International Maritime Organization (IMO) 2020

Strategies in a
Non-Compliant World

Executive Summary

- Effective January 2, 2020, the IMO 2020 regulation mandates ships to use fuel with less than 0.5% Sulphur vs. a maximum of 3.5% currently.
- The regulation was finalized in 2016 giving plenty of time for compliance, but the industry has adopted a wait-and-watch approach due to uncertainty in future compliance options, fuel availability and quality.

- To comply, shippers can install scrubbers or use Very low Sulphur fuel oil (VLSFO) or Marine Gas Oil (MGO) or Liquefied Natural Gas (LNG) but are unsure of the correct strategy to adopt.
- Scrubbers require large upfront costs and have long lead times.
- VLSFO can be produced using fuel blending, but the fuel quality could vary from port to port.
- MGO could be a good go-to option but can be costly.
- Conversion to LNG is costly and the availability of the fuel is limited to a few ports.
- Based on the facts presented in this briefing, in the short term, MGO and VLSFO prices are likely to rise, while High Sulphur Fuel Oil (HSFO) are likely to drop significantly.
- HSFO may find parity with coal.
- MGO and VLSFO price spread could tighten if ships use fuel switching as a strategy and maintain a balanced consumption between the fuel types.
- In the long run, LNG fueled ships will be a good option as IMO plans to reduce CO2 and Particulate Matter (PM) emissions.
- Low LNG prices in the medium to long term could make LNG very attractive as a marine fuel.

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IMO 2020 defined

IMO 2020, also known as Sulphur 2020 or MARPOL 2020, is a regulation officially confirmed by the International Maritime Organization (IMO) in October 2016....

with the aim of reducing harmful sulfur oxides (SOx) emissions by the maritime industry. It mandates shipping vessels outside the designated emission control areas to use fuel containing less than 0.5% of Sulphur, an 86% reduction from the current rule of 3.5%, from January 1, 2020 onwards.

To comply, ships have various options, including installing scrubbers in their current shipping fleet to remove SOx emissions due to the use of High Sulphur Fuel Oil (HSFO), also known as bunker fuel, or using alternatives like Very Low Sulfur Fuel Oil (VLSFO), Marine Gas Oil (MGO) or Liquefied Natural Gas (LNG).

Fuel oil with maximum Sulphur of 0.1% is called ULSFO — less than 0.5% is VLSFO, less than 1% is LSFO and less than 3.5% is HSFO. VLSFO can be produced by blending ULSFO with LSFO or MGO with LSFO, and LSFO is produced by hydrotreating or hydroprocessing residual fuel oil. This briefing analyzes data on LSFO, since VLSFO is not yet produced.

MGO belongs to the diesel family. It is close to the chemical structure of heating oil and is available at the bunkering ports. MGO does not require changes to the ship's engine or boiler nor any special storage and unlike VLSFO, MGO is tried and tested for marine purposes.

With less than three months remaining for the rule to come into effect, a growing question in the industry is what the level of compliance will be and more importantly, what will be the correct strategy to adopt in the shorter and longer terms, assuming there is a certain level of non-compliance. Keeping that in mind, this briefing aims to discuss the scale of the problem, challenges ahead, strategies that are pragmatic and achievable, and the longer-term options the shipping industry should consider.

