IMPACT OF SULPHUR CAP 2020 REGULATION ON THE SHIPPING INDUSTRY

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Abstract: The adverse health and environmental impacts caused by high emission of Sulphur Oxide (SOx) from shipboard machineries have been considered as one of the major issues in the maritime transport sector. MARPOL Annex VI espoused that the amount of SOx and particulate matter (PM) from shipboard emissions shall be limited to 0.5% of mass/mass (m/m) for vessels operating outside of the Emission Control Area (ECA). For vessels operating within ECA areas, the SO_X and PM emissions are limited to 0.1% m/m). The enforcement of Sulphur Cap 2020 regulation has seen the reduction in the production volume and price for Heavy Sulphur Fuel Oil (HFSO) and a significant price increased and higher production for Very Low Sulphur Fuel Oil (VLSFO). This event will result in increasing operating cost for vessels that chose to comply with the Sulphur Cap regulation by changing the usage of fuel oil. This study examines the impact of IMO's Sulphur Cap regulation to the shipping industry using the Economic, Technology, Environment, Legal and Operational (ETELO) approach.

Keywords: ETELO Analysis**,** MARPOL Annex VI, Scrubber, Shipping Industry, Sulphur Cap 2020.

Background

Nitrogen oxide, Sulphur Dioxide (SO_2), Carbon Dioxide (CO_2), Hydrocarbons (HC) and Particulate Matter (PM) are by far the most important pollutants emitted from ships engine combustion (Čampara, Hasanspahić, and Vujičić, 2018). Emissions from ships are easily transmitted to great distance in the atmosphere from the sea to land and between the continents. In addition, shipping emission effects can intensify in domestic seas, narrow channels, straits, gulfs and port areas, particularly including dense maritime traffic, sensitive ecosystems and population areas (Saraçoglu, Deniz and Kilic, 2013). The main source of the pollutants came from ships such as bulk carriers, container ships and tankers are driven by enormous two – stroke slow – speed diesel engines while all have minimum of one diesel generator available on – board (Čampara, Hasanspahić, and Vujičić, 2018).

According to United Nation Conference on Trade and Development (UNCTAD) (2018), Asia region had loaded 4.5 billion tonnes and offloaded 6.7 billion tonnes of cargo in its seaports. Less than half of

those amount were registered in the other continents. Due to this high maritime transport activities, approximately 2.6% of global Greenhouse Gas (GHG) emissions are produced yearly by maritime transport despite changes and improvement in ships' operational efficiency. Comparing among various type of maritime activities, international shipping contributes around 87% of total Carbon Dioxide (CO_2) emission each year (Olmer, Comer, Roy, Mao and Rutherford, 2017). During 2018, Maritime activities in Malaysia produced 250.3 million tonnes of CO_2, which translates to 0.7% of global CO_2 emission (BP, 2019).

The International Maritime Organisation (IMO) is implementing its own plan to reduce GHG from ships in line with agreed temperature goals under Paris Agreement. IMO has established the limit of SO_X and particulate matter (PM) emissions and enforced by signatory states since the 2010. IMO aims to reduce GHG output from shipping activities to at least 50% by 2050 (Joung, Kang, Lee and Ahn, 2020). The allowable limit is per Table 1.

Table 1: SO_X Allowable Limit (Source: INTERTANKO 2020 Practical Guide)

Outside An ECA Established to Limit SO_X and PM Emissions	**Inside An ECA Established to Limit SO_X and PM Emissions**
4.50% m/m prior to 1st January 2012	1.50% m/m prior to 1st July 2010
3.50% m/m on and after 1st January 2012	1.00% m/m on and after 1st July 2010
0.50% m/m on and after 1st January 2020*	0.10% m/m on and after 1st January 2015

MARPOL Annex VI: Sulphur Cap 2020

IMO regulations to reduce SOx emissions from ships first came into force in 2005, under Annex VI of the International Convention for the Prevention of Pollution from Ships (known as the MARPOL Convention). Since then, the limits on sulphur oxides have been progressively tightened. From 1 January 2020, the limit for sulphur in fuel oil used on board ships operating outside designated emission control areas has been reduced to 0.50% m/m (mass by mass). This will significantly reduce the amount of Sox emanating from ships and should have major health and environmental benefits for the world, particularly for populations living close to ports and coast region.

