

## MARINE INSURANCE IMO 2020: THE PERFECT STORM

84% percent of global consumer goods are transported by sea. Today, shipping is not only the most widely used means of transport in the world, but also the most efficient per ton shipped – and the one that pollutes the least. That being said, given the fact that 12 billion tons of goods were transported by sea in 2018 alone, the emissions of cargo ships must be taken into consideration. In fact, according to a number of sources, the shipping industry is one of the largest emitters of sulphur in the world, accounting for 5% to 10% of global sulphur pollution. Nevertheless, the industry is learning and has committed to a major reduction of its sulphur emissions with the coming into force of the new IMO<sup>1</sup> 2020 regulation.

This new IMO regulation on sulphur emissions will come into force on January 1<sup>st</sup>, 2020, as part of Annex VI of the International Convention for the Prevention of Pollution from Ships (known universally as the Marpol Convention). The new regulation, which is referred to in the shipping industry as “IMO 2020”, will enforce a new cap of 0.5 wt % sulphur content in fuel burned by vessels instead of the current 3.5 wt %, while vessels operating in Emission Control Areas (ECAs) will be restricted to a maximum sulphur content of 0.1 wt %. As a comparison, the regulation for cars only limits sulphur content to 0.001wt % or 10 ppm.

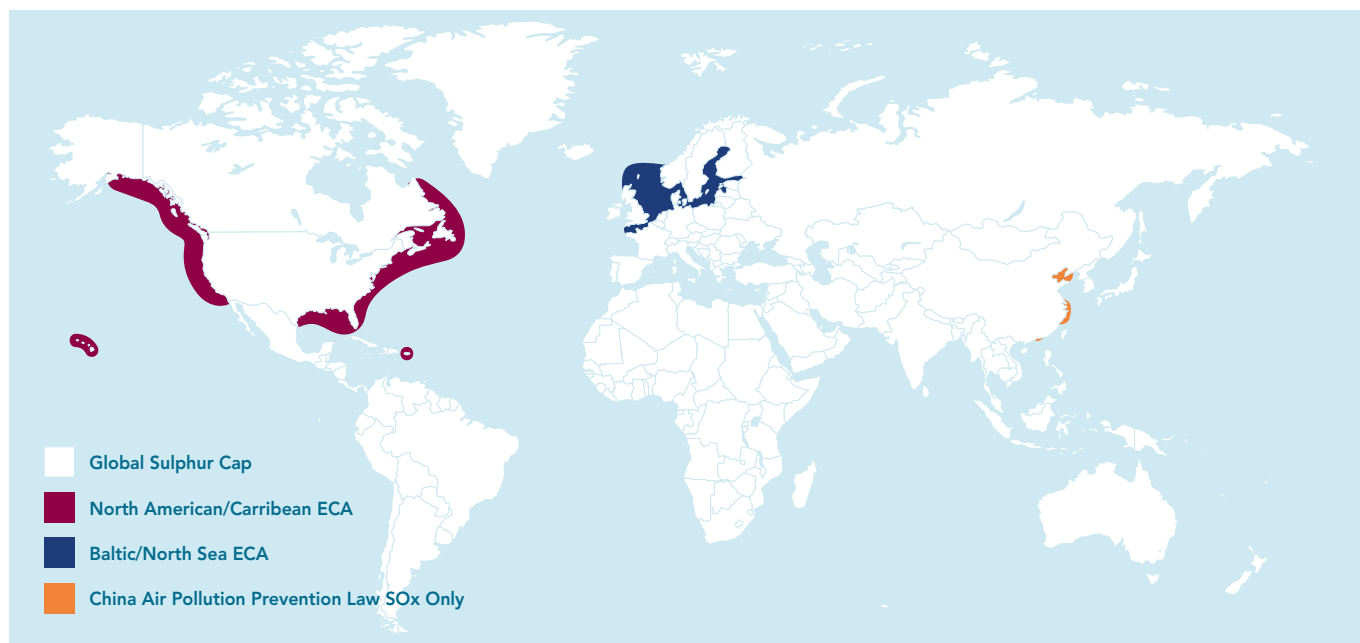


FIGURE 1: GLOBAL SULPHUR CAP 2020

Source: American Bureau of Shipping (ABS)

1. International Marine Organization



IMO 2020 will cover all ships navigating in open waters or national waters of countries that have ratified the Marpol Annex VI regulation. As of March 2019, 96% of the world tonnage is registered under states that have ratified Marpol Annex VI.