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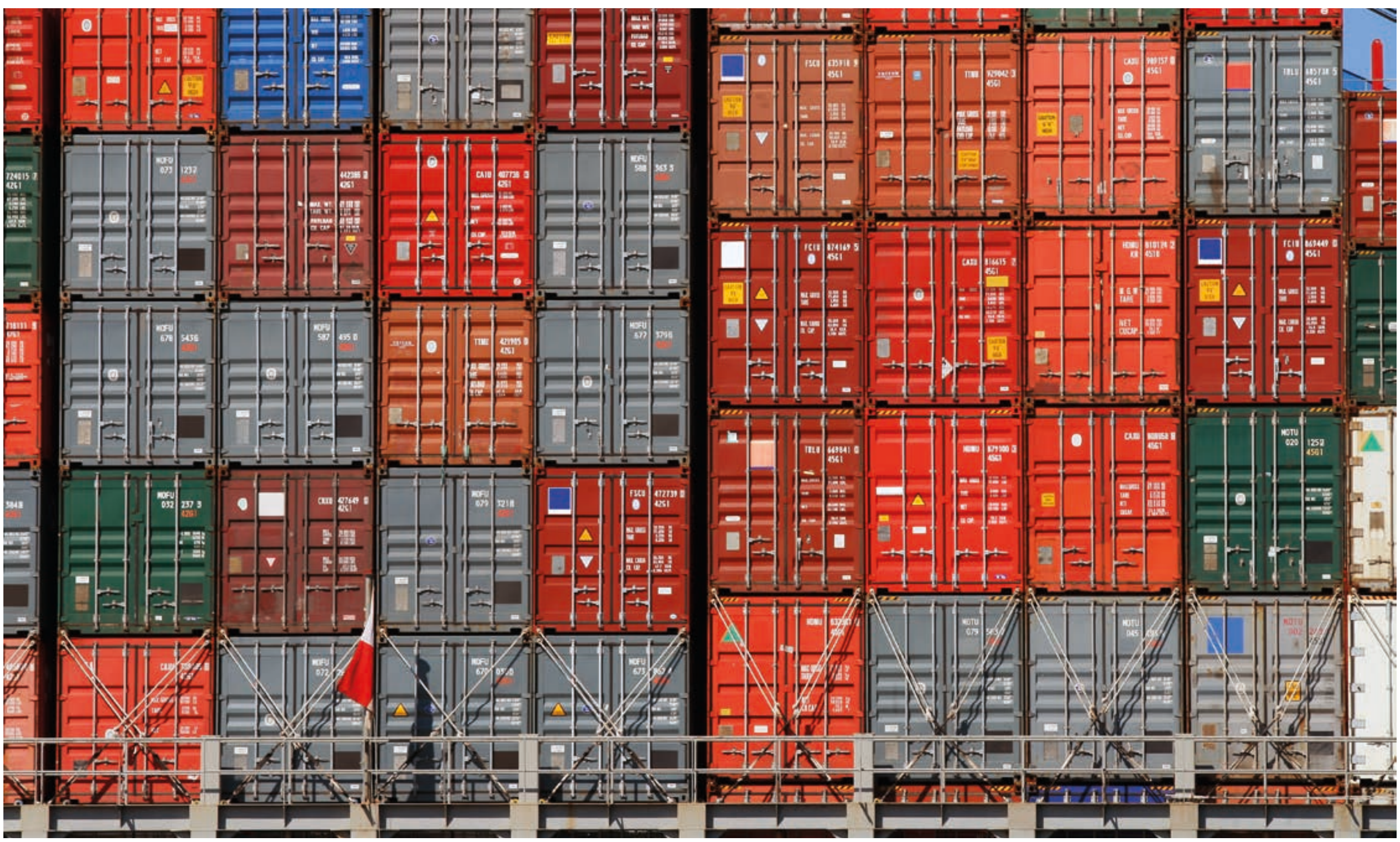
The problem – a dilemma for the shipping industry

More than 60,000 shipping vessels are in operation today, which fall into the IMO 2020 compliance designation[1]. Of these, only 3,000 have been retrofitted with a scrubber system to absorb SOx emissions so far[2]. A scrubber system can be expensive, costing up to $5 million and taking six to nine months to install[3]. In addition, large ships may require multiple scrubbers to be installed, compounding costs. Installation of such systems can mean large upfront capital expenditures.

Outside of scrubbers, hydrotreaters and LNG-powered engines can be installed. However, installation of a hydrotreater onboard, like a scrubber unit, is costly, has a long lead time and requires a large space which may not be a luxury for many ships. In the case of LNG, there are currently only 300 ships that run on the fuel. Switching to LNG is particularly challenging as it means installing a different type of ship engine, having special storage onboard, and requiring staff training — which makes this option too costly, complex and not viable in the short term.

