only one treatment system that has received type approval under these new guidelines [(2)], although there are about 70 which have received type approval according to the previous version.

For its part, the United States in accordance with its specific rules, has only approved six treatment systems up to date (February 2018). [(6)]

Furthermore, there is some uncertainty generated by the different interpretations made by ratifying States in those cases in which it is not possible to carry out the exchange of ballast water according to the requirements imposed by the Convention: at least 50 miles from the nearest land and in water at least 200 meters in depth. Since the Convention also states that a vessel shall not be required to deviate from its intended voyage, or delay the voyage, the Baltic countries have reached an agreement whereby, in the event that the ballast water exchange cannot be carried out in accordance with the Convention, it will be sufficient for the affected vessels to record in their log book the reasons why it has not been possible to exchange the ballast water. On the contrary, Ireland, announced that, if a ship cannot exchange its ballast water in a given traffic in accordance with the Convention, it will be required to install treatment equipment from the outset (September 8, 2017), if it wanted to call at

[4]() Marine Environment Protection Committee.

[5]() On 2 February 2018, Alfa Laval PureBallast 3, the third generation of this ballast water treatment technology, was the first solution to meet the revised IMO G8 testing requirements and received formal type approval by DNV GL, acting on behalf of the Norwegian Maritime Authority.

[6]() See: http://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Commercial-Regulations-standards-CG-5PS/Marine-Safety-Center-MSC/Ballast-Water/TACs/

any Irish port. This same situation arises in Spain, in trades with North Africa, and even possibly in other traffics in the Mediterranean, so that Spain, in contact with the States parties concerned, was also required to establish its position in this regard. Also, on this point, unified interpretations were proposed to the IMO, which were discussed in MEPC 71 (July 2017), two months before the Convention entered into force. [7]

In the medium term, once the date of renewal of its IOPP certificate is met, each ship operating in international trades will have to install ballast water treatment equipment on board. It is inevitable to consider whether it is really necessary to treat ballast water in trades between ports as close as Algeciras and Tangier, especially when the Convention does not apply to traffic between Algeciras and Ceuta, as it is a national cabotage trade. Therefore, the Convention provides for the possibility of granting exemptions, as long as it is demonstrated, through a risk assessment, based on biological studies, that these exemptions will not harm or deteriorate the environment. Therefore, IMO MEPC 71 discussed several proposals aimed at rationalizing the granting of these exemptions in certain short sea shipping trades, significantly reducing the workload and the cost, not only for shipping companies, but also for ports and national governments, through a concept called "same risk area" (SRA). [8]

Finally, proposals to delay, by two years, the entry into force of the obligation to install treatment systems, were also discussed by MEPC 71. [9]

The high cost of the equipment, the modification of the G8 guidelines by IMO, the lack of treatment systems approved by the USA and the uncertainties about the application in certain trades, delayed the decision making by shipping companies, many of which opted to bring forward the renewal of the ships' IOPP certificate, to a date prior to September 8, 2017, to undertake the investment once the rules of the game were as clear as possible.

3. Sulphur Content in Marine Fuels.

Sulphur oxides emissions' negative effects, both on the environment (generating acid rains) and, above all, on air quality and public health in the areas close to emissions sources, are well known. For this reason, MARPOL Convention Annex VI [4] provides for the gradual reduction of sulphur content in marine fuels.

Thus, since 2006, the maximum sulphur content of marine fuels has been reduced from a general 4.5% to 3.5%. In certain regions, designated as "Sulphur Emission Control Areas" (SECAs), this percentage has been reduced to 0.1% since 2015. In addition, the maximum sulphur content of marine fuels used by ships during their call at European Union ports is 0.1%. The next step of this process will take place on January 1, 2020, date in which the mentioned general limit of 3.5% will be divided by seven, being set at 0.5%, while the 0.1% limit in SECAs and European ports will remain unchanged.

In order to comply with these regulations, in existing ships or newbuildings, there are mainly three options:

- Using low sulphur fuels, usually distilled fuels as marine gas oil (MGO) or marine diesel oil (MDO);
- Continue using heavy fuel oil (HFO) and installing exhaust gas scrubbers;
- Using alternative fuels, such as liquefied natural gas (LNG), methanol, etc.

3.1. Use of distilled fuels.

This is technically the simplest option, which requires minimum adaptation investments. However:

- It leads to a significant increase in the ship voyage costs, due to the huge price differential between the two types of fuel (at the beginning of February 2018, MGO is 60% more expensive than HFO) [5]. Therefore, seaborne trades competing with land transport (the so-called Short Sea Shipping, SSS) would experience an important increase in their operating costs, between 20% and up to 35%, depending on the price of the fuel, the operational speed of the vessel and/or the maritime distances of the specific trade. Several studies have been published on this issue, and most of them agree on the risk of a modal shift from sea to land, basically towards road transport, due to the lack of competitiveness that this regulation will generate to maritime short sea shipping trades. This modal shift would mean a net increase in CO_2 emissions, a result contrary to the objectives of the EU maritime transport policy.
- Another direct consequence would be a foreseeable increase in the price of the MGO due to a higher demand and to the lack of capacity of European refineries to cover it, which could even affect road transport fuel costs.

