White Paper

Shipping

The 2020 Global Sulphur Cap: An Overview

First Edition

November 2018

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The 2020 Global Sulphur Cap – An Overview

Introduction

On 1 January 2020 amendments to the International Maritime Organization's (IMO's) International Convention for the Prevention of Pollution from Ships (MARPOL) enters into force. It will impose a global limit on allowable sulphur content in fuel oil of 0.5% m/m. The new global limit is achievable in one of two ways: by burning fuel that has a sulphur level that complies with the 0.5% m/m cap or by installing approved emission abatement technology – commonly referred to as scrubbers – on board. Either way, complying with the new regulations governing sulphur reduction in exhaust emissions potentially requires more expenditure than shipping has ever had to face.

Historical background to the regulatory framework

The new MARPOL Annex VI was adopted by the IMO in 1997. It imposes limits on the main air pollutants contained in ships' exhaust gas, including sulphur oxides (SOx) and nitrous oxides (NOx), and it prohibits deliberate emissions of ozone depleting substances (ODS).

No sooner had Annex VI entered into force on 19 May 2005 than the Marine Environment Protection Committee (MEPC), at its 53rd session in July 2005 (MEPC 53), agreed a revision to strengthen significantly the emission limits in light of technological improvements and implementation experience. The result was a progressive global reduction in emissions of SOx, NOx and particulate matter and the introduction of emission control areas (ECA[1]) to reduce emissions of those air pollutants further in designated sea areas.

With regards to SOx, the original global limit of 4.5% set in 2005 was reduced to 3.5% as of 2012 and 0.5% as of 2020. Even lower limits applied in ECAs, with the lowest level of 0.1% coming into force at the beginning of 2015.

2020 SOx issues

Burning fuel containing nitrogen and sulphur in air produces NOx and SOx. Although NOx levels are controllable (to some extent at least) by use of engine technologies, SOx levels are purely a function of the sulphur content of the fuel being used, which presents shipowners with a different set of compliance problems.

At the time when the sulphur level regulations were being drafted, it was considered by many that the only viable option to meet the prescribed levels was to use low-sulphur fuels. Addressing the concern of shipowners regarding the sufficiency and availability of fuel oil to meet the 0.5% sulphur cap by 2020, and the likely cost implications, agreement was reached at MEPC 57 in 2008 to amend Regulation 4 of Annex VI to allow an alternative compliance method by fitting approved abatement technologies on board ships. The methods adopted needed to be at least as effective in terms of emission reductions as those required by the annex. Scrubber technology is now an acceptable means of meeting these SOx emission rules.

Accepting that ships trade world-wide, the IMO recognised that there may be occasions when fuel with the required sulphur content may not always be available. Regulation 18.2 in Annex VI therefore allows whatever fuel is available to be used as long as the shipowner has made reasonable efforts to obtain the required fuel.

Concern has remained among those shipowners intent on complying with the regulations, notwithstanding the heavy cost involved, that less scrupulous shipowners will flout the regulations and continue to use non-compliant fuels. They demanded measures from IMO to stop this from happening.[2]

[1] Initially sulphur emission control areas (SECA)

[2] ShipInsight, 'Fuels and Lubricants', July 2018.

The IMO's response was to approve draft amendments to Regulation 14 of Annex VI at MEPC 72 in April 2018 that provide for a change in the form of the Supplement to the International Air Pollution Prevention Certificate concerning a prohibition on the carriage of non-compliant fuel oil for propulsion or operation on board ship, which was adopted at MEPC 73 on October 24th, 2018. This effectively bans any ship not fitted with an approved scrubber from having any fuel with sulphur content above 0.5% on board except as cargo. The exemption for all ships in case of non-availability of compliant fuel would still be available.