Only
3,000/60,000
vessels have been retrofitted with a scrubber system



[1] https://www.hellenicshippingnews.com/lsfo-demand-to-displace-hsfo-in-asia-ahead-of-imo-2020, accessed August 22, 2019
[2] https://www.hellenicshippingnews.com/scrubber-uptake-orders-nearly-double-in-six-months-to-april-dnv-gl, accessed August 22, 2019
[3] "IMO 2020 – Short term implications for the oil industry", Shroeders August 2018

That leads us to the remaining 57,000 or 97% of the total shipping vessels, for whom the prudent short-term solution will likely be switching to a cleaner fuel oil—maybe MGO or VLSFO—provided there is enough compliant fuel available. Let us investigate if that is the case.

Fuel switching brings into play the entire downstream oil value chain. Apart from the ships, the refineries and the ports that will bunker the new fuel type will have a role, even if they are not obligated to do so by the regulation. As far as refining is concerned, the total worldwide bunker fuel demand is roughly 4.3 million barrels per day (b/d)[4], which is fully met by the refineries. The total estimated worldwide fuel oil hydrotreating or hydro processing capacity for residual oil is 439 million metric tons per year (mt/y) or 8.05 million b/d[5]. If the regulation were to be effective in 2019, assuming an average feasible utilization of 85%, and with 50% of the total global Fuel Oil production being used by shipping vessels[2],a back-of-the-envelope calculation of the total marine compliant fuel oil supply from refining residuals suggests a shortage of 0.8 to 1 million b/d. It is worth noting, that by 2021-2022, the global desulphurization capacity is planned to grow by 4.9 million b/d[6], resulting in a substantial LSFO supply potential. But to address the immediate shortfall, MGO and other similar fuel blends will have a major role. In fact, the current MGO production, which is around 0.9 million b/d [5], should compensate for the shortfall of 0.8 to 1 million b/d in LSFO. However, the above calculation assumes MGO is second in preference to LSFO as the latter is currently cheaper. It does not consider future price spreads that will affect decision making, role of the ports and—more importantly—a dilemma for the shipping industry.

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The top ten ports in the world handle 60% of the bunkering market of 400 major ports globally [7].

It will be fair to assume that these major ports will possibly have enough compliant fuel; however, the uncertainty lies in the rest of the 390 ports, which are comparatively smaller. The dilemma for these smaller ports is in planning and strategizing for an unknown future that does not have a precedent. Questions include:

- **Will the ships rework their routes to avoid smaller ports?**
- **Will there be a certain economy of scale to negotiate a better contract with refineries and how much storage space will they need to offer three variants of fuel (VLSFO, MGO and HSFO) from only HSFO and MGO as is currently?**

Answers to these questions will not be known until the regulation kicks-in.

[4] https://www.iea.org/oil2019, accessed August 22, 2019
[5] "Assessment of Fuel oil availability", IMO July 2016
[6] World Oil Outlook 2040, Organization of the Petroleum Exporting Countries 2017
[7] World Oil Outlook, Organization of the Petroleum Exporting Countries 2015

As per IMO 2020, the obligation to comply rests with the ships, but ships are dependent on the ports and ports—in turn—on the refineries. Refineries and ports are not obligated, and their incentives are profit and market share, which are a function of demand. Demand at this point is an unknown resulting in a dilemma for the industry. The ships expect the ports to have enough preferred fuel, the ports expect refinery production to meet demand, and refineries are unsure of the demand. Moreover, IMO's exception clause that a ship can get waivers if able to demonstrate unavailability of compliant fuel at a port and uncertainty over strictness of compliance as pointed by other reports[8], adds to that dilemma. This dilemma has led to a wait-and-watch approach for the industry[9]. Ships want to wait until the market factors in the changes. Similarly, ports and refineries cannot plan unless the demand for a fuel type can be carefully quantified. In other words, the rational expectation for the industry is that there will be a lag in the supply chain to be in-sync and free of bottlenecks. This lag could result in non-compliance.

