JUST HOW DISRUPTIVE WILL IMO 2020 BE?

By Jamie Webster, Buddy Myers, Maurice Berns, Clint Follette, and Jaime Ruiz-Cabrero

Effective January 1, 2020, in accordance with a mandate from the International Maritime Organization (IMO), the allowable percentage of sulfur in marine fuel will fall substantially, from 3.5% to 0.5%. This looming change, known informally as IMO 2020, could pose a major disruption to the markets and business practices of oil refiners, shipping companies, and other stakeholders.

Precisely how great the disruption proves to be—and, critically, how long it lasts—will be influenced by several factors, including the speed at which refiners can produce compliant fuel and the specific strategies that shippers employ to meet the challenge. We have modeled a wide variety of scenarios and can imagine a disruption lasting anywhere from one year to more than five years, generating significant costs for many businesses. (Our analysis is underpinned by the BCG IMO 2020 Model, a tool that enables us to project how the disruption will impact markets and that will allow us to analyze markets in real time as 2020 unfolds.)

Risks notwithstanding, most stakeholders, including oil refiners and shipping companies, have opportunities to make smart moves and improve how they fare individually. Understanding the nature of the disruption, and what signposts to look for to gauge its potential length and progression, can help. (See the sidebar "Defining Disruption.")

The IMO and the Mandate

The IMO is the United Nations body responsible for regulating the shipping industry. As part of its charter, it is tasked with curbing pollution from ships—and sulfur emissions are particularly polluting. Hence, the IMO made the decision in 2016 to impose a markedly lower global standard for the permissible proportion of sulfur (by weight) in marine fuel, with the ruling to become effective in 2020. The IMO had embarked on a series of regional sulfur reduction efforts starting at the turn of the century by instituting so-called emission control areas, in which the allowable level of sulfur would be much lower than else-

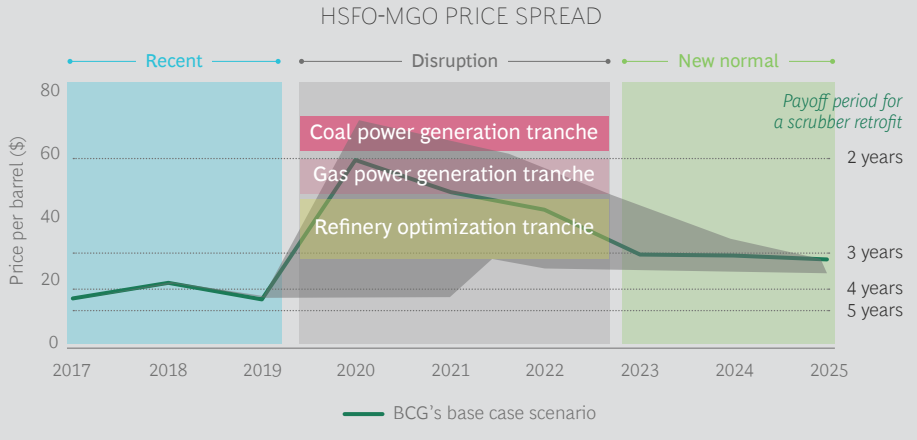
DEFINING THE DISRUPTION

Our primary metric is the price spread between high-sulfur fuel oil (HSFO) and marine gasoil (MGO). In recent history, this spread has usually been less than $20 per barrel. As disruption begins and the effects of IMO 2020 become more strongly felt, shipping companies will start to aggressively seek out relatively scarce low-sulfur fuels composed of very-low-sulfur fuel oil (VLSFO) and middle distillates, and refiners will seek to destroy excess HSFO. At this point, the price spread between HSFO and MGO will begin to widen. First, it will reach a level that incentivizes refiners to maximize coking capacity and, in some cases, bypass some fluid catalytic cracker capacity. In this refinery optimization tranche, as we call it, the spread will likely range from $30 to $45 per barrel.

At the height of disruption, however, such a spread will be insufficient to clear the market. The spread will likely then rise to what we term the gas power generation tranche, where HSFO is priced competitively with natural gas in some power generation markets. The additional demand that this generates among power producers (in our base case, we assume that about 700,000 barrels per day of incremental HSFO will be sold for purposes of power generation) should clear the market.