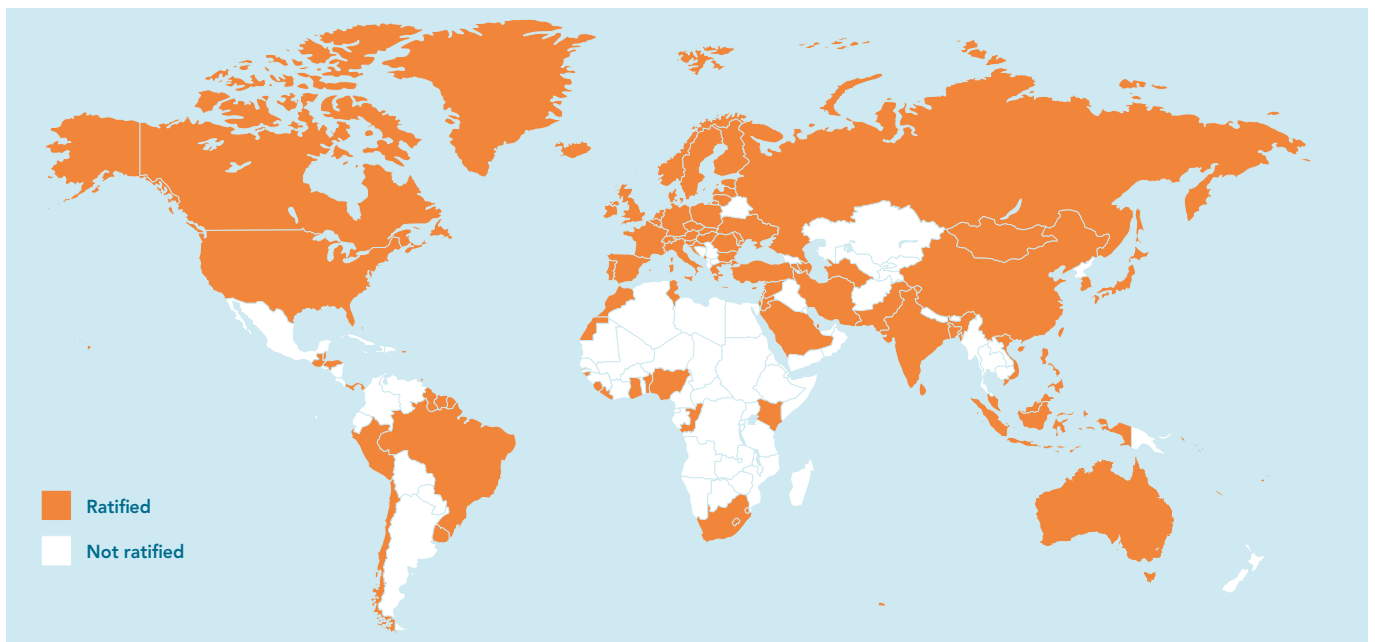


FIGURE 2: RATIFYING STATES OF MARPOL ANNEX VI, REPRESENTING 97% OF WORLDWIDE TONNAGE.

Source: IMO

Obviously, this new regulation will have huge consequences for shipowners and operators, and will also impact other sectors such as refineries, bunker suppliers and banks.

In the long journey to reduce the health and environmental impacts of the global shipping industry, how can we measure the impact of this new revolution? How could this regulation turn into a storm for insurers?

## DID YOU KNOW?

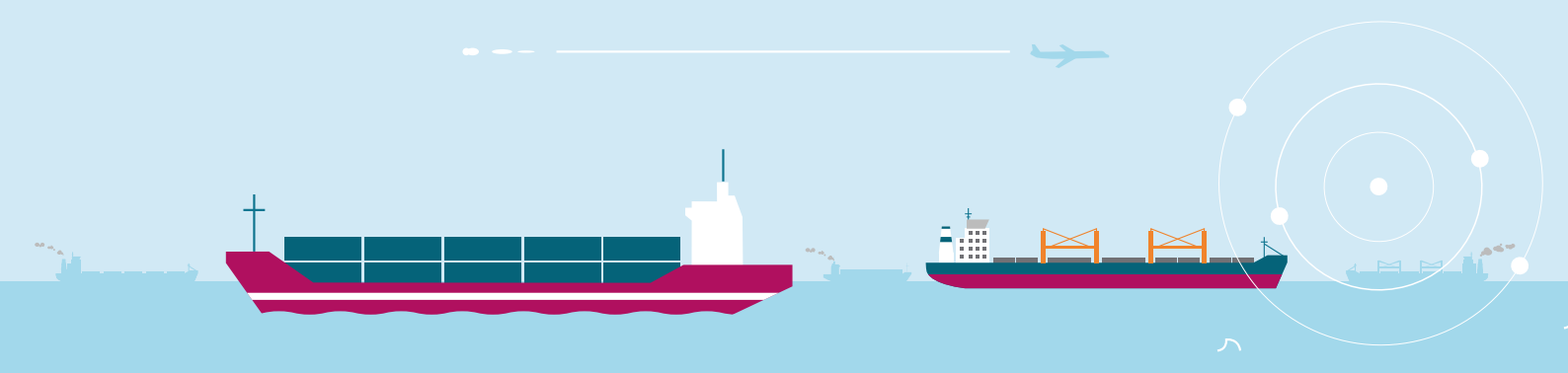
Regulations on sulphur oxides emissions (SOx) have been introduced because sulphur emissions have a major impact on health and the environment.

95% of the SOx emitted from the combustion of fossil fuel is sulphur dioxide, a toxic gas. Heavier than air, it can cause health issues such as chest pain, breathing problems and eye irritation. In some cases, it can also cause heart and lung disease. The formation of sulphates has been linked to an increase in asthma attacks, and in heart and lung disease.

Unlike CO<sub>2</sub> volatility, SOx pollute where they are emitted, so ports and coastal areas are particularly vulnerable to shipping emissions.

Finally, another effect is the transformation of sulphur oxides into acids. These acidic aerosols are eventually precipitated as acid rain, with strong effects on soil and aquatic life.

IMO 2020 should have major health and environmental benefits for the entire world, and particularly for populations living close to ports and coasts (about 60% of the global population).



## CONSEQUENCES FOR SHIPPING

Today, the main type of fuel used by vessels is heavy fuel oil, a residual fuel oil derived from High Sulphur Fuel Oil (HSFO), which is one of the heaviest cuts produced from the distillation of crude oil.

HSFO, which contains a high amount of sulphur (up to 3.5wt%), is mainly used by the shipping industry, which has the right engines to burn it, and because it is a cheap fuel. The sulphur contained in the bunker fuel – bunker is the word used for fuel oil burned by maritime vessels – is released during combustion, polluting the atmosphere.

The entire shipping industry, representing around 80,000 vessels worldwide sailing in areas that have ratified the Marpol Convention, will have to trade differently to comply with IMO 2020.

As this convention applies to all ships sailing in open waters and the national waters of ratifying states, all sizes and types of ships (tankers, containers, bulkers, ferries, cruise ships, etc.) will have to use fuel oil meeting the 0.5% limit with effect from January 1<sup>st</sup>, 2020.

Nevertheless, as stated by the IMO “Studies have shown that ships are by far the most energy-efficient form of transportation, compared with other modes such as aviation, road trucks and even railways. It is also relevant to remember that shipping responds to the demands of world trade. As world trade increases, more ship capacity will be needed”. The United Nations expects global seaborne trade volume to increase by a compound annual growth rate of 3.2% until 2022.

Furthermore, IMO 2020 will directly impact shipyards (retrofit, maintenance, scrap, new buildings), refiners, fuel demand and Liquefied Natural Gas logistics (port and terminal).