An introduction to marine fuels

The only alternative fuel to oil used in any appreciable quantity in the marine propulsion field is liquefied natural gas (LNG). However, while LNG is growing in prominence as a means of complying with the IMO's ambitious emissions targets (it has virtually no sulphur content, and its combustion produces low NOx compared to fuel oil), around one percentage of ships are designed to run on it. Further, although the supply infrastructure is developing apace, fossil fuels are widely acknowledged to remain the mainstay of power in shipping until the early mid-21st century.[3]

Oil fuels exist in several varieties but broadly speaking are divided into three types:

- Marine residual fuels, i.e., hydrocarbons from petroleum crude oil, oil sands and shale;
- Distillate fuels, i.e., hydrocarbons from synthetic or renewable sources; and
- Intermediate fuels, which are a blend of the above.

Some grades of each type and comments/their uses are illustrated in the following table:

<table>
<tr><th colspan="2">Marine residual fuels ➔</th><th colspan="2">Intermediate fuels ➔</th><th colspan="2">Marine distillate fuels</th></tr>
<tr><td>RMA</td><td colspan="2" rowspan="2">IFO 180</td><td colspan="2">DMX</td></tr>
<tr><td>RMB</td><td rowspan="6">Higher sulphur content than MGO due to small proportion of residual fuel</td><td>DMA</td><td>Widely used by tugs, fishing vessels, supply ships and ferries</td></tr>
<tr><td>MFO</td><td rowspan="5">MDO 380</td><td colspan="2">DMB</td></tr>
<tr><td>RFO</td><td colspan="2">DMC</td></tr>
<tr><td rowspan="3">FO</td><td colspan="2">Gas oil</td></tr>
<tr><td rowspan="2">MGO</td><td rowspan="2">Lowest sulphur content. Frequently used in ocean-going vessels not fitted with scrubbers and operating in ECAs</td></tr>
</table>

Distillate fuels – barriers to availability

It is far from certain that the refining industry will be in a position to produce low-sulphur fuels in sufficient quantity to meet the deadline of 1 January 2020. If it does not, and a vessel is not fitted with an approved scrubber or is incapable of burning LNG[4] as a fuel, the use of distillate will be the only option to comply with the 2020 sulphur cap. This brings significant problems for shipping.

Although distillates represent the easiest means of meeting the 0.5% global cap (mainly because they are already used in main engines normally run on heavy fuel oil), their availability will be a significant barrier to their wider use. At present, distillate fuels account for less than 25% of all marine fuels in use, and, while readily available to meet that demand, a wholesale post-2020 switch would place the shipping industry on a collision course with the non-marine sector, which relies heavily on distillate fuels and in far greater quantities.[5] It will also be competing for supply with ships specifically designed to operate on distillates such as ships employed on short sea trades and local passenger and cargo ferries, meaning there will be no guarantee that sufficient supplies will be available.

[3] *Ibid.*

[4] Or other alternatives as per the IGF Code

[5] *Ibid.*

Low sulphur fuel oil (LSFO) availability – a circular question

Whether or not there will be sufficient availability of LSFO by the 2020 deadline is a curiously circular question. Significant investment is required to upgrade refineries to rebalance the production of compliant fuel (meeting the 0.5% sulphur cap) and non-compliant fuel (which will continue to be used by ships fitted with approved scrubbers). At the same time, the factors affecting the shipowners' choice of going down the compliant fuels route (including LNG) or fitting scrubbers are also varied and, in many respects, speculative. They include predicting the availability and long-term price differential between compliant and non-compliant fuels.

As time progresses, there is evidence emerging that less than 10% of the world's fleet will have fitted scrubbers by 1 January 2020. Indeed, some estimates (e.g., UBS Bank) are closer to 2%.[6] So the significant majority of shipping will rely on compliant fuel. Whilst there is increasing evidence of cooperation between oil majors and shipping companies with a view to smoothing the transition, the conventional wisdom is that there will not only be an initial spike in the price of compliant fuel oils, but it also may well be difficult and in some cases impossible to obtain.

LSFO – not plain sailing

Much of the LSFO entering the market is a result of blending fuels of differing viscosities and characteristics, including different sulphur content, to make a fuel with an appropriate level of sulphur.