The advantages of implementing IMO's Sulphur Cap 2020 started with better quality air. IMO states that this new regulation helps to reduce SO_X from ship by 77% that is equal to approximately 8.5 million metric tonnes of SO_X (IMO, 2020). Better quality air will have positive impacts on human health such as the reduction of respiratory and pulmonary diseases. This regulation will ensure that majority of ships will use better fuel oil by changing from Heavy Sulphur Fuel Oil (HSFO) to Very Low Sulphur Fuel Oil (VLSFO). IMO had also informed ship operators, owners, refineries and bunker ports the guidelines to ensure the preparation to implement Sulphur Cap 2020. In ensuring this regulation is being enforce, flag states and port state control authorities have to ensure ships entering or using their waters comply with the requirement by performing inspections (IMO, 2020).

Complying with Sulphur Cap 2020

Today, there are more than 60,000 vessels in operation, which fall within the IMO 2020 compliance classification. Of these, about 3,000 vessels were retrofitted with a scrubber device to remove SO_X pollution (IMO, 2020). In order to fulfil the 2020 specifications, ship owners and ship operators would either need to use compliant ISO 8217:2017 fuel oils with a maximum sulphur content of 0.5%, such as VLSFO and Marine Gas Oil (MGO), installation of an exhaust gas cleaning machine (EGCS), also known as a scrubber or opt for renewable fuels containing very small rates of sulphur such as methanol and LNG. Decision-making must take into consideration the specifications, where applicable, of the individual Flag Administrations and Port States as well as the construction arrangements, operating characteristics and trade trends of each vessel (INTERTANKO, 2019).

Challenges to Shipping Industry

Out of the three alternatives to achieve the IMO's Sulphur Cap 2020, the simplest option with the least capital investment required, is simply to switch from fuelling ships with High Sulphur Fuels Oil to fuel oil with low enough Sulphur emissions to be considered as IMO–compliant (Smith, 2019). Prices for heavy fuel oil have remained fairly stable, varying from just under USD 300 to USD 370, depending on the bunker port. Regarding the price for VLSFO, the price for a metric tonne of this fuel was around USD 740 during the first week of 2020 compared to roughly around USD 550 at the beginning of December 2019. However, the price dropped to USD 570 per metric tonne after the third week of January 2020 (opisnet.com). In light of the recent uncertainty in the price, shipping firms are also experiencing a significant rise in fuel oil prices, which is projected to impact profit margins because many businesses have minimum to no leeway to pass on the increased costs to their consumers (Saville, 2020).

According to Organization of the Petroleum Exporting Countries (OPEC) (2015), there are 400 major ports globally. Top ten ports in this list handle 60% of the bunkering market. It will be fair to assume that there may be enough compliant fuel on these major ports. The uncertainty, however, lies in the remaining 390 ports which are comparatively smaller. For these smaller ports the problem is in preparing and planning ahead about an uncertain future that has no precedence. According to IMO's Fuel Oil Non – Availability Reports (FONAR) 2020, Brazilian ports recorded shortages of the 0.5% VLSFO. The same event also occurs in India and Sri Lanka (Jordan, 2020).

Even if some ship – owners have decided to install scrubbers as a remedy, many of their vessels may not be able to install them because of numerous factors including time constraints and shipyard capacity constraints. A scrubber machine may be costly, costing up to US$5 million and need time around six to nine months for installation and commissioning. Additionally, big ships may require installation of several scrubbers that will further increase the cost (worldmaritimeaffairs.com, 2019). Installing such systems can mean a large amount of capital investment outlays upfront. From the perspective of the supply industry, the best possible outcome is 1,200 scrubbers installed and are up and running before the 2020 deadline (Odey and Lacey, 2018). Scrubbers allow vessels to continue using Heavy Sulphur Fuel Oil (HSFO). However, there have been reports that the corrosive nature of the gases exhausted by the scrubbers means that these ships will require more maintenance than non–scrubber ships. Adding further problems related to scrubbers, several countries have prohibited open-loop systems even in their seas. The Marine Department of Malaysia, Singapore's Maritime and Port Authority (MPA) as well as the Ministry of Transport of China, have banned vessels from discharging wash water in their ports and pollution control zones (Britannia P&I, 2020).