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Several reports have indicated different levels of non-compliance. For example, IEA estimates non-compliance of 700,000 b/d[10] (20%) or more. Some analysts expect a non-compliance of 10%.[10] These estimates may have a basis, but the bigger question lies in the effect on the overall pricing of these fuels, which—in turn—has a direct correlation as to what that demand may likely be in the short term.

[8]https://stillwaterassociates.com/imo-2020-part-5-enforcement/, accessed August 22, 2019
[9]"The Effects of Changes to Marine Sulphur Limits in 2020 to Energy Markets", EIA March 2019
[10]https://www.freightwaves.com/news/fuel/imo2020-compliance-iea-estimates, accessed August 22, 2019

Short term outlook – 2020

Now we will discuss one of the non-compliance scenarios (15%) and estimate potential short-term price and demand impacts. We have excluded the LNG ships from the calculations, as they are a very small part of the fleet. We have assumed an average annual growth rate of 3%, equivalent to the historical growth rate in the last five years in marine fuel demand, which equates to a total marine fuel demand of 4.49 million b/d in 2020.

A case of 15 % non-compliance

Assuming the non-compliant ships and the scrubber-fitted ships will continue using HSFO, the demand for HSFO will likely be 0.89 million b/d in 2020 – a 74.4% drop from 2019. Such a significant drop in demand could cause HSFO prices to fall significantly.

HSFO is currently used for power generation in countries such as Saudi Arabia and Russia as a competing fuel against coal. A low HSFO price scenario may make it economically attractive to compete with coal elsewhere as well. A reasonable assumption, therefore, will be that HSFO price will likely find a floor when it finds parity with coal in terms of BTU and emission content.

Out of the remaining bunker fuel demand of 3.6 million b/d, the distribution of market share between MGO and LSFO is unknown at this point. We assume two sub-scenarios – 60% and 40% of MGO.

60% MGO

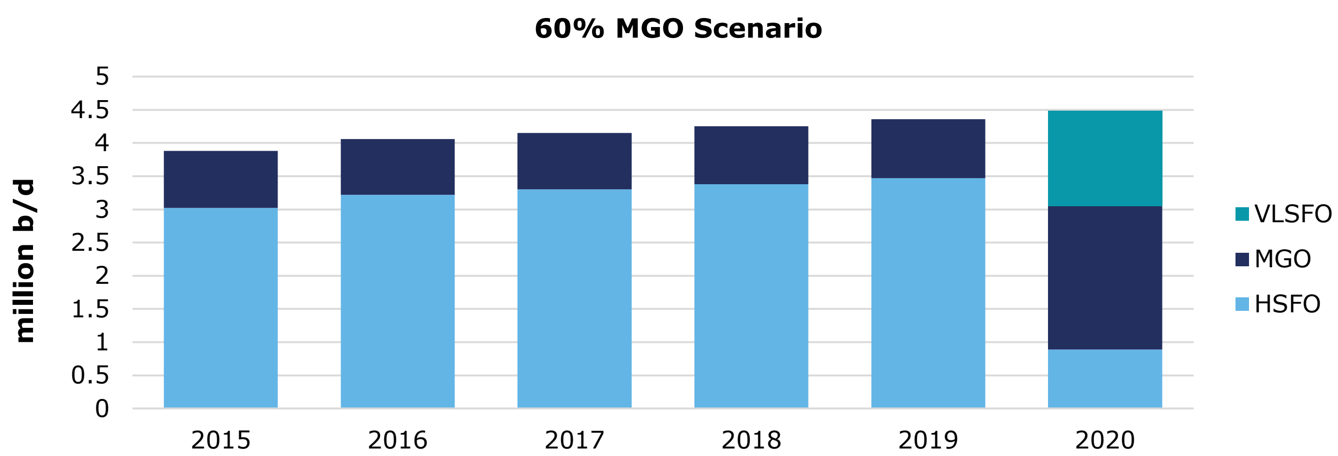
A 60% MGO demand will mean 2.16 million b/d – an increase of 140% over current MGO production of 0.9 million b/d.