However, while there is an ISO standard (8217) for marine fuels that is updated at regular intervals (the most recent version (sixth edition) appearing in March 2017), it is not widely appreciated that no ISO standard applies to the new products being marketed as MARPOL-compliant fuels. Predictions are that until an ISO standard is established, compatibility issues and consequent operational problems on board will increase as suppliers strive to develop new products to meet the 0.5% sulphur levels outside ECAs. This is particularly so when using bunkers stemmed in different geographical locations or provided by different suppliers.

As a blended product, LSFO has some characteristics of distillate products, which means it can exert a 'cleaning' action that may mobilise previously deposited asphaltenes potentially leading to increased filter loading and other operational issues.[7]

A blended fuel may also separate out in a ship's bunker tanks or become unstable when mixed with other fuel during subsequent bunkering operations. If blended fuel separates, the ship may unknowingly burn fuel that exceeds the sulphur limit permitted by MARPOL, resulting in detention or the imposition of penalties.[8]

Instability in blended fuel can also result in poor ignition, causing the fouling of cylinders, turbo chargers and exhaust systems and leading to increased risk to the operation and reliability of ship's machinery and even breakdown, with consequent risk to safe navigation.

Abatement technology

The introduction of scrubber technology as an alternative method of compliance (by setting equivalent emission limits laid down in Regulations 14.1 and 14.4) came about at MEPC 57 in 2008. This was followed in 2009 at MEPC 59 with the production of Exhaust Gas Cleaning System Guidelines, which set out two accepted forms of technology by which SOx could be removed from the exhaust gas, namely by wet or dry scrubbers.

Each party to Annex VI has to ensure that its ports and terminal facilities can accommodate residues from exhaust gas cleaning systems.[9]

Wet scrubbers

The SOx in the exhaust passes through a water stream and reacts with the water to form sulphuric acid, which then passes out of the system. Whilst highly corrosive, when mixed with sufficient alkaline seawater it is neutralised and wash water can be discharged into the open sea after being treated in a separator to remove sludge. However, the alkalinity of seawater varies; in estuaries and close to land, it is likely to be brackish and close to neutral. By contrast, some areas where there is volcanic activity, the seawater may be acidic.

Wet scrubbers are sub-categorised into two types – open loop and closed loop.

Open loop

Seawater is used to scrub and neutralise the SOx and no additional chemicals are needed. The volume of seawater needed depends on engine size and power output. Generally 40 cubic metres per megawatt hour is needed so a high pumping capability is required for the system to operate effectively.

The system can only work satisfactorily, however, if the scrubbing seawater has sufficient alkalinity. Fresh water or brackish water is not effective and neither is seawater with a high ambient temperature. The open loop system is not, therefore, suitable for all circumstances or trading areas, for

[6] TradeWinds, 'Compliant fuel, not scrubbers, chief choice for IMO 2020', 17 August 2018.
[7] ShipInsight, 'Environmental Technology , October 2017.
[8] *Ibid.*
[9] *Ibid.*

example in the Baltic Sea where salinity levels are relatively low.

It is a MARPOL requirement that wash water in such a system is monitored before discharge to ensure that the acid/alkaline balance (PH value) is not too low (i.e., is acidic).

Closed loop

A closed loop system works on similar principles to an open loop system but instead of using seawater it uses fresh water treated with chemicals (often sodium hydroxide) as a scrubbing medium. This converts the SOx into harmless sodium sulphate, which together with the wash water passes into a process tank where it is cleaned and recirculated. Fresh water is carried on board or is produced on board by a fresh water generator.

To avoid a build-up of sodium sulphate, a small amount is either allowed overboard or is moved to a holding tank and new fresh water added.

The volume of fresh water required in a closed loop system is about half that of the open loop one but more tanks are required for fresh water and/or buffer space as well as a holding tank where discharge overboard is prohibited and a storage tank for the sodium hydroxide liquid and/or storage space for the dry sodium hydroxide.