LNG powered engines can be mounted as an option beside using scrubbers. However, fitting an LNG system aboard, like a scrubber unit, is pricey, has a lengthy lead period and needs a wide space for certain ships, which might not be a luxury (Smith, 2019). LNG has no substantial effect on greenhouse gas (GHG) pollution and can only be a partial alternative to zero carbon fuels. Nevertheless, LNG technology is a successful path ahead. It offers a sufficient response to the forthcoming air pollution problems and its small CO_2 reductions will also help the sector embark on the move to low emission solutions (Santamoto, 2019).

According to Drewry's survey, 33% of respondents reported low comprehension and interpretation of the current legislation, while 52% feel either not prepared or not prepared at all for the effect of the current pollution regulations. The ships are obliged to comply with this regulation, but the ships are dependent on ports for their fuel oil and ports depend on the refineries for supplies. However, ports and refineries are not bind by Sulphur Cap 2020 directly. Ports and refineries are focus on profit and market share which are based on demand (Slaughter, Ray & Shattuck, 2019).

ETELO Analytical Tool

According to Animah, Lamptey, Korsah & Sackey (2018), installation of a scrubber system on board ships requires high capital cost which is around US$1 million to $5 million and it will take from six to nine months to complete. The long installation process will make the ship owners lost their revenue. As for ships that decided to change the use of fuel oil, the price of VLSFO remains unstable based on demand and most likely the price will be high (Saville, 2020). High price of fuel oil will also increase the ship operating cost. Around 57% of a ship operating cost is for fuel oil only (Furuichi and Shibasaki, 2015). Based on calculations, it shows the cost expand between 20% to 85%, depending on speed, fuel price and ship size. The fairly wide gap is primarily attributed to the instability around low sulphur ship fuel availability (DNV-GL, 2016). Higher operation cost will result in low profit margin to the ship owners. Some ships will try to avoid from entering small ports to reduce their operating cost and seek major ports with available VLSFO for ships without scrubber system (Slaughter, Ray, Shattuck, 2019).

Scrubber system for ships is considered as a new technology to reduce particulates emission from engine combustion. Several researchers stated that this technology is new and still unproven that is able to achieve the intended purpose. There are two types of scrubber available to be installed on board, which are wet type scrubber and dry type scrubber (Smith, 2019). Comparing the maintenance of engines when using HSFO, VLSFO or LNG, LNG-fuelled ship engines and its associated equipment have greater longevity and require less maintenance than ships powered by fuel oil (Smith, 2019). Several reports have been made to IMO related to contamination of fuel oil for ships that used MGO and VLSFO. Most of the contamination happened during bunkering (Short, 2019). Therefore, the responsibilities to reduce or eliminate this problem falls to the ship operators/owners and bunker ports.

IMO's Sulphur Cap 2020 helps to reduce air pollution from ships and is expected to bring major health and environmental benefits to the world, especially to people living near ports and coastal region. Reducing SO_X also helps to prevent acid rain, which in turn brings benefits to plants, crops and forests. Preventing acid rain from happening will also assist in reducing the rate of ocean acidification. According to a study performed by IMO Marine Environment Protection Committee (MEPC) (2016), more than 570,000 additional premature deaths worldwide between 2020 – 2025 would likely to happen if the SO_X vented out by ships remains as before the implementation of Sulphur Cap 2020.