## WAYS TO ENSURE COMPLIANCE

IMO 2020 has been discussed for many years (the regulation was adopted in 2008 and the deadline for its implementation in 2020 was confirmed in October 2016) and there are

currently three main compliance solutions, with different costs depending on the vessels involved:

- ◆ keep same fuel and treat exhaust gas, with scrubbers;
- ◆ change fuel quality, with LSFO, VLSFO or MGO;
- ◆ change type of fuel and propulsion, with LNG.

### SOLUTION 1: HSFO WITH SCRUBBERS (WHETHER INSTALLED WITH AN OPEN, CLOSED OR HYBRID LOOP)

A scrubber installation keeps the same fuel (HSFO) and treats the exhaust gas.

There are two main systems: open-loop and closed-loop.

Initially, the process of these two systems is the same: the exhaust gas enters the scrubber and is sprayed with seawater or chemicals. The contact between SO<sub>x</sub> and water or chemicals creates sulphuric acid. Then, in an open-loop system, the water from the scrubber is treated so it can be discharged into the sea.

With a closed-loop system, the liquid is recycled back into the scrubber each time it passes through the tower. Remaining effluent is then held in a tank and discharged in appropriate ports.

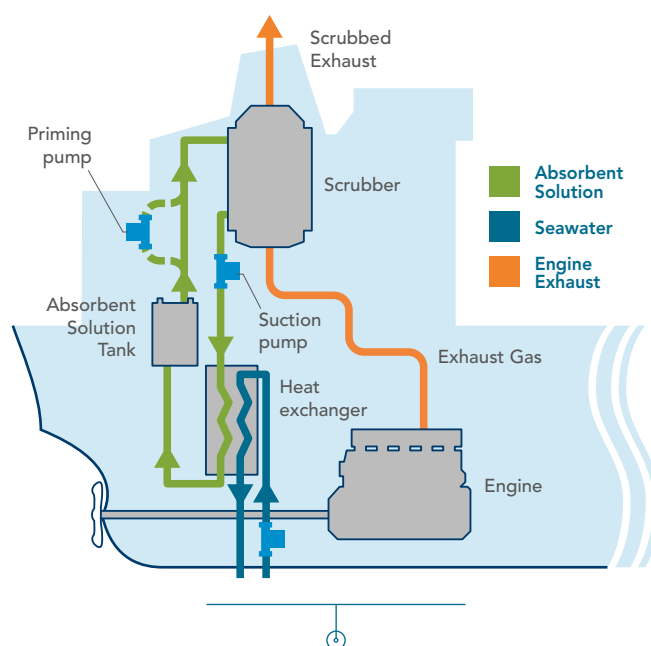


FIGURE 3: SCHEMATIC OF A TYPICAL CLOSED-LOOP SCRUBBER ON BOARD  
Source: IONADA



This is an expensive solution, costing between one and five million U.S. dollars per vessel and implying a shipyard immobilization period of around two weeks for installation work. Scrubbers necessitate significant upfront costs and can be uneconomical for old vessels that do not have much of a commercial life left.

- ♦ The open-loop system is only a partial solution, because, as of March 2019, the following areas have banned the use of open-loop scrubbers in their waters: Singapore, three special emission areas on the coast of China, the Baltic sea, Belgium, certain German coastal areas, and two U.S. States (California and Massachusetts).
- ♦ According to shipping specialists, these bans could have a negative impact on open-loop technology, which has traditionally been the most popular solution amongst scrubbers because it is cheaper to install and seems better suited to operating in open water.
- ♦ Furthermore, even though the main engine manufacturers like Wartsila and Alfa-Laval offer all types of scrubbers, hybrid and closed-loop systems take up more space on board and require major structural modifications, leading to less room for cargo.

The classification society DNV GL estimates that around 2,200 vessels are fitted with an open-loop system, versus 500 vessels with hybrid systems and 50 with closed-loop systems.

This represents no more than 5% of the global shipping fleet. And by the end of 2019, only 4,000 vessels should be fitted with scrubbers, with the rest using IMO-compliant fuel.

## SOLUTION 2: USING LSFO, VLSFO, OR MGO

Vessels not equipped with scrubbers will have to use bunker fuels with less than 0.5wt% sulphur to comply with IMO 2020 regulations. Three options are available:

- ♦ LSFO (Low Sulphur Fuel Oil) with 1wt% sulphur;
- ♦ VLSFO (Very Low Sulphur Fuel Oil) with 0.5wt% sulphur;
- ♦ MGO (Marine Gasoil) with 0.1wt% sulphur.

The easiest and safest option for shipowners is to burn a blend of LSFO and MGO or HSFO and MGO, as LSFO and MGO are currently used by vessels trading in the Emission Control Areas (ECAs). More widely spread, they do not represent any operational risk. However, the rising demand in MGO will push its price up and make it an expensive option.

As described in “How will refineries adapt?” on page 10, this will lead to significant issues with fuel supply, bunkering and costs.

An alternative option could be to use VLSFO. VLSFO is a new bunker fuel with different properties (heat value, viscosity) from MGO. When using it, shipowners and charterers will need to be vigilant in terms of ensuring that it does not damage the engine and pumps, which could lead to accidents and pollution. In fact, this blend of LSFO and MGO appears to be an untried combination that could, for example, cause filter-damaging sedimentation if catalytic filters are situated too high up in the evacuation chimneys. However, in January 2018, the classification society Lloyd’s Register announced that its testing of new fuel blends had shown positive results, with samples meeting specific formulations (refer to the next section for further details on specifications).

The use of VLSFO would be a more economical option, because of the difference in price between VLSFO and MGO.