Hybrid systems

A further sub-category of wet scrubber is the hybrid type. These combine both open and closed loop systems, which can be operated in open loop mode where seawater conditions and discharge regulations allow and in closed loop mode at other times. The flexibility makes such hybrid systems popular among shipowners.

A recent development has been the introduction of a membrane option to the wet scrubber. Instead of the exhaust gas passing through scrubbing water, non-porous ceramic membrane separation tubes are used to extract the SOx from the exhaust gas. SOx is dissolved into an absorbent solution that runs through the membrane tubes. Manufacturers claim that a smaller volume of discharge water is produced and the reduced exhaust contaminants absorbed, and so cleaning discharge water is simpler.

The membranes require periodic cleaning and frequency depends on the operating conditions of the engine. Sludge is collected by back-flushing an absorbent solution under pressure through the membranes and transferred to the general sludge tank.

Dry scrubbers

The dry system employs pellets of hydrated lime to remove sulphur and transforms it to gypsum. Spent pellets are discharged in port and used for fertiliser and production of plaster board as well as other products. The system consumes less power than wet systems as no pumps are required, but the weight of the unit is much higher and, while commonly used in land-based plants, has limited use in marine systems to date.

Control and regulation

MARPOL Annex VI allows two schemes:

a. Certification of Performance which requires no continuous exhaust emissions monitoring provided it is always operated within approved parameters. Parameters that must be continuously recorded are:

   i. Scrubbing water pressure;

   ii. Flow rate of scrubber inlet;

   iii. Exhaust pressure before scrubber and pressure drop;

   iv. Fuel oil combustion equipment load;

   v. Exhaust gas temperature either side of the scrubber, and

   vi. Record of chemical consumption.

b. No Certification of Performance but exhaust gas must be continuously monitored while the system is in use.

Both systems require the condition of any wash water pumped overboard to be continuously monitored for acidity, turbidity and polycyclic aromatic hydrocarbons (PAH) – a measure of the harmful components of oil – and data logged against time and the ship's position.

To scrub or not to scrub

It is widely accepted that, if the process has not been started already, it is now too late to complete the engineering, procurement, installation and approval process before 1 January 2020.[10] As mentioned earlier, however, while it is estimated that scrubbers will account for less than 10% of the world fleet's method of compliance with the 0.5% m/m sulphur cap by 1 January 2020, that figure rises to 25% of the newbuild order book.[11] Further, it may be that some shipowners will retrofit ships with scrubbers, based on the experiences gained by other ships.

A key consideration for the shipowner adopting the scrubber option is the estimate of the payback period for the initial capital expenditure (capex) of fitting a system – typically around US$2–5 million. This in turn will depend upon a number of factors including the estimate of the price differential between standard fuel and LSFO post 2020, the

[10] Reed Smith Ship Law Log, 'IMO and Liberia's stance', 3 October 2018.
[11] TradeWinds, 'One quarter of newbuild orderbook fitted with scrubbers', 31 August 2018.

additional operational expenditure (opex) incurred due to high power demands and consequent increases in fuel consumption – typically expected to be around 3–5% – and the time required to retrofit a system – typically longer than a standard dry-docking. This means an additional loss of earnings during the retrofit. Naturally, if the estimated payback period extends beyond the anticipated remaining service life of the ship, then the option will not be an attractive one.

Scrubber technology is not suitable for all ships. The systems and associated equipment take up a lot of space, which may not be available. There is also some concern about the long-term viability of exhaust gas cleaning systems (EGCS) where the environmental effects of the wastewater effluent discharge of the open loop system is already being called into question.[12] The Exhaust Gas Cleaning System Association (EGCSA) challenges such uncertainty, citing the fact that coastal power stations and oil tankers' inert gas systems have been using such technology for many years without environmental issues arising.[13] Nevertheless, the chances of EGCS becoming the target of future environmental legislation cannot be entirely discounted.