But if demand from power producers is still insufficient, or the demand for MGO from shipping companies is higher than anticipated, then the spread may enter what we call the coal power generation tranche, where HSFO prices reach parity with coal prices. Even if they do reach this point, however, they are unlikely to stay there long. As more VLSFO is brought to market and HSFO is destroyed, the disruption will begin to moderate, bringing the spread back down through the tranches in reverse order. The end of the disruption will not be marked by a return to the historic price relationship between HSFO and MGO; instead, the spread will remain elevated for an extended period, reflecting ongoing heightened production (we assume an additional 500,000 barrels per day in our base case) of marine diesel fuel by refiners. When this point is reached, the disruption will be over and a new normal will have been established. (See the exhibit below.)

Defining the Disruption



Source: BCG analysis.
Note: The gray area represents the range of spreads in BCG's four disruption scenarios. The calculation of the payoff period for a scrubber retrofit assumes a $7 million installation cost (including the cost of lost trading time) for an open-loop scrubber on a very-large crude carrier. HSFO = high-sulfur fuel oil; MGO = marine gasoil.

where in the world. IMO 2020 transforms that aggressive sulfur reduction effort, which had been regional, into a global campaign.

Initially, compliance with IMO 2020 among shippers was forecast to be low: some shipping companies delayed taking the necessary actions because of doubts about the actual launch date and whether, or how aggressively, regulations would be enforced. (Note that the IMO itself does not have an enforcement mechanism. Responsibility for compliance instead rests with the individual governments of the IMO's member states, which guarantee compliance by shipping companies domiciled in their countries and establish penalties for noncompliance in their waters.)

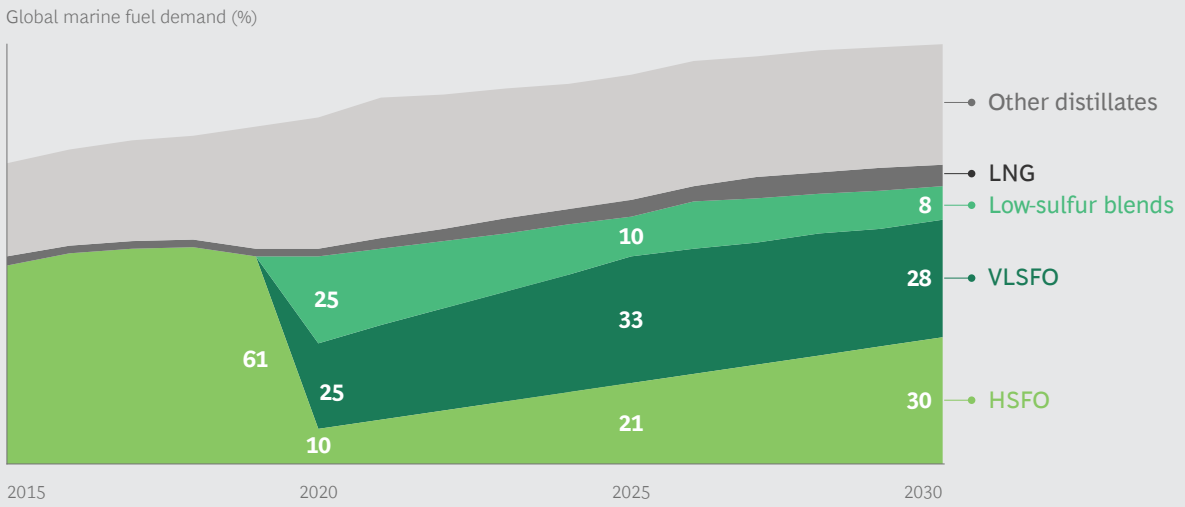
Now, however, the degree of compliance among shippers seems likely to be high. Shippers will certainly have incentive to comply. Major ports, as well as insurers, will demand that ships use compliant fuel. The shipping industry is also relatively consolidated, which limits the number and percentage of ships in the global fleet owned by rogue operators that might be inclined to ignore the mandate. Finally, in late 2018, the IMO approved a so-called carriage ban that prohibits the transportation of noncompliant fuel by ships that lack scrubbers (technology that removes polluting sulfur emissions from ship exhaust). This regulation, which is scheduled to take effect in March 2020, reduces the likelihood of ships switching fuels at sea.

Disruption and Its Effects

IMO 2020 stands to sharply decrease demand for high-sulfur fuel oil (HSFO), which has 3.5% sulfur content and represents the vast majority of marine fuel currently sold, at a rate of nearly 4 million barrels per day. Simultaneously, IMO 2020 will raise demand for very-low-sulfur fuel oil (VLSFO), which has 0.5% sulfur content. (See Exhibit 1.) This dynamic will result in a substantial widening of the price spreads between HSFO and VLSFO, which will have major implications for stakeholders.