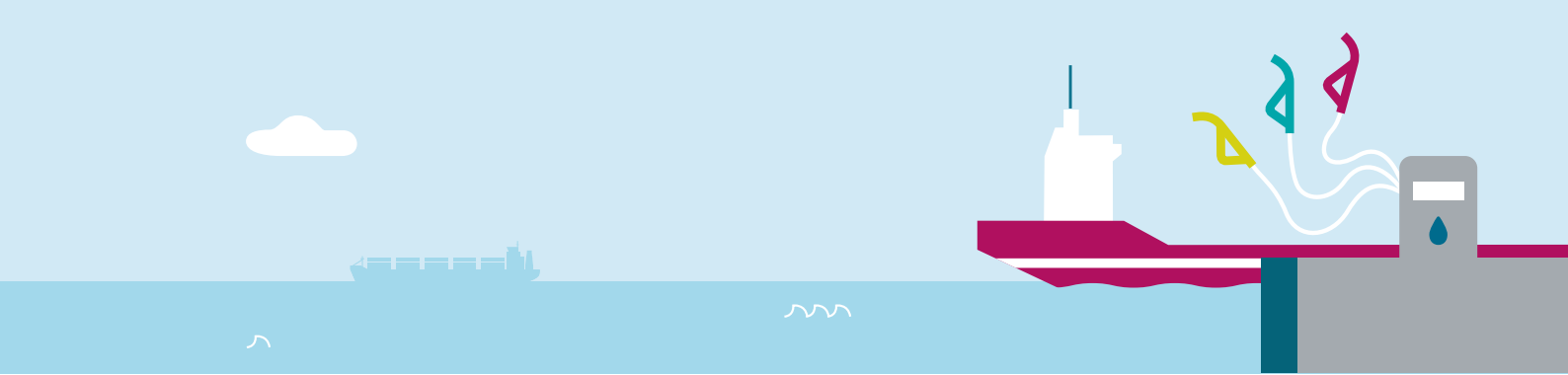
Nevertheless, even if VLSFO is less expensive than MGO, it is important to remember that due to their lower calorific value, engines using LSFO, VLSFO, and MGO will burn more fuel to deliver the same power as (engines using) HSFO.

In fact, with this solution, vessels should burn higher quantities of more expensive fuel.

## SOLUTION 3: LIQUEFIED NATURAL GAS (LNG)

LNG as ship fuel is a viable option in terms of compliance with IMO 2020. LNG carriers have used LNG as fuel for decades, whereas other vessel types have only been using it for the past 20 years. According to DNV GL, “the technical main systems used in LNG as fuel technology are the containment systems, used to store LNG on board, the process systems for conditioning the LNG and the engines to generate propulsion power and electrical energy”. The shipping industry makes little use of LNG as fuel though: in 2014, only around 100 vessels were using it, mainly small ferries in Northern Europe. In 2020, LNG bunkering should account for just 6% of total marine fuel demand.

Of course, this solution would have a significant impact on the equipment and management of ships – e.g. special dual fuel engines, bunker storage on board, classification issues, training and hiring of qualified engineers, bunkering offer in ports.



## COST IMPACT OF THESE SOLUTIONS

All these solutions have significant impacts in terms of costs: the cost of the scrubber (the scrubber itself + shipyard work + immobilization of the vessel), the cost of a more expensive low-sulphur fuel, the cost of LNG and associated propulsion, and the cost of training crews to use the new propulsion system.

Shifting to VLSFO is expected to be the most common way of complying with IMO 2020. A ship burns between 1 to 16 tons per hour, and as of March 2019, a ton of HSFO costs USD 445, compared to USD 686 per ton for MGO. The cost of fuel

represents around 30% to 50% of a ship's operating costs (OPEX), so the fuel efficiency of a vessel will be a leverage factor for charterers as bunker prices rise.

Where will shipping companies find the capital they need to comply with this global regulation? The price of investment in scrubbers or more expensive fuels will increase operating expenses, and will have a direct effect on the supply chain. In a September 2018 press release, CMA CGM, one of the top shipowners with 500 containerships, estimated that IMO 2020 would trigger an average additional cost of USD 160 per TEU (twenty-foot equivalent unit that is the equivalent of one standard container).

## CMA CGM

Interview with Xavier LECLERCQ  
Vice President of CMA – CGM & CMA SHIPS



CMA CGM, is a leading worldwide transport and logistics group present in more than 160 countries, with a diverse fleet of 509 vessels.

CMA SHIPS was created on January 1<sup>st</sup>, 2008, as a wholly owned subsidiary of CMA CGM, to manage all fleet related operations, sharing CMA CGM values.

### 1. In order to be compliant, CMA CGM has decided to use the three solutions offered by the market. In the long term, which technical solution should last?

This regulation is at the heart of the energy transition and CMA CGM, a world shipping and logistics group, has been actively taking it into consideration for decades.

Our philosophy was to anticipate IMO 2020 by investing in LNG or hybrid scrubbers. LNG reduces sulphur and nitrogen oxides to zero, and decreases fine particles by up to 75%, which exceeds the regulation's requirement. By opting for hybrid scrubbers, CMA CGM anticipated the multiplication of local regulations which are more restrictive.

The environmental impact is a determining factor for our customers. Thus, the improvement of the carbon footprint on our ships is a commercial asset versus our competitors.

The next four years will be a transition phase: less HFO on the market and more LSFO. The challenge is to have the same quality of LSFO worldwide.

The return on investment of a scrubber (about 1.5 years today) will be lower in a few years.

The best solution to date is LNG and the network set up in large hubs responds to demand.

Over the next 10 years, we are considering the use of LSFO, with an increasingly large share of LNG, through storage solutions.

In the long run, perhaps hydrogen would be the ideal solution.

### 2. Human error on board is a critical subject: how will you train your crew to use these new solutions?

The training of our crews is a very important issue. The number of sailors with knowledge of gas and its handling at -169 degrees is limited. They must be trained and conditions for this training have to be settled.

CMA CGM has a major recruitment and training program, mainly located in Marseille.

As far as scrubbers are concerned, we are talking about installations of extreme complexity. It is necessary to measure, add and maintain this installation. lengthy training is carried out in collaboration with the suppliers.

### 3. As a major shipowner, do you foresee any other environmental regulations in the coming 15 years?

IMO 2020 is in fact already more or less engaged with the implementation of the Energy Efficiency Design Index (EEDI). Its objective is to classify ships by their energy efficiency and to propose a plan to improve its energy performance. Environmental issues are a priority for the Group.