3.2. Installing Exhaust Gas Scrubbers.

Experience acquired to date through shipowners who have installed this equipment can be synthesized in:

[7] () On July 2017, MEPC 71 approved BWM.2/Circ.63, on the application of the Convention to ships operating in sea areas where ballast water exchange in accordance with regulations B-4.1 (at least 50 nautical miles and in water at least 200 meters in depth), and D-1 (with an efficiency of at least 95 percent) is not possible. This circular recommends to the States Parties to the Convention that, for these vessels, and up to the date in which they must install the treatment equipment on board according to their own schedule, it should not be mandatory to exchange the ballast water neither to download it at reception facilities, unless specific areas have been designated for ballast water exchange. The Spanish Maritime Authority agreed with Morocco the application of this circular. Ireland stated that it could not agree to the approval of this draft guidance.

[8] () MEPC 71 approved a revised version of the Guidelines for risk assessment for granting exemptions of the BWM Convention (G7) to introduce the SRA concept. Previously the guidelines contained only methods for assessing specific ships' routes, but now it is possible to perform risk assessments of small sea areas as a whole.

[9] () MEPC 71 decided on a 2 years delay to the retrofitting schedule for some ships. Fitting date for new buildings remained unchanged, that is, ships built (keel laid) on or after 8 September 2017.

- The cost ranges between 5 and 10 million euros, depending on the type of vessel, power, location of engines and scrubber system;
- Its installation requires the immobilization of the ship between 2 and 6 weeks;
- Its maintenance means an increase of the running costs and the additional weight leads to a loss of transport capacity. In addition, the use of scrubbers increase the ship's fuel consumption, around 2-3%;
- In the particular case of dry scrubbers (closed cycle), they produce up to 40 tonnes per week of chemical waste, which must be pumped ashore and require specially adapted reception facilities. Most EU ports do not have yet such facilities nor specific regulations for the collection of these wastes;
- Several EU Member States (such as Germany and Belgium) prohibit the use in their ports of open-cycle wet scrubbers, so the equipment to be installed should be preferably hybrid, which is more complex and expensive.

The return time of the investment is directly related to the price differential between conventional fuel oils (that the ship could burn) and the low sulphur fuel that should be used if the scrubber is not installed. In the case of MGO, while at the beginning of 2014, the price differential with HFO was about $350 per t, by beginning-February 2018 it had been reduced to $200 per t. With these market prices, although the scrubber could still be profitable, the payback period had virtually doubled.

3.3. Use of LNG.

This is surely the option that offers more long-term possibilities due to its obvious environmental advantages, since it not only completely eliminates SO_x and particulate matter emissions, but it also reduces NO_x emissions by 85%, and CO_2 emissions by around 25%, as long as the leakage of methane to the atmosphere is minimized.

The required technology is available and has been well tested for many years in methane tankers, with a very favourable safety record.

Also, at least until the beginning of 2014, LNG was competitive in price. Until then, experts predicted that LNG prices would follow a decreasing trend in the medium and long term, while both HFO and MGO prices were expected to increase. However, current low oil prices make it very difficult to predict the relative evolution of LNG and petroleum products prices.

And it is clear that, as for scrubbers, the payback period of the investment in storage tanks and engines will depend on the evolution of these prices. For this reason, shipowners studying the retrofitting or commissioning of new LNG-burning vessels are in contact with suppliers to achieve medium to long-term price agreements in order to reduce the risk of investment.

As all that glitters is not gold, the use of LNG also presents some drawbacks:

- For existing ships, retrofitting to dual engines and installing LNG storage tanks and feeding systems is very expensive and results in a reduction in the ship's cargo capacity due to the larger storage space on board for the fuel: double for LNG than for HFO, 3 times in the case of dual fuel;
- In new vessels, the engine cost is estimated to be 15 to 20% higher than for conventional vessels. This difference will probably go down with time;
- And, very important, except for a few exceptions, for the time being there are very few ports in which LNG bunkering is available. This imposes trade limitations on vessels, which must depend on the existence or not of the necessary supplying infrastructure.

3.4. Perspectives.

Shipping companies must decide, among these three alternatives, which will be their strategy to meet the 0.5% sulphur cap in 2020. The main element of uncertainty being the conventional fuels (HFO and MGO) price differential, and also with LNG.

Looking to 2020, when the maximum sulphur content in marine fuels declines from 3.5% to 0.5%, MGO demand will foreseeably increase while that of HFO will probably decline, so that the prices of both fuels could evolve in opposite directions, increasing its differential and justifying the investment in scrubbers.