Such increase in MGO demand will not likely happen without affecting middle distillate prices or crude prices or both, which will indirectly affect MGO price.

For the same crude run, more MGO means less of other middle distillates putting upward price pressure on diesel, which could have wide-ranging ramifications on the broader economy and, therefore, limits a significant rise in diesel prices. On the other hand, by increasing crude runs, MGO production can be increased which means more diesel as well as gasoline production, thereby putting downward price pressure on gasoline and diesel. In either case though, MGO prices will likely end up higher as refineries try to offset loss in margin from gasoline and diesel.

To meet the remaining 40% of the bunker fuel demand, 1.44 million b/d of LSFO must be produced. As mentioned before, current hydro processing capacity can meet that demand, however, LSFO prices will likely trade at a premium because of this increased demand.

Figure 1: Bunker fuel consumption by year for 60% MGO scenario



Source: 2015-2019: IEA[4], 2020: As per calculations in this paper

40% MGO

A 40% MGO will mean a demand of 1.44 million b/d - an increase of 60%. VLSFO demand will be the remaining 2.16 million b/d. Figure 2: Bunker fuel consumption by year for 40% MGO scenario

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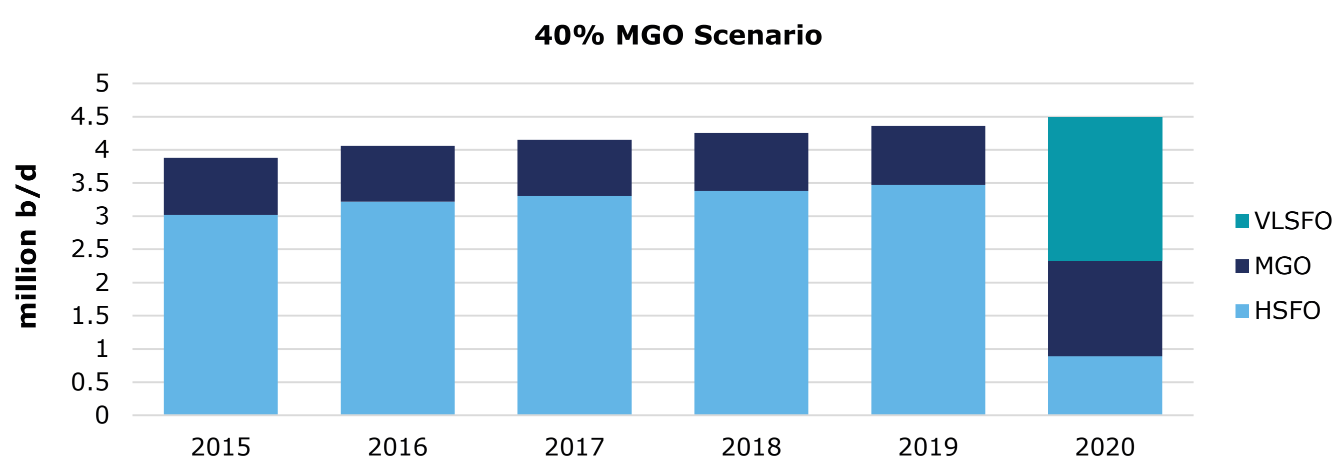
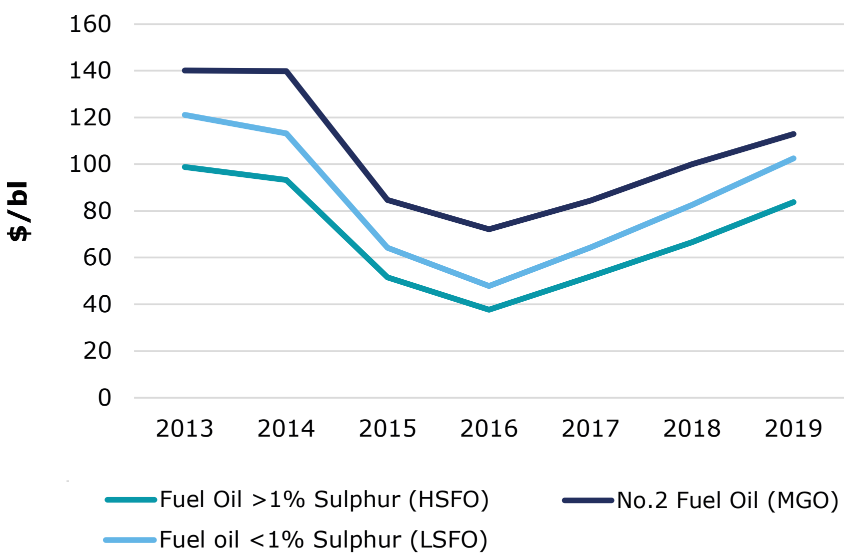