With just a few months to go until enforcement, there are still significant uncertainties in terms of which solution shipowners will choose from the options available - each of which requires a different bunker fuel (HSFO, MGO, VLSFO, LNG, etc.) – and in terms of what the compliance percentage will be. Unavoidable non-compliance vessels should be substantial in 2020 since no perfect solution to be compliant exists.

Could this lead to a potential loss of insurance coverage? As per IMO requirements, a vessel that does not comply with the global sulphur cap could be declared “unseaworthy” due to suspensions by the vessel’s flag state, while vessels without a flag can no longer be insured.

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## NEW RISKS AHEAD?

### A. MACHINERY BREAKDOWNS

The three technical solutions all seem to lead to the same risks: increase of engine and pump damage.

Regarding VLSFO: it could increase fuel contamination risk due to additive and associated engine issues. Moreover, given their impacts on engines and pumps, the industry is quite reticent about adopting these new fuels.

Regarding scrubbers: one main question is how this new technology, which is tailor-made for some vessels, will perform in five, ten, or twenty years? What level of maintenance will be required?

Regarding LNG: in 2017, the site VesselsValue estimates the global fleet of vessels transporting LNG at 600, 200 of which are themselves powered by LNG (mainly passenger ships). Consequently, statistics about accidents are scarce and it is difficult to forecast what could happen.

### B. BUNKERING CAPACITIES

As stated at the end of this document, not all refiners will be able to produce VLSFO, consequently they will have to raise their production of MGO. This could lead to a shortage of fuel and oblige shipowners to burn HSFO, which would make them non-compliant if they don’t have scrubbers installed.

There are also questions regarding the quality of VLSFO, as mentioned above.

### C. TRAINING OF CREWS

Scrubbers are new pieces of equipment that will require maintenance and trained crews.

When it comes to LNG Fuel, the picture becomes more critical, as running a dual fuel engine or bunkering LNG is a very high-tech operation, which requires a highly trained crew and state-of-the-art processes.

The current population of LNG-certified seagoing officers able to operate LNG vessels is too small to cope with the huge increase in demand should the industry choose the LNG option.

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## INSURANCE IMPACTS

The shipping industry is old, and old habits die hard. Just like in Marine Insurance.

Yet, as seen above, IMO 2020 implies a change in terms of risk. For insurers, the risk is evolving, and uncertainty cannot be measured.

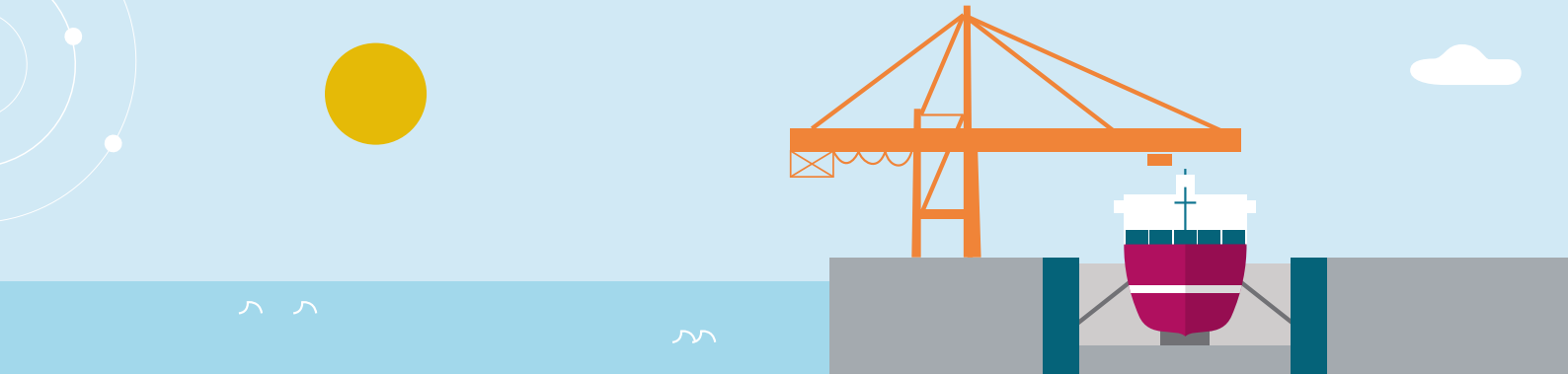
As one of the oldest industries in the world, Marine insurance likes metrics and measures, and does not welcome new technologies and equipment with no track record. A predictive approach remains difficult, particularly when numerous sectors (i.e. shipping, refineries, logistics) are involved.

### SHIPPING INSURANCE

When speaking about shipping insurance, three markets are involved: Protection & Indemnity (P&I), Hull & Machinery (H&M) and cargo. Two of them are directly concerned by IMO 2020.

P&I covers mainly personal injury to or illness or loss of life of crew members, stevedores and passengers, collision liability and marine oil pollution.

H&M is a policy taken out by shipowners or ship operators covering physical damage that might occur to ships, sue and labor, and third-party collision.



The first practical consequence of the regulation will be to install dialogue with shipowners, and to adapt existing policies based on the new fuel compliance obligation.

For Protection & Indemnity (P&I) and Hull & Machinery (H&M) underwriters, the quality of the fuel is primary: the former will be mainly concerned with pollution, and the latter with mechanical breakdown.

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## P&I

Since P&I Clubs cover marine pollution, they should feel the largest impact from IMO 2020.

First, they may have to pay for owners' fines. P&I Clubs are known to cover discretionary fines, including for the violation of Marpol.

They will also need to consider how to protect themselves against potential legal disputes linked to the new regulation. All the charter parties - commercial contracts negotiated between a shipowner and a charterer - negotiated prior to the implementation of IMO 2020 will have to consider how the fuel switch will be managed, since the charterer is in charge of paying and handling bunkers.

Disputes between Charterers and Owners could be numerous: variations in the price of the remaining HSFO on board, tank cleaning, insufficient compliant fuel on board, who will pay for the scrubber installation in the case of long-term charters, delays, etc.

Moreover, P&I will have to deal with the weight of reputational risk in a world where pollution is blacklisted.