Shippers. Choosing to fuel vessels with increasingly expensive VLSFO would cost the shipping industry dearly—an additional $60 billion in 2020 over current fuel costs, according to one estimate. There might also be logistical hurdles associated with this strategy. The availability of VLSFO will be limited relative to expected demand, at least initially, as refiners work to boost supply by increasing yields and

EXHIBIT 1 | Low-Sulfur Fuel Oil and Blends Will Likely Be Shippers' Near-Term Choice



Source: BCG analysis.
Note: HSFO = high-sulfur fuel oil, which has a sulfur content of 3.5%; LNG = liquefied natural gas; VLSFO = very-low-sulfur fuel oil. VLSFO and low-sulfur blends have a sulfur content of 0.5%.

initiating new projects. (See Exhibit 2.) Fuel compatibility issues may arise as well, with potentially critical inconsistencies emerging among fuels produced by different suppliers.

Some shipping companies might turn to marine diesel, an established fuel that poses no compatibility risk, for their fuel needs. But marine diesel will be the most expensive option among the oil-derived products. Liquefied natural gas (LNG) is yet another alternative for shippers. But the high cost of engine and infrastructure conversion and the logistics of onboard storage (LNG tanks take up considerable space) will likely dissuade a critical mass of shipping companies from pursuing it, at least in the near term. (Over the longer term, as the global fleet of vessels turns over, LNG could become increasingly popular as a fuel, especially if pressure to reduce emissions intensifies.)

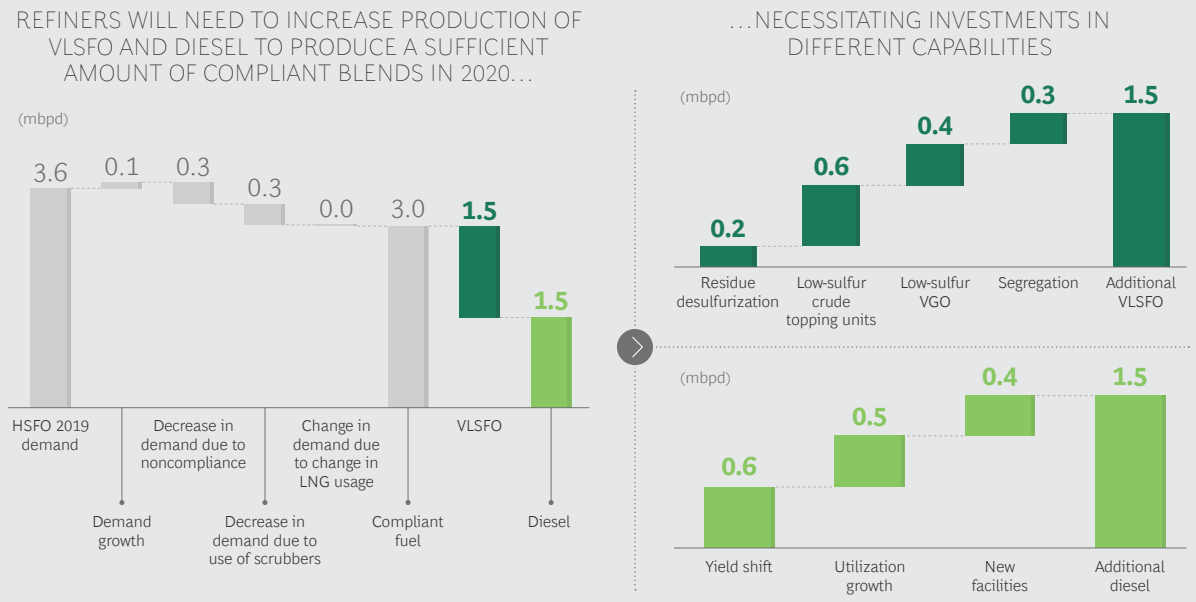
Scrubbers could be yet another viable choice for some shippers. But scrubbers are expensive—retrofitting a vessel requires an investment of $2 million to $3 million—and installation can take up to six months. Scrubber installation is also hindered by shortages of skilled craftsmen and necessary raw materials, such as high-quality steel and chrome alloys. In addition, the open-loop scrubbers now being installed could prove to be a short-lived option, given environmental concerns about putting sulfur directly into the water.