Protagonists of abatement technology, on the other hand, point to the lower fuel costs associated with scrubber-fitted ships as likely to be more attractive to time charterers, which outweighs the uncertainties.

The initial lack of ISO standards and questionable stability of those standards that exist for the blended compliant fuels that are coming on line have already been discussed. Further, the likely spike in initial price is not the only cost that will be incurred by a 'wait and see' approach. Now that the IMO has adopted draft amendments to Regulation 14 of Annex VI to prohibit the carriage of non-compliant fuel oil (other than as cargo), where a ship is not fitted with an approved scrubber all non-compliant fuel will need to consumed and purged from a ship's systems before turning to the new compliant fuel. Some Port State Control regimes have already announced that they will take enforcement of the global 0.5% sulphur cap seriously from "day one".[14] With confirmation at MEPC 73 that day one for this purpose will be 1 March 2020, shipowners will need to plan ahead (if necessary by discharging all non-compliant fuel) to ensure their ships are burning compliant fuel on the effective date.

Who foots the bill?

It was said at the outset of this overview that the cost of complying with these new regulations governing sulphur reduction in exhaust emissions is potentially the most expensive that shipping has ever had to meet. This raises the issue of the allocation of responsibility for time, risk and expense of fitting scrubbers or, alternatively, converting to and paying for compliant fuel. Owners' and time charterers' interests in this regard will clearly be divergent. The case of long-term charters in particular, where the issue is unlikely to have been addressed at the outset of the charter, could be highly contentious.

No existing bunker clauses address this unique situation. The likely issues arising are diverse and there will be no 'one size fits all' when it comes to the drafting of new bunker clauses. Among the concerns parties will need to consider when negotiating new charter parties (or discussing the resolution of issues under existing charter parties) are as follows:

a An owner is unlikely to have liberty to unilaterally decide to take a vessel out of service to fit a scrubber, although the balance period of the charter where the charterer might benefit from cheaper fuel costs is likely to be determinative of the terms of a negotiated resolution to the issue.

b. Does a charterer have any rights when exposed to additional fuel costs consequent upon an owners' decision not to fit a scrubber?

c. Where general terms of a charter party require a vessel to comply with all regulatory requirements, the terms do not likely extend to charterers having the right to require an owner to fit a scrubber, because an approved scrubber is only one option for compliance. However, what about in circumstances where forecasts indicate that compliant fuel will not be available in the trading area where the ship is employed?

d. Which party will be responsible for the costs of removing non-compliant fuel (including cleaning non-compliant residues from tanks and systems) and replacing it with compliant fuel?

e. When will the switch be made from non-complaint to compliant fuel if in advance of 1 January 2020?

f. Bunker quality clauses often refer to international quality standard ISO 8217 but, as mentioned, the new blended fuels may not be adequately addressed by the existing standards.

g. Performance warranties may be affected by the additional demands placed on machinery to power scrubbers. Similarly, blended fuels are likely to have different calorific values to standard fuels, which may also affect performance warranties.

[12] Reed Smith Ship Law Log, 'IMO and Liberia's stance', 3 October 2018.
[13] Signals, 'EGCS: do they scrub up well', Summer 2018.
[14] Gard, 'Port state control to focus on ship emissions', 25 July 2018. http://www.gard.no/web/updates/content/25927675/port-state-control-to-focus-on-ship-emissions

h. Indemnification provisions should be considered where the risk exists for instability of blended fuels leading to separation of fuels having different sulphur levels and inadvertently burning fuel having a sulphur content above 0.5% m/m with consequent exposure to fines and detention.

i. Forecasts suggest considerable price volatility of the new blended fuels, particularly in the period immediately following the implementation of the 0.5% m/m sulphur cap. Such volatility is not confined to compliant fuels, with some forecasts suggesting that standard fuel prices will tumble in 2020. Bunker price adjustment clauses might be the subject of negotiation.

