



Al-Attiyah Foundation Research Series

Expert energy opinion and insight

The IMO 2020 shift: choppy waters ahead

The sharp crackdown in sulphur emissions from bunker fuel by 2020, according to new rules introduced by the International Maritime Organization (IMO) in 2016, will bring a sea change to the marine fuel market, with huge ramifications for shippers and refiners. Around 4mn barrels a day (b/d) of global fuel demand is used as marine fuel. This is a relatively small percentage of the total global oil market — around 4%. But the sector has been an important outlet for high-sulphur residual fuel oils, the predominant marine bunkering fuel, which refiners can't sell elsewhere because of tightening environmental standards on road and industrial fuels. A reliable source of oil-products demand is about to change fundamentally — a regulatory impact that the market must soon start to account for. It is not yet clear how shippers will adapt — many are not ready. Their fuel costs are likely to rise.

Cutting pollution: two hard options

In October 2016, the IMO, a United Nations regulatory body for international shipping, took a landmark decision to cut the global limit for sulphur emissions from marine bunker fuels from 3.5% to 0.5% starting in 2020 (see Figure 01). The tighter limit on global sulphur emissions comes after much of Europe, North America and the Caribbean adopted even more stringent standards in 2015, capping bunker-fuel sulphur emissions at 0.1%. Hong Kong and some southern mainland China ports also enforce a 0.5% limit, and plan to cut that to 0.1% by 2020. The crackdown on sulphur emissions has come in response to a growing recognition of the role the international shipping sector plays in contributing to air pollution around the world.

High-sulphur residual fuel oils, which emit more sulphur than will be allowed under the IMO's 2020 regime, currently make up around 80%, or 3.2mn b/d, of the 4mn b/d market for marine fuel, according to the International Energy Agency. The remaining 20% is mostly marine gasoil — a lower sulphur middle distillate similar to diesel. The average sulphur content of fuel was around 2.45% in 2015, compared to around 0.11% for distillate fuel.

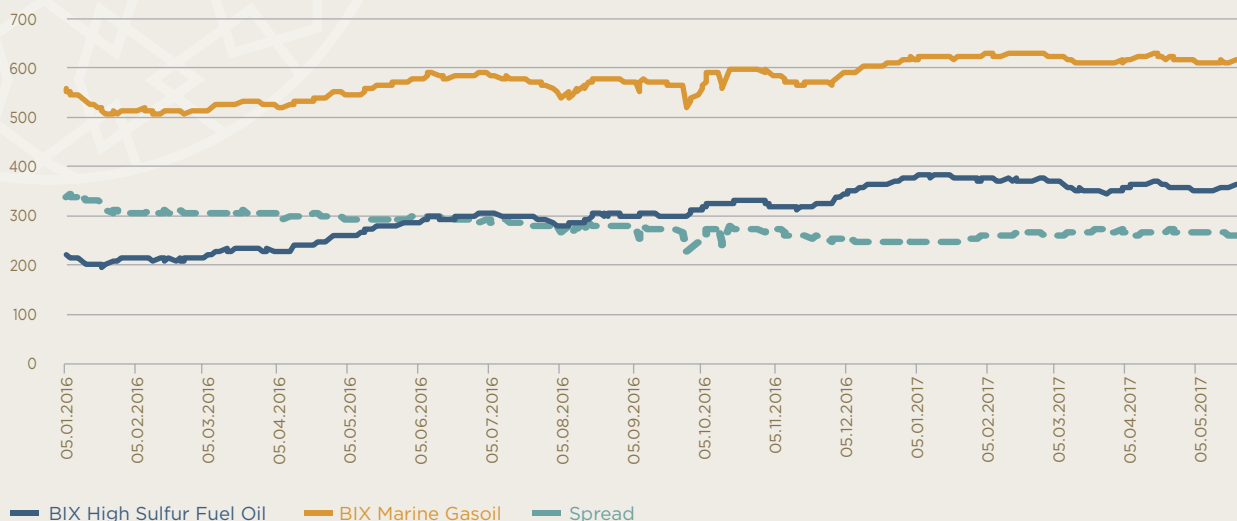
Shippers have several options for meeting the new emissions standards, all of which carry varying degrees of risk and costs. The first option is a straight switch from

high-sulphur fuel oil to lower-sulphur marine gasoils or hybrid-blended fuel oils — such as high-sulphur fuel oil blended with low-sulphur light products — that meet the new emission standards. This approach requires minimal upfront investment, but will raise fuel costs. Exactly how much is a multi-billion-dollar question hanging over the shipping industry, and will depend on the choices shippers and refiners make in the coming years.