As for the use of LNG, there are many variables to consider and there is great uncertainty about other alternative energy sources that could be incorporated into the market, so it is extremely difficult to estimate what its price will be on board.

4. Monitoring, reporting and verification of CO_2 emissions from ships

In May 2015, EU Regulation 2015/757 was published in the Official Journal of the European Union, approving a system for Monitoring, Reporting and Verification of carbon dioxide emissions from maritime transport (better known as "MRV regulation") [6]. This system started to operate on January 1, 2018, although shipping companies had to meet certain obligations from August 31, 2017.

On the other hand, IMO MEPC 70 adopted, in October 2016, a similar system, although global in scope and not limited to the European Union, which will enter into force in 2019.

The purpose of these systems is to collect data on fuel consumption and the associated CO_2 emissions of each individual vessel, as a first step to analyse the possibility of introducing additional measures to reduce these emissions. The main aspects and the obligations that are derived from these systems for shipping companies are summarized below.

4.1. The EU MRV regulation.

As of January 1, 2018, regardless of their flag, all vessels of more than 5,000 GT have to monitor their CO_2 emissions during their voyages to / from EU ports as well as within ports of call under the jurisdiction of an EU State. Only fishing, military, wooden hull or state-owned vessels used for non-commercial purposes are exempted.

For this purpose, shipowners had to prepare a monitoring plan for each ship covered by the MRV regulation and submit it, by August 31, 2017, to an independent verifier, duly accredited to this purposed by a national accreditation entity. These plans, according to the model published by the Commission, must include numerous operational procedures for the collection and recording of data.

The regulation provides for two emission monitoring systems, both of which are compulsory: a follow-up per trip and a yearly one. Only if all of the ship's voyages either start from or end at a port under the jurisdiction of a Member State and, according to its schedule, performs more than 300 voyages during the reporting period, the company is exempted from the obligation to monitor on a per-voyage basis.

From 2019, and during the first four months of the year companies must submit to the Commission and the authorities of the flag State concerned, an emissions report on the CO_2 emissions of their vessels, in relation to the previous year and for each vessel under its responsibility. This report must have been verified as satisfactory by an independent verifier.

4.2. IMO Data Collection System

For its part, IMO data collection system for ships' fuel consumption will be effective as of 2019 (the first year for which information will be collected) [7].

Like the EU MRV system, it will be applicable to ships of 5,000 GT or more, but only to those engaged in international trades. Taking into account that States parties to MARPOL Annex VI collectively represent more than 96% of the world merchant fleet tonnage, the scope in number of vessels is expected to be much higher than that of the EU MRV regulation.

This system consists of three main elements:

i. Consumption data must be collected by ships and reported to the flag State;

ii. Flag States verify the data and issues a Statement of Compliance to the ship;

iii. Creation by the IMO of a centralized Ship Fuel Consumption Database.

4.3. The EU MRV system versus IMO data collection system.

Both systems pursue the same objectives, but there are relatively important differences between them that, without adding value to the final goal, do complicate, and much, the day to day operation of shipping companies, and could seriously prejudice them, in particular:

- The European system requires, except in certain cases of ships that according to its schedule, perform more than 300 voyages during the reporting period, a per voyage monitoring of CO_2 emissions (in addition to annual monitoring), and to collect other data such as energy efficiency indicators and type and amount of cargo transported. This daily reporting is going to add considerable bureaucracy and associated workload to ships crews, but it is not clear what will be the added value.

- The EU regulation foresees to make publicly available, on a per ship basis, the information reported, including fuel consumption, CO_2 emissions, technical efficiency (for example, it's EEDI) and other parameters. This is an aspect which is not contemplated in the IMO system and was firmly opposed by the shipping industry during the regulations' ordinary legislative procedure, due to the possible commercial sensitiveness of this information.

- According to the EU regulation, the verification of the monitoring plans must be done by an accredited private entity, while the IMO entrusts this task to the flag States or recognized organizations, that is, classification societies.

4.4. Prospects: possible alignment of both systems.

The EU MRV system provides that, if an agreement is reached in the IMO on an equivalent global system, the Commission should review it with a view to aligning both systems.

At the beginning of March 2017, the EU Directors-General for Transport and for Climate change stated that the Commission is aware of the fact that an EU Regulation different from the global IMO system implies a competitive handicap for European shipowners, so they were studying the options to harmonize both systems.

As a first step of the legislative process aiming at reviewing the EU MRV Regulation for its alignment with the IMO CO_2 Data Collection System, the European Commission launched, in June 2017, a preliminary consultation on their Inception Impact Assessment and in September a public consultation.

However, the European Parliament believes that the IMO system is less transparent and not as reliable as the European one, so are still pushing for "greater transparency" in the publication of data and a "greater robustness" of the verification system.