Source: 2015-2019 IEA[4] 2020: As per calculations in this paper

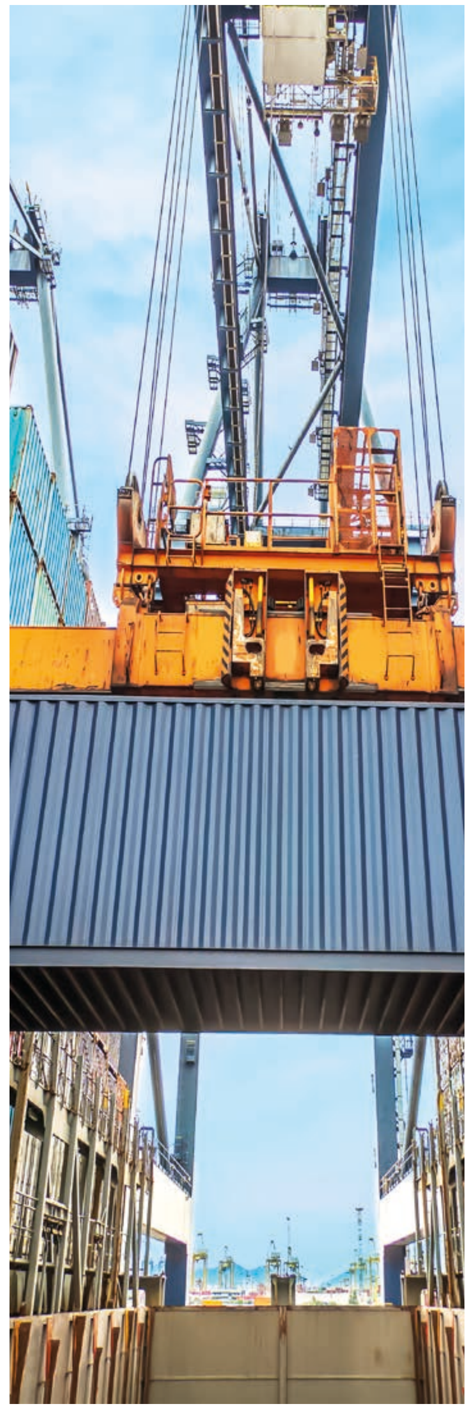
The 2019 projected spread between MGO and LSFO is $10.35 as shown in Figure 3, MGO being higher. If we were to take the 60% MGO case, with almost 50% more MGO demand than in the 40% case, the spread will likely widen in 2020. In the 40% MGO case, with higher LSFO demand, the spread will likely tighten in 2020 as LSFO is currently cheaper than MGO. In both cases, spread between HSFO and MGO or HSFO and LSFO will widen with drop in HSFO demand.

Figure 3: Annual oil product prices in the US



Source: 2015 – 2018[11] EIA 2019: Projected using average growth from 2015-2018

If price elasticity is considered in the above scenarios (i.e., a higher priced MGO will drive shippers to LSFO and vice-versa), the spread between MGO and LSFO will tighten. Additionally, VLSFO will likely trade at a premium to LSFO because of blending and hence would reduce the spread further.