Regardless of what path shippers ultimately choose, they will try to pass along their costs to customers. How successfully they will be able to do so remains to be seen.

Refiners. Meanwhile, refiners will strive to keep up with soaring demand for VLSFO. Complex refineries that can convert high sulfur (or sour) crudes to low sulfur (or sweet) products, including VLSFO, and maximize their production of distillates—which can be used to make compliant fuel, such as marine gasoil (MGO), a fuel that could rise sharply in demand—could see their margins surge. Simple refineries that mostly produce HSFO and have relatively low distillate yields will have greater difficulty maintaining their margins.

Simultaneously, refiners will struggle to work through falling demand for, and a resulting oversupply of, HSFO. Ultimately,

EXHIBIT 2 | Refiners Will Need to Invest to Meet Demand in 2020



Source: BCG analysis.
Note: Projections are based on BCG's base case scenario. HSFO = high-sulfur fuel oil; LNG = liquefied natural gas; mbpd = million barrels per day; VGO = vacuum gasoil; VLSFO = very-low-sulfur fuel oil. Because of rounding, not all numbers add up to the totals shown.

they will have to lower prices on HSFO until it reaches the point where it can compete on price with natural gas as a fuel for power generation. These price reductions will diminish refining margins. But the effects will be more than made up for by higher market prices for VLSFO and middle distillates, leaving most refiners, particularly complex refiners on the US Gulf Coast, with substantially higher margins than they had before the disruption.

Suppliers of crude oil. A further widening of price spreads between sweet and sour crudes is likely to occur. Oil derived from US shale fields will be regarded as increasingly attractive, and thus command a rising price premium, due to a sulfur concentration that is lower than that of oil from other sources. Logistics bottlenecks that may emerge as markets adjust to the changing demand picture, however, could reduce this premium.

Variables That Could Influence Disruption

The extent and duration of the disruption will hinge on the following factors.

The Degree and Speed of Scrubber Adoption. This factor will be the most influential of all. Widespread adoption of scrubbers would allow shippers to continue to burn HSFO, thereby curbing the price spreads with VLSFO. But few ships are currently equipped with scrubbers and, as discussed, there are limits to how quickly the industry could install them: BCG projects that fewer than roughly 2,000 ships (about 3% of the global fleet of 60,000 ships) are likely to have scrubbers by 2020. And that number will climb only gradually, rising to about 11,000 at most by 2025.

The Rollout of the Mandate. As of this writing, IMO 2020 is scheduled to become operant on January 1, 2020, and the IMO has not indicated that there might be a delay. The organization undoubtedly recognizes that a delay would raise the potential for disruption in the short term, affect the scale and duration of such a disruption, and undermine the organization's credibility regarding the launch of future regulation. But several governments of IMO member states, including the US, have indicated that they might be in favor of a delayed launch if shipping prices were to spike, harming consumers, as the launch approaches. Shipping companies have also lobbied for a delayed launch as they seek to secure approval for their plan to pass along costs to consumers. And the World Bank has announced that global economic growth is losing momentum, increasing the odds of an outcry against any new measure that seems likely to accentuate the trend. Taken together, these facts raise the specter of a delayed launch. The chances of a delay are dwindling quickly as 2020 approaches, however. Acknowledging this, some shipping companies have indicated that they plan to comply with the mandate as early as the beginning of the fourth quarter in 2019.

Additional Investment from Refiners. If refiners were to bring enough suitable capacity online before 2020, bottlenecks would be eliminated or reduced, and fuel pricing would be unlikely to change much. The needed investment would emphasize desulfurization of high-sulfur crude, production of middle distillates, and the destruction or disposal of HSFO. This would entail bringing new hydrotreaters, hydrocrackers, and cokers online, as well as small projects aimed at improving molecule management to better segregate VLSFO. The question remains, however, whether refiners, which have already invested substantially in recent years—adding 1.7 million barrels per day of conversion capacity since 2017—are likely to make additional investments of major scale in the near term and, if so, how quickly they would be able to bring those investments online.