FIGURE 01: **EVOLUTION OF IMO SULPHUR EMISSION RULES**

Date	IMO rules
January 2010	Global 4.5%
July 2010	ECA 1%
January 2012	Global 3.5%
January 2015	ECA 0.1%
January 2020	Global 0.5%

Source: IMO, PPI

FIGURE 02: GLOBAL INDEX OF PRICES FOR BUNKER FUELS (\$/METRIC TONNE)


Source: Bunker Index, PPI

Looking at the Northwest Europe ultra-low-sulphur diesel to HS IFO 380 (heavy fuel oil) spread shows the lower-sulphur fuel has traded at around a \$20 a barrel premium to fuel oil over the past couple years (see Figure 02). However, if most shippers pursue this path, the spread between middle distillates and fuel oil will widen sharply, reflecting surging demand for IMO 2020-compliant marine gasoil fuels and plummeting demand for fuel oils.

The consultancy Ensys looked at two scenarios. In one, around 90% of shippers switch over to marine gasoil. In the other, uptake is around 50%. In the high-uptake scenario, marine gasoil's premium over fuel oil jumps in 2020 to as much as \$70/b. Even in the 50:50 scenario, the premium could jump to as much as \$60/b. Estimates on the total economic impact of switching to marine gasoil have varied widely, but it could easily add \$50bn to \$60bn a year in fuel costs for the global shipping industry.

The second option for shippers is to install exhaust-gas cleaning systems, or scrubbers, that allow vessels to continue burning high-sulphur fuel oils by cutting sulphur output at the "tailpipe". Scrubbing systems use either seawater or special chemicals to strip the sulphur out of a ship's exhaust. Existing scrubber technologies are able to meet both the 0.5% and more stringent 0.1% standards.

Given the prospects of sharply higher fuel costs on the horizon, there would seem to be a strong incentive for ship-owners to install scrubbers on their vessels. However, only a few thousand of the global international shipping fleet of 70,000-plus are expected to have scrubbers installed by the time the new emissions rules come into force.

Part of the reason is that cash-poor shippers are balking at the upfront investment required to install the kit. The economics of installing scrubbers depends on the type of vessel and the payback period on the investment will depend on the gap between fuel oil and marine gasoil prices, creating

a large degree of uncertainty, which complicates raising the financing for the retrofits. For instance, installing a scrubber system on an Aframax tanker would cost around \$5mn, which could take anywhere from 2.5 years to six years to pay off, depending on the price spread, according to the consultancy DNV GL. Installing a scrubber on a new container ship is costlier, at \$10mn, but the payback period is shorter, at one to three years, because the vessel uses more fuel. Given that there is a potentially lengthy payback period, scrubbers are a better option for either newbuilds or relatively new ships that have enough of a lifespan left to recoup the investment.

There are further downsides to installing the scrubbers. Ships typically have to be dry docked and taken out of service for as much as a month, which adds to the cost. There is also a question of the industry capacity to install the scrubbers, which is a relatively new technology. Even if the whole international shipping fleet wanted to add scrubbers to allow themselves to continue burning high-sulphur fuel oil, existing capacity means it's only really feasible to install several thousand over the next two and a half years, though of course installations could continue after the rules are put in place. Still, scrubbers would be a very attractive option in a world in which most shippers eschew the upfront investment and switch to marine gasoils and the price of fuel oil collapses.

A natural gas solution?

The third option is to switch over to a cleaner-burning alternative fuel — most likely LNG. There are compelling reasons to consider LNG. Most notable are the environmental benefits. LNG is much cleaner burning than either fuel oil or marine gas oil. And the IMO 2020 regulations hint at a wave of stricter emissions standards coming to the high seas, in the same way road and industrial fuels have had to meet tighter environmental regulations. These regulations limit sulphur emissions, but other pollutants like nitrous oxide and carbon

dioxide, which scrubbers won't be able to deal with, are also likely to come under scrutiny in the coming years. In a world of ever-tightening environmental standards, LNG will become more attractive.