j. Irregular availability of compliant fuel may influence trading limits/warranties.

k. Redelivery issues need to be contemplated such as:

   i. Owners' obligation to buy back unused bunkers. Does that obligation extend to non-compliant fuel? If so, at what price where non-compliant fuel may have little value if the vessel is not fitted with a scrubber?

   ii. The quantity of bunkers on redelivery to enable the vessel to reach a bunkering port with available compliant fuel.

   iii. The availability of compliant fuel within redelivery range specified in the charter party.

l. Discharge of wastewater effluent from open loop scrubbers and waste from closed loop scrubbers will involve time and cost but which party pays?

Voyage charters are less likely to be impacted, although the ambit of liberty clauses will need to be reviewed to take account of occasions where deviation becomes necessary to obtain compliant bunkers.[15] While Regulation 18 provides that owners need not deviate from the intended route or unduly delay the performance to achieve compliance, the exception is dependent on the owners being able to show that they took reasonable steps to comply.[16] Compliance with contractual terms and MARPOL may be at odds if requisite flexibility is not built into the voyage charter terms at the outset.

BIMCO

Recognising that not one all-encompassing 2020 clause is capable of dealing with all the varied and specific issues, the Baltic and International Maritime Council (BIMCO) is rolling out a series of 2020 bunker clauses over a period of several months, targeting early 2019 for completion. The first of the series is a compliance clause, which was intended for publication by the end of October 2018 and has been named the 'BIMCO 2020 Global Marine Fuel Sulphur Content Clause for Time Charter Parties'. It will set out a time charterer's obligations and liabilities in providing fuel of the required sulphur content post 2020. Fuel management remains the responsibility of owners.

The second clause in the series will address the 'transitional period' leading up to and immediately after 1 January 2020. This is still the subject of discussion by the BIMCO expert group but is intended to address some of the points highlighted above, such as responsibility for tank cleaning costs and redelivery issues.

The third 2020 clause will be the scrubber clause, which will aim at coming up with a cost-sharing formula between owners and charterers for the installation of a scrubber.

Industry response

A smooth transition by 1 January 2020 depends on a degree of collaboration within the triumvirate of owners/charterers, the refining industry and the regulatory authorities.

The Liberian flag state has recently called upon the IMO to issue a resolution or circular requiring early reporting of compliant fuel availability by member states. This is in response to owners (and charterers) lobbying for littoral states to be doing more to assist the industry in its planning to meet the 1 January 2020 deadline.[17]

The refinery approach

Meanwhile a 'chicken and egg' approach is being adopted by the oil majors, with some seeking a commitment from owners to embark on trials to operate with their 2020-compliant fuel before going into full production.

Sinopec is Asia's largest refiner and is in discussion with its top shipowner clients (primarily large container shipping lines) to provide straight-run, low-sulphur bunker fuel, which it says has better stability and compatibility compared to blends. The company is said to be seeking a commitment from owners to buy 1 million tonnes of fuel a year at three or four Chinese ports to allow the refinery to plan and work on fuel specification. However, as if to reinforce availability concerns, Sinopec has stated that only a few of its 32 plants can produce this type of low-sulphur fuel.[18]

[15] Steamship Mutual, 'Sulphur emissions: the clock is ticking', August 2018. https://www.steamshipmutual.com/publications/Articles/MARPOLAVI0818.htm

[16] Reed Smith Ship Law Log, 'IMO and Liberia's stance', 3 October 2018.

[17] Reed Smith Ship Law Log, 'IMO and Liberia's stance', 3 October 2018.

[18] Lloyds List, 'Sinopec offers owners straight-run compliant fuel, sources say', 9 October 2018.