To summarize, IMO2020 in the short term will likely lead to price increase for MGO and LSFO and a drop for HSFO, but at a 15% non-compliance, shipping firms should have enough wiggle room to switch between MGO and VLSFO (40% to 60%) as demonstrated by the scenarios, without having to pay significant premium, if any, between the two. However, the greater the demand for either of MGO or of VLSFO (i.e., outside the 40-60 band), the wider will be the spread. In these circumstances, a win-for-all strategy will likely be if big shipping firms such as Maersk or MSC maintain this consumption balance between MGO and VLSFO across their fleet, either by assigning ships to use a specific type or use fuel switching at ports, provided the viscosities of the fuels are within an acceptable range.

[11] https://www.eia.gov/dnav/pet/pet_pri_refoth_dcu_nus_a.htm, accessed August 22, 2019

Long-term horizon

Unlike the short-term, where fuel prices and quality of fuel will be big factors in decision making, once the industry stabilizes through this uncertain period, the long-term will likely be about investing in the correct technology or solutions to become future-ready. While fuel switching and scrubber installation may pick up in the medium- to long-term horizons, other solutions such as LNG as a marine fuel will have increased adoption, as suggested by the EIA[12].

In fact, IMO's plans to reduce PM, and CO2 emissions will likely propel new ship builders to consider LNG as an option, since it emits 21% less CO2 than fuel oil and emits substantially less particulate matter[13].

Further, low LNG prices is an enticing proposition for the ship owners. The LNG market, coupled with an over-capacity in US liquefaction, abundant gas production in the US including cheap associated gas and dwindling demand in Northeast Asia (such as Japan), has been facing a glut. This over supply will likely continue in the medium-term, keeping prices low and possibly even continue in the long-term for the following reasons:

1. **Abundant shale gas supply in the US** – In less than a decade, from being a net importer of gas to one of the largest producers of gas and a net exporter of LNG in the world today, the US has been instrumental in reshaping the global gas and LNG markets. The US has about 2,462 Tcf of recoverable reserves, out of which at the end of 2017, there was 464 Tcf of proved reserves that are economically recoverable at existing economic condition as per the EIA[14]. At a production of 30 Tcf/year and an average Henry hub price of $2.99 as was in 2017, there should be at least seven years of such cheap production assuming a standard decline rate of 10%.
2. **US LNG exports set to more than double in two years** – Current US LNG exports stands at 3.6 Bcf/d[15], which is expected to grow to 11.2 Bcf/d[13] by 2022 as more liquefaction facilities and LNG trains come online. As the US exports more LNG comprised of this low-cost gas, as mentioned above, and causes downward price pressure on spot LNG, long-term gas contracts will likely decouple from crude, especially if crude prices go up.
3. **Abundant and cheap associated gas** – The Permian basin, which is the second highest producing gas basin in the US after the Appalachian basin, is racing forward with cheap associated gas production at near zero or even negative gas prices. As more liquefaction facilities and pipelines come online in the US Gulf coast, and the Permian gas finds its way to the global LNG market, plus if crude prices rise as projected by the Annual Energy Outlook 2019,[16] Permian associated gas will continue to be heavily discounted and therefore cause downward price pressure on LNG. That means with at least 281 Tcf of recoverable reserves as per USGS,[17] at a current production of 13.2 Bcf/d, the Permian can theoretically supply unlimited discounted gas in the forceable future.
4. **Renewable penetration** – Renewable-based generation in the US has doubled since 2008, from 9% market share in 2008 to 17.1% in 2018. As per the Annual Energy Outlook 2019,[16] renewables are set to grow to 31% of the generation market, an 82% growth by 2050, compared to 39% from 34% market share currently for gas, a meager 15% in as many years. Such growth is only possible if renewables displace gas demand domestically. As that happens, excess gas will likely find way to the LNG markets leading to a lower LNG price.