FIGURE 03: US LNG BUNKERING COSTS (\$/MMBTU)

US LNG bunkering cost (\$/mmBtu)	
Cost of gas: \$/mn Btu	\$4.00
Transportation	0.5
Liquefaction cost	5.09
Trucking	0.9
Total at dock	10.49
Bunkering	5
Total at sea	\$15.49

Source: IMO

However, the economics for many shippers to take up LNG remains challenging. Depending on the type of ship, adding LNG fueling capabilities can cost anywhere from \$10mn to \$30mn, with payback periods potentially stretching beyond 10 years. The lack of needed infrastructure is another worry. Outside a few ports in Europe, North America and Singapore, LNG bunkering port infrastructure remains limited. So, for now, only vessels that frequent one of the few ports with the necessary infrastructure are even able to consider LNG as a bunkering fuel.

This will change. Qatar Petroleum, through its Wave LNG Solutions division and Shell recently signed an agreement to develop a global network of LNG-bunkering stations, predominantly in East Asia, Europe and the Middle East and cited the impending IMO rules as part of the rationale. Saad al-Kaabi, QP's President, said demand for LNG in ships could reach 50m tonnes a year by 2030. The deal follows two memoranda of understanding from 2016.

Aside from infrastructure, there is the question of LNG pricing. Shippers know oil markets well, but aren't as familiar with the vicissitudes of the more regionally fractured gas market. For example, LNG supply pegged to Henry Hub in North America will likely hold a cost advantage over marine gasoil for years to come thanks to the region's surfeit of gas. A study by the IMO found that all-in bunkering costs with Henry Hub at \$4.00/mmBtu would be around \$15.50/mmBtu (see Figure 03). Liquefaction adds around \$5.00/mmBtu and bunkering adds another \$5.00/mm Btu. However, even with those added costs, it is very competitive with marine gasoil,

despite the recent decline in oil and oil-product prices. The equivalent cost for middle distillates is around \$19/mmBtu, though with this would be expected to rise sharply around 2020 on demand pressure.

But in much of the rest of the world, LNG is likely to be priced at a premium to refined products. Moreover, spot natural gas prices can be subject to major seasonal price swings, adding further uncertainty for shippers looking to shift to LNG. So, while there are long-term trends working in LNG's favour as a bunker fuel, namely tighter environmental restrictions on shippers and the continued expansion and flexibility of the global LNG market, LNG as a bunkering fuel will likely remain a niche product for the foreseeable future.

Refiners react (or don't)

It isn't just shippers that are dealing with some vexing questions around the IMO 2020 rules. Refiners too face their own choices on how to respond to the new marine fuel rules, and likely radical changes in the makeup of fuel demand to come.

The rules have set off a fierce debate over whether or not the existing global refining system will be able to meet the potential surge in demand for middle distillates as ships switch over from fuel oil. According to IEA figures, demand for middle distillates from the shipping industry could jump overnight by 2.2mn b/d from around 800,000 b/d to close to 3mn b/d (see Figure 04). This will stretch the refining industry's capacity — and some, including the IEA, have questioned whether there will be enough supply to meet this surge in demand.

There are a couple of trends that could ease the pressure. In China, diesel demand has flatlined as industrial activity has taken a hit, leaving the country with a large amount of middle distillate overcapacity. And in Europe, the growth of dieselisation in the vehicle fleet is reversing as governments grow increasingly concerned over diesel-related air pollution.

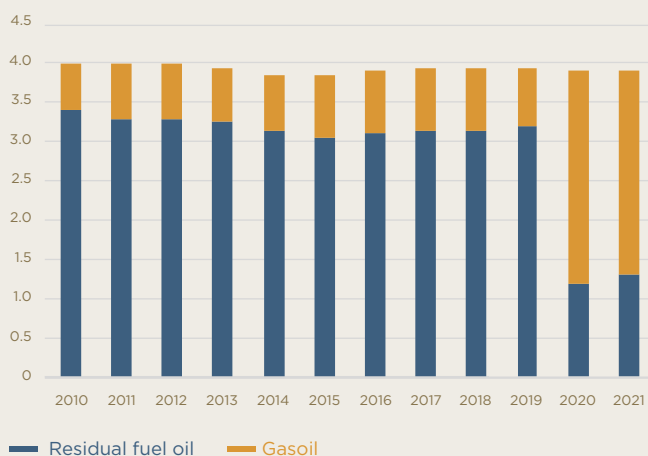
IMO rule changes will have lasting effects on specific crude and product markets. heavy fuel oil risks becoming a forgotten fuel with a shrunken global market

One option for refiners is to make major new investments in desulphurization, hydrotreatment, crackers and other refinery upgrades to increase middle distillate output capacity. But those upgrades take time, and refiners have so far not shown any inclination towards making those investments, meaning capacity will be similar in 2020 when the new rules come into force as it is today.