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## H&M

Even if IMO 2020 specifies that *"All fuel oil for combustion purposes on a ship must meet required fuel oil quality standards, as set out in IMO MARPOL Annex VI (regulation 18.3). For example, the fuel oil must not include any added substance or chemical waste that jeopardizes the safety of ships or adversely affects the performance of the machinery"*, the shipping world is still aware that all technical solutions could lead to more claims.

How will engines and pumps that have burned HSFO for years, having been designed to do so, react to VLSFO? What impact will scrubbers have on engines? Technical advisors expect more engine and pump damage from new bunker blends, along with more breakdowns.

What about crew training for the use of new scrubbers and new fuel? Human error is one of the main causes of marine losses (accounting for 80% to 90%). Inadequate knowledge of a vessel's system can lead to misconduct and fatal errors. Sufficient marine training, and adequate knowledge of all the technology on board, are key factors in terms of limiting accidents.

According to experts, the availability of compliant fuel could be a solution to a smoother transition. Nevertheless, depending on the Flag States and Port State Control jurisdictions in charge of enforcing compliance, we may encounter different levels of compliance with IMO 2020. It is up to insurers to set the level of their standards with shipowners, and to adjust Insurance policy Terms & Conditions accordingly.

The installation of scrubbers and the cleaning of tanks for new fuel will require time spent in shipyards. Experts believe that time spent in drydocks in 2019-2020 will refine the market by removing a certain number of ships from circulation. Will it also have an impact on the value of vessels, or on premium levels?

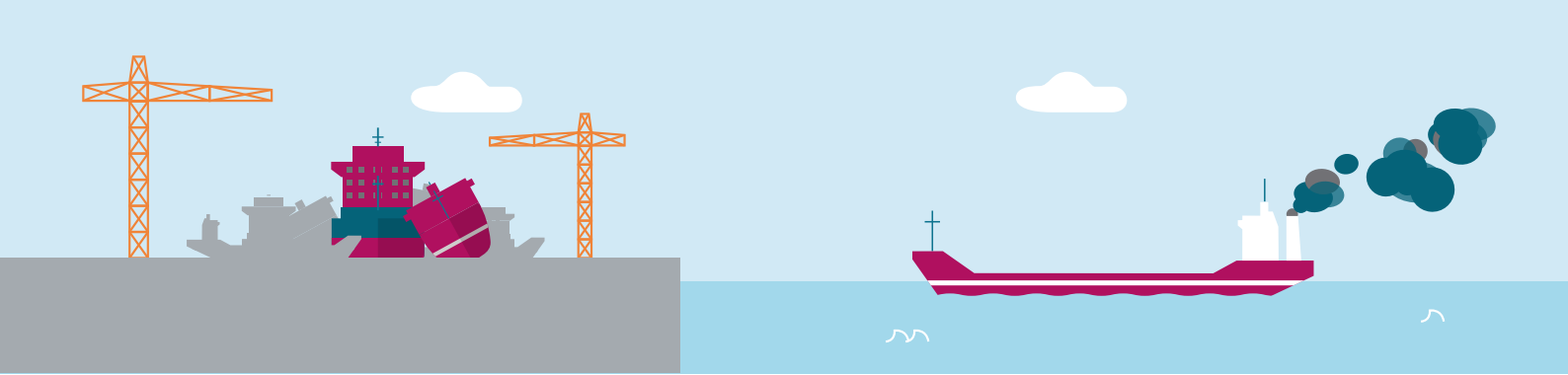
The scrubbers will raise the insurance value of vessels and consequently their H&M premiums... but they will also lead to higher average claims in general.

Finally, IMO 2020 could lead to an improved environmental footprint and a younger, more efficient fleet. This new regulation will clean up the shipping landscape.

The costs of the regulation will send older vessels to scrapyards (with a focus on demolition voyages for insurers).

Retrofitting with scrubbers should imply more maintenance and fewer accidents. A costly new system on board will hopefully encourage better management, and closer monitoring of onboard technology.

The costs of bunkering and new interest in LNG vessels should lead to new designs and the efficient construction of new vessels.



## CONCLUSION

While shipping is slowly emerging from a major economic crisis, the financial margins of shipowners remain low. A few months before the endorsement of IMO 2020, the costs associated with compliance remain uncertain for shipowners, as do the costs of the risks involved – of which non-compliance may well be the biggest one.

IMO 2020 is more than just another regulation. It is one of the biggest revolutions the shipping industry has encountered since the double hull regulation in 1992, and it will imply a structural change to the sector. Like every perfect storm, its consequences will spill over into other industries: in this instance refining and insurance. Insurers will need to help insureds to face this spillover and the new risks it brings.

The challenge for insurers will be how to deal with all the new elements involved, which will impact the frequency and severity of risks, data handling, cross-over interests with refineries, and above all their relationships with their clients.

The regulation should have a substantial impact on the shipping landscape. It may help insurers to distinguish better run fleets and adjust Terms & Conditions accordingly.

Marine insurers will have to take on board this new deal by adapting their offer, developing their risk assessment and enhancing their predictive model.

With all these challenges, it will probably take years to measure the success of this regulation in terms of the environment, health, the economy and claims.

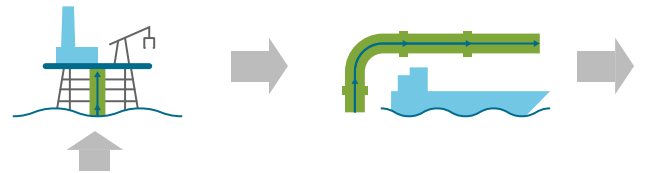
It is a major milestone for the Shipping industry, and one with which SCOR is particularly proud to support its clients, who are increasingly committed to Corporate Social Responsibility and improving their environmental footprint.

With more than 40 years of experience in the underwriting of large corporate risks, SCOR will ride out this perfect storm alongside its clients, using technical understanding and tailor-made solutions.