ExxonMobil has undertaken a billion dollar upgrade of its Antwerp plant and is assessing upgrades in Singapore and the United Kingdom. The company has announced that its low-sulphur fuel range will be available initially at the ports of Antwerp, Rotterdam, Genoa, Marseille, Singapore, Laem Chabang and Hong Kong. The company meanwhile acknowledges the concerns of the industry regarding compatibility as being justified.[19]

Shell is offering trials to test its new 2020-compliant blended fuels to its existing shipowners and charterers at its Rotterdam, Singapore and New Orleans facilities. The trials are focusing primarily on the preparation of tanks and fuel-handling systems on board, fuel changeovers between grades, performance reports during use, and engine inspections after use.[20]

Heading down the compliant fuel road

Some of the notable shipping companies that have largely rejected scrubbers as a means of compliance with the 2020 sulphur cap include Hapag-Lloyd, Maersk, OOCL, Euronav, Epic Gas and Tsakos.

Hapag-Lloyd is on record as having estimated the likely price differential between standard and compliant fuel at US$150 – 250 per tonne, equal to US$80 – 120 per 20-foot equivalent unit (TEU) increase, which will be passed on to its customers.[21] Although it is installing scrubbers on a small number of its ships, the company has described the low-sulphur fuel option as the only viable one available to it.[22]

Similarly, Maersk is on record as having said that it is simply not feasible to invest in the capex required for scrubbers on the more than 700 ships that it operates. It has reached an agreement with Royal Vopak to provide 2.3 million tonnes of compliant fuel a year from its Rotterdam refinery, which represents about 20% of Maersk's global demand.[23] Like Hapag-Lloyd, Maersk is passing on the anticipated extra cost of the compliant fuel to its customers in the form of a bunker adjustment surcharge factor.[24]

OOCL has dismissed the fitting of scrubbers, saying that its vessels will be LSFO and LNG ready.[25]

Seatrade recently reported that fewer than 200 containerships are likely to be fitted with scrubbers out of a total fleet of some 5,300 likely to be in service in 2020.[26]

Tsakos and Epic LPG are among the non-containership operators that have publicly stated that scrubbers offer no cost-benefit.[27,28]

Scrubbing up

Barely a day passes without an announcement in the trade press of another company fitting scrubbers. But although it is estimated that around US$20 billion will be invested in the technology, the actual percentage of the world's fleet that will be fitted out before 1 January 2020 will only be in single figures.[29]

According to the EGCSA, bulk carriers account for 28% of scrubber orders, tankers 23%, containerships 16%, cruise ships 15% and ro-ro ferries 13%. It says that 63% of scrubber orders are for retrofits, and the balance is for newbuilds.[30]

Among the companies making significant scrubber investment are Scorpio (146), Star Bulkers (111 ships), Vale (48 ships) and Eagle Bulk (37 ships).[31,32,33,34] Estimated payback periods vary based on predicted price differential between standard and LSFO, with Star Bulkers' decision based on an assumed price differential of US$250 per tonne. Fredriksen estimates a payback period of less than a year for the US$250 million it is investing in scrubbers for its 16 capesize bulkers.[35]

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https://lloydslist.maritimeintelligence.informa.com/LL1124525/Sinopec-offers-owners-straightrun-compliant-fuel-sources-say.

[19] Seatrade Maritime News, 'ExxonMobil seeks to reassure shipowners on 2020 compliant low sulphur fuels', 4 October 2018. http://www.seatrade-maritime.com/news/europe/exxonmobil-seeks-to-reassure-shipowners-on-2020-compliant-low-sulphur-fuels.html.

[20] TradeWinds, 'Shell offers trials of low sulphur fuel oil', 23 August 2018.

[21] TradeWinds, 'Hapag-Lloyd reveals its 2020 fuel recovery hand', 8 October 2018.

[22] TradeWinds, 'Hapag-Lloyd: low sulphur only feasible solution for IMO 2020', 2 August 2018.

[23] TradeWinds, 'Maersk secures big chunk of 2020 fuel supply', 20 August 2018.

[24] TradeWinds, 'Maersk asking shippers to meet low-sulphur fuel costs', 17 September 2018.

[25] TradeWinds, 'OOCL shows hand on next generation of boxships', 24 August 2018.