Fuel Compatibility Issues. Optimal marine engine operation hinges not just on sulfur content but on secondary fuel characteristics (such as viscosity and stability), and the comingling of fuels from different providers on vessels is inevitable. If sufficient consistency of these characteristics cannot be ensured across refiners, and shippers have associated engine problems, the length of the period of disruption will

grow. There are positive developments on this front, although not all questions have been resolved. Refiners and regional marketers have begun to offer new blends that meet the IMO's requirements—but there is no explicit coordination among these efforts. Oil majors have declared their intention of making compliant fuels available by 2020—but the ultimate degree of compatibility across the companies' offerings is still unknown. (Indeed, several blend types have already been patented, which limits choices and raises costs.) The International Standards Organization is preparing a specific standard for IMO 2020 fuels—but until that standard materializes, the potential for compatibility-related problems remains.

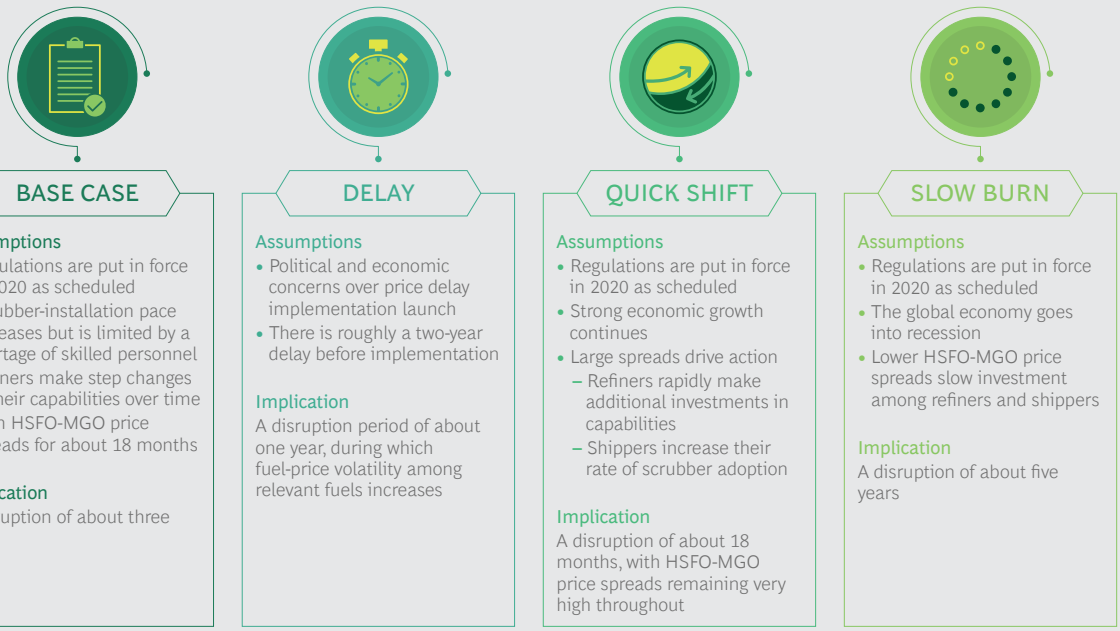
Lighter, Less Sulfurous Crude. This trend in the world's crude supply, driven in large part by the growing production and representation of US shale oil, could also influence the disruption, though to a lesser degree than those discussed above. API gravity (a measure of crude weight) is expected to rise 0.1 degree, while sulfur content is expected to fall 0.1%, from 2020 to 2025. A rising percentage of lighter, sweeter crude in the global crude pool over the next few years means that, all else being equal, the complexity of producing IMO 2020–compliant fuel, along with its associated costs, should fall.

Scenarios for Length of the Disruption

How might these factors play out in combination and influence the length of the disruption period? Leveraging BCG's proprietary IMO 2020 Model and focusing on such critical variables as scrubber-adoption rates, fuel compatibility, refinery projects and optimization efforts, and production rates of sweet crude, we have defined four scenarios. Note that, in the descriptions, "very high" spreads are differences in the prices of HSFO and MGO wide enough to result in surplus HSFO being sold into the power generation market; "high" price spreads are wide enough to incentivize refiners to maximize coking capacity and, in some cases, bypass some fluid catalytic cracker capacity. (See Exhibit 3.)

- **Base Case.** This scenario assumes that the mandate goes into effect on January

EXHIBIT 3 | IMO 2020 Disruption Scenarios



Source: BCG analysis.
Note: HSFO = high-sulfur fuel oil; MGO = marine gasoil.

1, 2020, as scheduled; 2,000 ships have installed scrubbers by 2020 and 8,000 have done so by 2025; refiners make step changes to their capabilities (including major upgrades in residue desulfurization, fuel segregation, and throughput volume) over time; and high price spreads between HSFO and MGO occur for approximately 18 months. In this scenario, we would expect the disruption to last about three years.