Focusing on legal issues, there are still uncertainties felt by some of the ship operators/owners regarding the enforcement of the Sulphur Cap regulation (Odey and Lacey, 2018). The uncertainties came from exemption that a ship can be exempted if it is able to show the unavailability of compliant fuel at a port. This reflects the confusion about strict enforcement of the regulation (Slaughter, Ray & Shattuck, 2019). The inconsistency also involves the selection of scrubber system for certain ports. As an example, some

countries such as Malaysia, Singapore and China have banned the use of open-loop scrubbers (Smith, 2019). This has created a problem in selecting a scrubber system that is within an acceptable cost to the ship operators/owners. Ensuring that ships comply with the regulation, strict enforcement needs to be implemented. However, no single entity other than flag state has the authority, let alone the technical capacity to carry out inspections on the high seas. The IMO lacks jurisdiction over the high seas and does not maintain a force capable of carrying out inspections (Halffa, Younesb & Boersmaa, 2019). Qualified inspectors are also needed in port state control to carry out the on board inspections. Only PSC personnel with sufficient knowledge of fuel systems, machinery and fuel sampling should be authorised (DNV-GL, 2016).

Related to impact of Sulphur Cap 2020 to ship's operations, the availability of acceptable fuel oil is still in question especially for smaller ports. Some ship operators/owners have voiced out their concern that the VLSFO viscosity, stability or compatibility may not be suitable to the ship's main engine even though the fuel oil complies with ISO 8217:2017. Contamination of fuel at bunker ports also had been reported in Texas, Panama and Singapore (Short, 2019). This shows that there is still a long way to go before the Sulphur Cap 2020 can fully fulfil its purpose. Availability of LNG and its infrastructures to support the increase in demand are also still debatable. Establishing these infrastructures requires huge investment that not all investors are able to handle (Smith, 2019). According to Smith (2019), ships fitted with scrubber system require more maintenance because of corrosive nature of the gases exhausted by the scrubbers. This event has been reported by some of the ship operators/owners.

Based on the preceding discussion, the issues concerning the Sulphur Cap regulations can be analysed by using five aspects namely Economic, Technology, Environment, Legal and Operational (ETELO). The summary of this qualitative analysis is listed at Table 2.

Table 2: The Summary of the ETELO Analysis

Factors	Issues
Economic	1. High capital cost for scrubber installation. 2. Uncertain and fluctuation of oil price. 3. Increase in ship operating cost. 4. Little profit margin due to high operating cost that needed to be handled by ship operators/owners. 5. Rerouting of ship to avoid smaller ports.
Technology	1. Scrubber system for ships is considered as a new and unproven effectiveness.

	2. LNG-fuelled ship engines and associated equipment have greater longevity and require less maintenance. 3. Development of special equipment to reduce or eliminate cross fuel oil contamination.
Environment	1. Bring major health and environmental benefits. 2. Help to prevent acid rain which in turn brings benefits to plants, crops and forests. 3. Preventing acid rain assist in reducing the rate of ocean acidification. 4. Prevent a huge number of additional premature deaths.
Legal	1. Uncertainties felt by some of the ship operators/owners regarding the enforcement of the regulation due exemptions given if ships able to show unavailability of compliant fuel at a port. 2. The selection of scrubber system for certain ports since some states have banned the use of open-loop scrubbers. 3. Lack of enforcement on the high seas. 4. Qualified inspectors are needed under port state control to carry out the on board inspections.
Operational	1. The availability of acceptable fuel oil is still in question 2. Compatibility of fuel oil with ship/s engine. 3. Contamination of fuel at bunker ports. 4. Availability of LNG and its infrastructures to support the increase in demand are still debatable. 5. Ships fitted with scrubber system require more maintenance because of corrosive nature of the gases exhausted by the scrubbers.

Conclusion

IMO's Sulphur Cap 2020 have influenced key stakeholders such as ship operators, owners, refiners, port state control and bunker ports to prepare for greener shipping industry. It has also propelled the progress of technological and infrastructural reediness to comply with the requirements. Although the regulation is focussed on the shipping industry, the effects are expected to benefit all human being especially those living near ports and the coastal region by having better air quality. Further improvement, training and regulation enforcement are needed to ensure the regulation is consistently adhered by key stakeholders. Shippers of products have to be prepared for the possibility of increase in freight rate due to the increase of fuel price and other operational costs, which will translate into higher market price for the consumers.

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