[26] Seatrade Maritime News, 'Surge in scrubber orders for containerships to meet 2020 sulphur cap', 9 June 2018.

[27] TradeWinds, 'IMO 2020 transition period critical to avoid bunker contamination', 8 September 2018.

[28] TradeWinds, 'Epic Gas says yes to consolidation but no to scrubbers', 16 August 2018.

[29] TradeWinds, 'Bulkers take lion's share in scrubber fits', 30 July 2018.

[30] *Ibid.*

[31] TradeWinds, 'Scorpio in for 146 scrubbers across two fleets', 15 October 2018.

[32] TradeWinds, 'Star Bulk Carriers to equip entire fleet with scrubbers', 10 September 2018.

[33] TradeWinds, '"New era" Vale goes big on scrubbers amid 2020 "structural shift"', 3 August 2018.

[34] TradeWinds, 'Eagle Bulk to install up to 37 scrubbers', 4 September 2018.

[35] TradeWinds, 'Scrubbers a final piece in Fredriksen's dry bulk dividend vision', 20 August 2018.

The alternatives

Distillate fuels will continue to be used to meet the 0.1% sulphur levels permitted in ECAs, but wider availability remains a concern.

Similarly, concerns remain regarding the infrastructure necessary to make LNG widely available, although Clarksons says that 10% of newbuilds on order will be fuelled by LNG.[36] Among the high-profile proponents of LNG-fuelled ships is CMA CGM, which has on order nine such containerships of 22,000 TEU. The space needed for LNG tanks is considered an issue, but CMA CGM has stated that just 1% of cargo capacity will be lost in these ships to accommodate the storage tanks.[37]

Methanol is capable of being used in a diesel engine and is considered a possible fuel of the future, because it reduces SOx emissions by about 99% and NOx by about 60%. However, it comes with baggage. It burns with a very low flame temperature and, with a flashpoint of −12°C, it requires storage in inerted tanks. Methanol is not covered by the IMO's International Code of Safety for Ship Using Gases or Other Low-Flashpoint Fuels (IGF Code) and so it is only likely to become commercially viable as a fuel when an internationally agreed code has been adopted. Work is, however, expected to begin soon at the IMO on a methanol code.[38]

Compagnie Maritime Belge (CMB) is pioneering the use of hydrogen. It has introduced into service a small passenger vessel fitted with dual-fuel internal combustion main engines designed to burn hydrogen and diesel oil. If successful, CMB is expected to fit one of its container ships with a hydrogen-powered auxiliary engine. But widespread commercialisation of hydrogen as a fuel is considered unlikely until it is used in conjunction with fuel cells, where its full potential is more likely to be realised.[39]

Post script

Although attention is currently focused on the introduction of the 2020 sulphur cap, another environmental challenge s looming for the shipping industry in the shape of the IMO's commitment to reduce the total annual greenhouse gas (GHG) emissions by at least 50% by 2050 compared to 2008, while at the same time pursuing efforts towards phasing them out entirely.

The piecemeal nature of IMO's regulatory roadmap to the reduction of GHG' emissions is arguably flawed where the introduction of a control on one gas can affect the production of others. The control on Sox is an example in the case of ships that are converting to the use of LNG. Methane leakage is a characteristic of the use of LNG, but even SEA/LNG (the main advocacy group promoting the use of LNG as a marine fuel) acknowledges that utilising best practices and appropriate technologies to minimise methane leakage will result in only a 10–20% reduction in GHG emissions.[40]

Only a step-change in technology is likely to meet the IMO's ambitious target. The likelihood is that ships being built in the 2030s and onwards will need to look towards the likes of hydrogen, ammonia, sustainable biofuels and sail to power them across the oceans. In the interim, measures such as speed restrictions and requirements to improve the efficiency of existing ships are likely to be implemented.

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[36] TradeWinds, 'One quarter of newbuild orderbook fitted with scrubbers', 30 August 2018.
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