- **Delay.** Here we assume that political and economic concerns about price increases for shippers and, ultimately, consumers delay the mandate's launch by two years (although we can imagine materially longer or shorter delays), and that uncertainty about policy implementation increases the price volatility of relevant fuels, such as marine diesel. In this scenario, the two-year delay is followed by lingering uncertainty among stakeholders and wide spreads between MGO and VLSFO; this lasts about a year, giving the IMO and stakeholders additional time to prepare for the mandate's eventual launch. (Additional refinery projects will be brought online; the rate of scrubber adoption will increase as well.)

- **Quick Shift.** This scenario assumes that IMO 2020 goes into effect as currently scheduled, and that extremely high and sustained (that is, for approximately 18 months) price spreads between HFSO and MGO, underpinned by strong economic growth, prompt rapid action by both shippers (through aggressive adoption of scrubbers) and refiners (through an increased rate of investment in conversion capacity). In this scenario, the total disruption would likely last about 18 months.

- **Slow Burn.** In this scenario, we assume that the mandate becomes operant as currently scheduled; the global economy goes into recession, blunting the mandate's economic and environmental impact; price spreads between HSFO and MGO remain relatively small (that is, the price of HSFO does not fall to the point at which it is at parity with the price of natural gas when used as fuel for power generation) due to unexpectedly high levels of noncompliance among shippers; and the narrow price spreads reduce the perceived urgency for remedial measures and slow the rate of investment among shippers and refiners. Under these circumstances, disruption would likely last about five years.

What Companies Can Do

Disruption will significantly affect specific energy companies, particularly simple refiners and producers of sour crude, which will have limited options for creating higher-value fuels. Companies that could suffer substantially from higher fuel prices include heavy users of transportation fuel, such as shipping companies, airlines, railway companies that use diesel-powered trains, and freight-transportation businesses.

But disruption will also create winners, depending on which of the four scenarios we describe comes to pass. The list of potential winners includes complex refiners, ships with scrubbers (especially ships that installed scrubbers early on), sweet-crude producers that have strong ties to demand centers, companies that store oil and petroleum products, traders, and power producers able to burn fuel oil.

Key stakeholders can take a number of steps to mitigate the potential negative effects of disruption on their businesses. For shipping companies, the most important steps include determining a plan for fuel use during the disruption and putting contingency plans in place. Another critical action is to identify and test different ways of passing on higher fuel costs to customers to ensure that revenues are not negatively impacted by higher fuel costs or customer migration.

Refiners can—and should—take a host of steps, all of which may positively impact revenues in all cases except for our delay scenario. They should do what is necessary

to ensure that they can operate efficiently and without interruption through 2021. Appropriate measures include inspecting equipment and making sure that spare parts for critical equipment are secured or readily available. Refiners should also take steps to prepare for the oversupply of HSFO—such as developing a plan to blend, store, and trade products to exploit arbitrage opportunities; identifying power-generation facilities that represent HSFO demand; and, in the case of simple refiners, identifying complex refiners that are potential HSFO buyers. To facilitate production of marine diesel fuel and distillates, refiners should identify and work to remove bottlenecks and capacity constraints. To lock in sources of demand, they should partner with ship owners.

Crude producers should take steps to facilitate maximum production of sweet crude—including, for instance, performing maintenance and conducting equipment inspections before the disruption hits. Crude producers should also take steps to secure takeaway capacity and facilitate takeaway—by, for example, examining and working to address import and export bottlenecks. And they should work to secure takeaway of heavy and sour crudes specifically through advance planning and by conducting scenario analyses.

Traders, particularly those with physical assets across the value chain, are in an excellent position to translate the changes in the market surrounding IMO 2020 into additional physical assets and potentially lucrative financial positions. Some traders have already installed scrubbers on their fuel ships; traders should also consider engaging in swaps and in offsetting positions on the forward curve. Traders that combine such moves with the ability to store crude could find that IMO 2020 and the associated disruption could more than offset any lost or reduced revenue caused by lower volatility and prices in the market in recent years.

IMO 2020 will affect multiple stakeholders, but it could weigh particularly heavily on refiners and shipping companies. Most refiners and shipping companies can take steps to increase their chances of emerging in relatively good shape. Though the time for taking many of these actions is limited because the disruption is nearly at hand, many investments, even if made late, will still likely prove profitable, given the disruption's potential length.

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