The road ahead

What is the likely trajectory? Both shippers and refiners seem content to mostly wait and see how things shake out. Neither have shown much of an inclination to make significant upfront investments.

FIGURE 04: MARINE FUEL DEMAND 2010-2021 (MN B/D)



Source: International Energy Agency

Shippers are already financially pinched and there hasn't been a big move towards making major investments in scrubbers given the high degree of uncertainty over future prices, which will determine the payback period on those investments. If marine gasoil costs spike and fuel oil prices plummet, early movers would stand to profit enormously. But there isn't yet a clear enough price signal to spur those investments. This isn't totally surprising. In 2015, when the Emission Control Areas went into effect around North America, the Caribbean and Europe, most shippers simply switched to marine gasoil to meet the lower sulphur-emission standards. They appear to largely be choosing this strategy again ahead of the IMO 2020 rules.

Nor has there been a sense of urgency from refiners to add middle distillate capacity. In spite of warnings about potential supply shortages, most international oil companies have sounded confident on the refining system's ability to meet demand. At this point, with just two and a half years until the new rules go into effect, there is little refiners can do in terms of upgrades in time for 2020.

Another aspect of this is that neither side wants to be the first mover because it could entail unnecessary costs. Shippers, for instance, want to know if refiners will add middle distillate capacity, which would reduce the incentive for them to install scrubbers. Refiners, on the other hand, want to know how many shippers will add scrubbers because that will affect the makeup of marine fuel demand.

There are clearly risks on the path the industry is headed, as mentioned above. With the demand mix from the marine sector essentially flipping from an 80:20 fuel oil to marine gasoil mix to an 80:20 marine gasoil to fuel oil mix, there is the potential for an enormous strain on the supply chain and even localised shortages.

What seems certain is that there will be a surge in the price of middle distillates when the rules take effect. That could produce disruptions in the market, and higher prices could be felt well beyond the marine sector. But it will send a clear price signal that is likely to spur action to restore some balance and stability in the market. If a wide spread between marine gasoil

and heavy fuel oil persists, shippers will take a hard look at the economics of either installing scrubbers to take advantage of cheaper fuel oil or switching over to an alternative fuel like LNG. Some refiners too would feel more confident in making investments to expand their middle distillate capacity to capture higher margins.

While the IMO says it is confident fuel supplies will be sufficient, it is unlikely to just sit by amid chaos in the market. The organisation could push back the requirements if it becomes clear closer to the implementation date that there won't be sufficient fuel supplies, if for instance middle distillate demand growth is stronger than expected over the next couple years. IMO may also hand out waivers to vessels that aren't able to comply with the new rules despite their best efforts. One area that IMO hasn't yet clarified is how the rules will actually be enforced. IMO has proposed requiring vessels to collect data on their fuel consumption and report it to their flag state, which will send it to IMO. But in the meantime, monitoring may fall to ports.

Conclusion

The IMO rule changes will have lasting effects on specific crude and product markets. Heavy fuel oil, for one, risks becoming a forgotten fuel with a drastically shrunken global market. The marine sector's roughly 3.2mn b/d demand for heavy fuel oil represents about 40% of total demand for the product. A rush to switch away from heavy fuel oil in the marine sector could see the global market for fuel oil shrink by nearly 30% overnight. For complex refineries with secondary upgrading units that can re-process fuel oil into higher grade products, this isn't as big of a problem. However, for simple refineries, they face a potentially stark choice of either making heavy investments to be able to upgrade unwanted heavy fuel oil or risk shutting down.

The rules will also have knock-on effects in crude markets, with high-sulphur crude grades likely to trade a steeper discount than they otherwise would to reflect the higher cost for refineries to strip out sulphur. High-sulphur grades that are likely to see their relative value decline include Venezuela's Orinoco oil (4.5%), Western Canadian Select (3.4%) grade from the oil sands, Mexico's Mayan crude (3.3%), Iraq's Basrah Light (2.9%) and others.

Implementation of the IMO 2020 rules promise to be highly disruptive period for fuel markets, with effects likely to be felt beyond just the narrow marine fuel sector. The lack of major upfront investments from refiners and shippers is likely to add to the disruption. The path of least resistance for shippers will be to simply switch to costlier middle distillate fuels, which is what most will do, though scrubbers and alternative fuels like LNG will also play an important role in meeting the IMO's new lower-sulphur rules. However, due to the long lead time of investments that will eventually be needed, the fuel markets could be in for months, if not longer, of turmoil.