One of the key elements will be that the IMO Ship Fuel Oil Consumption Database, which IMO is developing and will probably be presented at MEPC 72 (April 2018), include some elements which may be considered as steps forward in that direction.

Conclusions.

After several especially hard years, with extremely depressed freight levels, due to excess fleet supply, the result of high levels of pre-crisis contracting, shipping companies were hoping to start recomposing their operating accounts along 2017 and 2018.

However, the strong pressure to which they will be subjected by the new environmental standards that will enter into

force in these and coming years is going to seriously undermine this possible recovery.

Shipping is universally recognized as the most sustainable, most efficient mode of transport, the one that generates least greenhouse gases emissions, both in absolute values and per ton-mile transported.

In order to maintain this position, the maritime transport sector must move towards environmental excellence, something that it could certainly assume and which would be an opportunity to reinforce its leadership as the more sustainable mode of transport. It is a fact that the environmental behaviour of the different transport modes has an increasing weight in the user decisions.

However, the regulation of the sector should be analysed from a holistic point of view, avoiding, for example, that measures for the reduction of sulphur oxide emissions have collateral effects such as increasing global CO_2 emissions. It is therefore especially necessary to pay special attention to Short Sea Shipping (SSS) services, to avoid a possible modal shift from the sea to the road, which would go against the profit pursued.

All rules governing maritime transport should be adopted after a thorough cost/benefit analysis, which must necessarily be carried out with special attention to these SSS trades which compete directly and every day with the road. Any kind of uncertainty, as a result of a rush to adopt new regulations without having completed a rigorous impact analysis, must be minimized.

Even the IMO has amended, before its entry into force, the phasing-in schedule of the Ballast Water Convention, which was adopted before the necessary technologies for its implementation existed. IMO has also published numerous explanatory guidelines, some of which have already been modified. MEPC 71, two months before the Convention entered into force, adopted further clarifications on its application to certain trades in which it is impossible to strictly meet the requirements for the exchange of ballast water. And at the same meeting, the IMO had also to clarify the exemptions procedure, which was linked to a strict risk assessment that required the sampling and study of each anchorage, mooring and berth, both in the port of origin and destination. Obviously, this meticulous system was not intended, in the case of Spain, for short distance voyages as those of the Straits of Gibraltar, with several shipping companies providing services between different Spanish and Moroccan ports, in an area so small, that it certainly does not require such a thoroughly risk assessment. The same case is presented in other European trades, such as between Denmark and Sweden in the Kattegatd and Oresund Straits or in the Baltic Sea. MEPC 71 also postponed, two more years, the obligation to install treatment systems for existing ships, to encourage the use of equipment that meets the G8 guidelines on type approval, which are supposed to be more reliable. And all these changes just two months before the entry into force of the Convention. Does this make any sense? How can shipowners make decisions that require important investments with such an uncertainty?

Nor it is easy to understand the way in which our EU institutions, particularly the European Parliament, are working, systematically proposing new European standards different from International ones, undermining the competitiveness of European shipping companies, unnecessarily increasing the crews workload and contributing nothing or very little added value to the final goal that is pursued. Does it make any sense that companies had to develop a Plan to monitor their CO_2 emissions, and only one year later they will have to adapt it to the IMO system? Wouldn't it have been more reasonable to put pressure on EU States to promote the development of rules at the global level?

Some 20% of the tonnage of registration of the world merchant fleet is flagged in Europe, whose 28 countries also have an important weight in the IMO. What is the point of Europe having a regional standard on ship scrapping, mostly in line with the Hong Kong convention, while most of its member States have not yet ratified this IMO Convention?

A recent study of the current situation of the maritime sector, commissioned by ECSA (*European Community Shipowners´ Associations*) to the consultant Monitor Deloitte, shows that there are clear signs that the competitiveness of EU shipping is under significant pressure. "*If the EU is to remain a competitive place to do business on a global level, and if further de-flagging and relocation of shipping activities to other jurisdictions are to be avoided, the EU will have to reorient its focus on shipping to a global level.*" [8]

Among other aspects, the Deloitte-ECSA study recommends strengthening the competitiveness of European ship registers, many of which are losing tonnage to third countries. To this end, the study recommends, in particular, to avoid establishing on European shipping companies and ships requirements that go beyond international standards and conventions.

Although it can also make mistakes, the IMO is a global forum of high efficiency and technical level, the only one that should regulate in the area of safety and environment such a globalized sector as it is shipping. And it must be done after an adequate cost/benefit assessment, taking into account the available technology, without political interference that undermines the outcome of their decisions. For its part, the EU, instead of proposing regional standards that put the IMO's work under question, should use its political weight to favour not only the adoption of new standards at global level, but also its early ratification in order to speed up their entry into force.

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