## CONSEQUENCES OF THE IMPLEMENTATION

Roughly 50% of HSFO (with a sulphur content of 3.5wt%) produced by refineries is currently used as bunker fuel. This represented 3.5 to 4 million barrels in 2018

1. Production → 2. Transport →

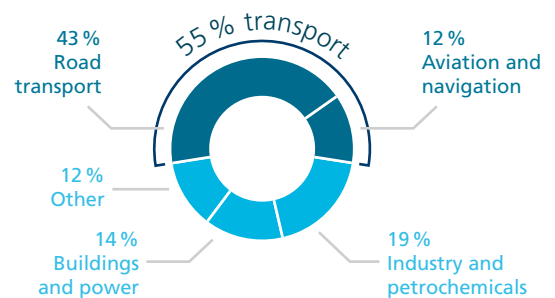


### CRUDE OIL

#### What is it used for?

After crude oil is produced at a field, it is sent to a refinery where the various hydrocarbons in the crude are separated, converted and treated to make useable petroleum products. Crude oil is heated and put into a distillation tower where different hydrocarbon components are boiled off and recovered as they condense at different temperatures. The molecules can be converted further by the use of catalysts, with the application of heat/pressure.

Most petroleum products are used as fuel. A growing share is used for non-energy purposes (petrochemical feedstock, lubricants, bitumen).



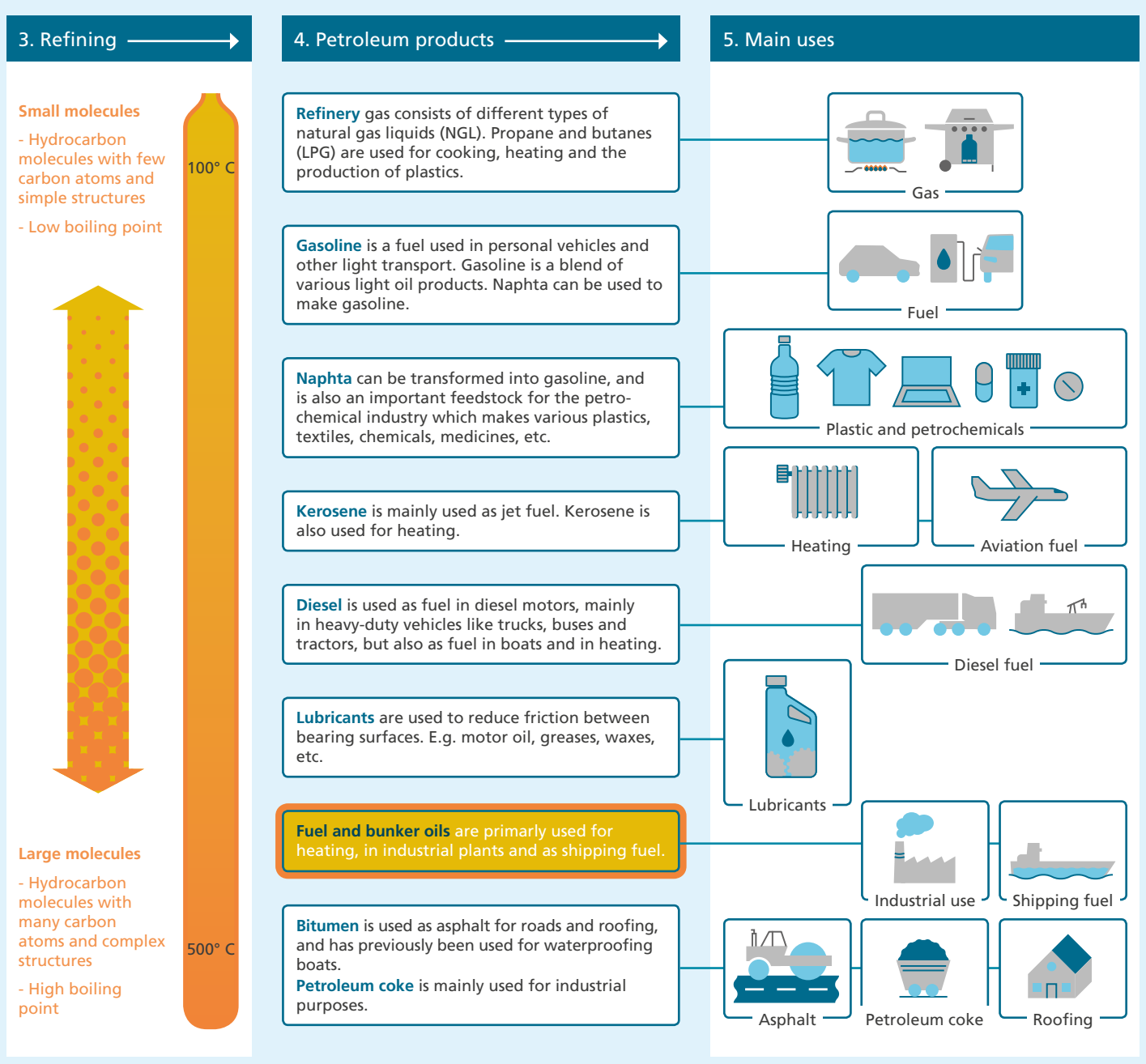
Norwegianpetroleum.no





## OF IMO 2020 STANDARDS FOR REFINERIES

(source: McKinsey). The implementation of IMO 2020, which limits the sulphur content to 0.5wt % in all marine combustibles, will have a severe impact on the consumption of HSFO.





### Market changes

On the one hand, due to the fall in demand for HSFO (this reduction is estimated at 2-3 million barrels per day), the price of HSFO could decrease significantly to USD 150-200 per ton, i.e. less than one third of the price level in August 2018, according to Forbes.

On the other hand, this new regulation will require an additional 2-3 million barrels of MGO per day, leading to further tensions on the middle distillate market. The difference in price between HSFO and MGO could increase from USD 200 per ton to more than USD 700 per ton on average according to various sources.

Estimated Price in 2020		
HSFO	3.5wt% S	USD 200 / ton
VLSFO	0.5wt% S	USD 400 / ton
MGO	0.1 wt% S	USD 900 /ton

Consequently, most analysts predict that refining margins will improve in the years following the implementation of the IMO 2020 bunker fuel specifications.