[12] The Effects of Changes to Marine Sulphur Limits in 2020 to Energy Markets", EIA March 2019

[13] "LNG as maritime fuel – Prospects and policy", Congressional Research Service February 2019

[14] https://www.eia.gov/naturalgas/crudeoilreserves/, accessed August 22, 2019

[15] https://www.eia.gov/todayinenergy/detail.php?id=37732, accessed August 22, 2019

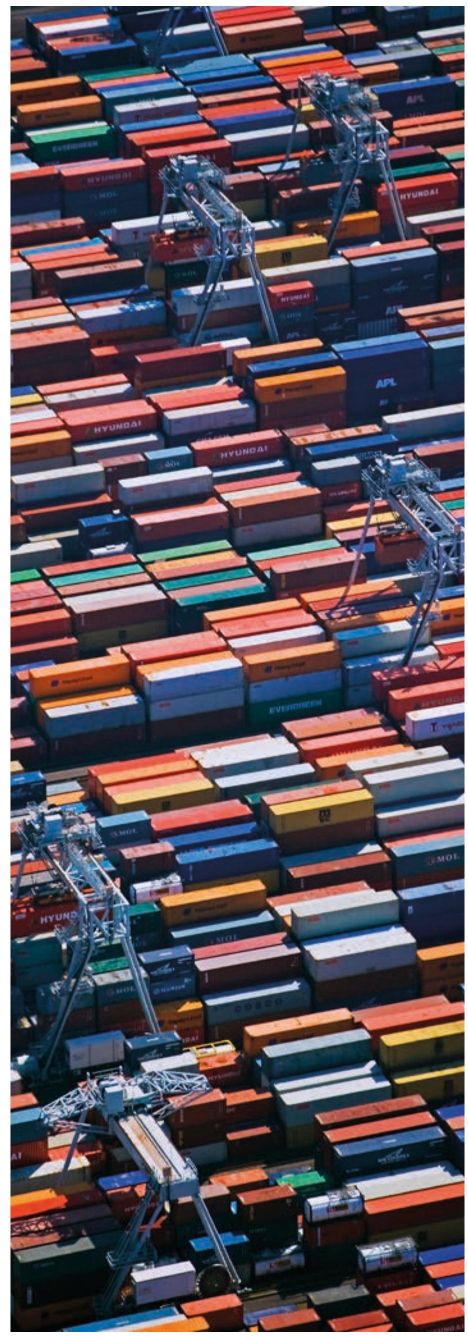
[16] "Annual Energy Outlook 2019", EIA January 2019

[17] https://www.usgs.gov/news/usgs-announces-largest-continuous-oil-assessment-texas-and-new-mexico, accessed August 22, 2019

Conclusion

For the 57,000 ships looking to navigate through uncertain times, fuel switching and maintaining a demand balance between fuel types are good strategies to consider in the short-term and LNG as an alternate fuel for the longer horizon, but these decisions are not in isolation. Rather they are dependent on several factors, including:

- **Compliance enforcement** – In this paper, we have assumed a 15% non-compliance as per IEA's forecast. However, if IMO is lenient in enforcing this as noted earlier in this briefing, non-compliance will likely be higher. Increasing non-compliance will mean higher HSFO prices and lower MGO and LSFO prices, compared to projections in this briefing and more wiggle room for the ships. However, for scrubber fitted ships, this could mean higher costs because of lower ROI, further discouraging ships from choosing scrubber as an option.
- **Quality of fuel** – Fuel switching to VLSFO will depend on the quality of the fuel. Since VLSFO can be produced by multiple blending combinations as mentioned earlier, quality and actual specification of the blended fuel may vary from port to port. If doubts over quality arise, ships may be forced to burn MGO only.
- **Streaming speed** – Ships have the flexibility to enhance fuel consumption against speed. Keeping that in context, ships may be able to save fuel at a lower speed and hence offset a higher price. By leveraging this tactic, depending on which fuel ends up costlier because of higher consumption, ships could reduce the excess consumption of one type to some extent. In other words, there could be additional elasticity effect due to streaming.



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