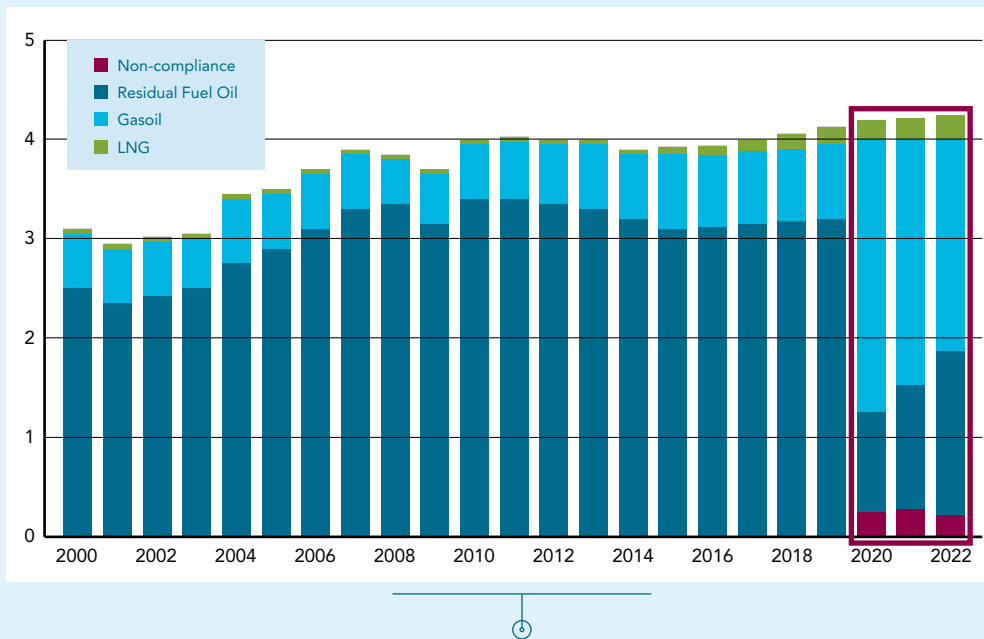


FIGURE 4: MARINE FUEL CONSUMPTION IN INTERNATIONAL NAVIGATION

### How will refineries adapt?

These changes will have a huge impact on the fuel oil markets, and refiners will have to adapt their industrial tools to these new market conditions. There is no one-size-fits-all solution. Solutions will be tailor-made depending on the geographical conditions and the refinery complexity involved (see Technical Newsletter #34 – November 2016 “Petroleum Refinery and Insurance”).

Firstly, refiners will have to develop the formula of VLSFO, which is a new product. VLSFO will be obtained by blending several petroleum cuts, each with different properties. This is a real challenge, as the blended product must be stable (i.e. its properties must remain constant over time) and compatible (i.e. it must be able to blend with another bunker). It will take time and effort for



refiners to find the correct formula. As a result, it is likely that the VLSFO available on the market will have different properties, as each refiner (BP, Shell, ExxonMobil, etc.) will develop its own formula. VLSFO fuels will then fall into two different categories: aromatic or paraffin-based fuels, each of which has its own challenges. For example, paraffin-based fuels have a higher pour point and could freeze at higher temperatures during the winter. At the present time, all marine distillates must comply with ISO standard 8217 2017, which does not include VLSFO. The next revision that will include it is not expected before 2022-2023. In the meantime, the only solution is for shipowners to be cautious when purchasing VLSFO.

Not all refiners will be able to produce VLSFO, as they need to have enough flexibility in their blending facilities and enough tanks to accommodate this new product. So it comes as no surprise that the availability of VLSFO is expected to be limited in 2020.

In addition, refiners will have to reduce their production of HSFO and increase their production of MGO. Several options are available in this regard:

- ◆ Refiners could change their crude slate and process lower sulphur crude oil instead, to reduce the sulphur content in their products such as HSFO. The problem with this is that it could put further pressure on the refining margins due to the higher cost of low-sulphur crude oil.
- ◆ Refiners could invest in new hydro-processing and conversion capacities to increase gasoil production.

The increased demand in low-sulphur gasoil is likely to increase gasoil margins and will make it attractive for refiners to invest in new desulphurization capacities to produce low-sulphur products, and in new conversion capacities (such as delayed cokers and hydrocracker-type units) to maximize diesel output and limit fuel oil production. These are long-term projects and their cost ranges from USD 100 million up to USD 1 billion, depending on the technologies used and the capacity involved. A few studies have indicated that 60-75 % of additional hydro-processing units will be needed by 2020 compared to planned projects, to cope with the increased demand due to IMO 2020.

Refineries will always produce HSFO as it is inherent to crude oil and they will need to find new markets for HSFO.

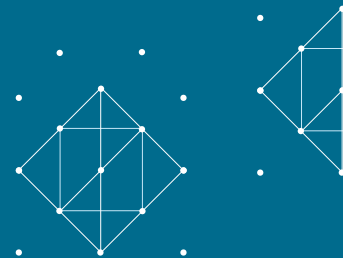
- ◆ Due to its lower price, HSFO could compete with coal for electrical power generation. This solution is available in regions where power is generated from coal, i.e. mainly in Asia.
- ◆ They could switch HSFO production to bitumen, if the refinery configuration can manage it. This solution would suit countries investing in infrastructure like roads and highways, such as India.

The majority of refiners interviewed by Reuters (as published on September 28, 2018) claimed that they are IMO 2020 ready. As a sign of buoyant activities, S&P Global Platts noted that refinery upgrades are expected to pick-up in H2 2018 and 2019 (published by Factbox on August 6, 2018) with new conversion units coming on stream in Europe.

As an example, ExxonMobil has built a new delayed coker unit in Antwerp and Shell has invested in a solvent deasphalter at the Pernis refinery in Rotterdam.

The most recent and complex refineries built in the Middle East and in Asia are already IMO 2020 compliant and will not need to make any investments. They will benefit from the improved refining margins.

Conversely, the least complex refineries are likely to see their refining margins decrease, making their operations unsustainable in the long term, leading to potential further closures worldwide - unless they enjoy the benefits of a local market, which will not be impacted by these regulatory changes.



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