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SEABURY MARITIME

IMO 2020

What Every Shipper Needs To Know

Produced by

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Key Takeaways

- Jan. 1 will mark the full implementation of IMO 2020 regulations reducing sulfur oxide emission from 3.5 percent m/m to 0.5 percent m/m.
- Carriers have several ways to comply with these new rules. Each method brings its own advantages, disadvantages, and cost implications.
- New emission standards will lead to significant improvements in pollution derived from ships' emissions.
- Compliance will lead to an increase in operational costs, which carriers will attempt to pass on to shippers through new bunker formulas.
- 2019-2020 trans-Pacific contract negotiations will occur amid the uncertainty of this pending cost increase.
- Shippers should accept and endorse that the benefits of environmental improvements come with some increases in costs for low sulfur fuel, while engaging in a thorough dialogue and review of fuel surcharge trade factors with their carrier partners.
- Fuel costs already represent more than 50 percent of total operating expenses, and IMO 2020 poses an increase too significant for carriers to absorb and stay operational.

To navigate IMO 2020, carriers and shippers will need open dialgue. This report provides insight and a general overview of the issues in order to support better understanding and negotiations.

Introduction

With less than 10 months before the International Maritime Organization (IMO) regulation on sulfur oxide emission goes into effect, carriers and shippers alike are facing an uncomfortable uncertainty over its potential effects on costs and freight rates as they enter the 2019-2020 trans-Pacific contracting period. The 2020 deadline to reduce sulfur oxide emissions to 0.5 percent m/m is one of the most significant regulations impacting liner shipping in recent memory. Lacking an industry standard for fuel-surcharges computation or a clear picture of the underlying costs for low-sulfur fuel, participants can only roughly estimate its economic impact. Several factors affecting a carrier's calculation of the fuel surcharges add complexity, making transparency ever so paramount to building trust on both sides. The intention of this whitepaper, produced by Seabury Maritime in cooperation with Gemini Shippers Group, is to promote **open dialogue between carriers and shippers by providing insight** and a general understanding around metrics used behind bunker calculations.

The IMO is the United Nations agency responsible for implementing global maritime regulations after they are ratified by a number of member states. On Oct. 27, 2016, its Marine Environmental Protection Committee (MEPC) agreed to implement a global 0.5 percent m/m sulfur oxide emissions limit, effective Jan. 1, 2020. The current global limit is 3.5 percent m/m sulfur oxide. Airborne sulfur oxide is a dangerous pollutant, especially near population centers, and is a leading cause for acid rain. Studies have shown that sulfur oxide is a cause of respiratory diseases such as asthma.

This exhaust limitation can be met in various ways including:

- Low-sulfur-compliant fuel oil use.
- Low-sulfur alternative fuel use, such as Liquefied Natural Gas (LNG).
- Exhaust gas cleaning system, aka “scrubbers,” installation.

Each of these solutions has its own advantages, disadvantages, and complexities.

History: IMO Efforts to Reduce Pollution

In 1997, as part of the IMO’s work to reduce shipping’s harmful impact on the environment, the organization adopted Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL Convention). MARPOL Annex VI went into effect in May 2005. The annex set limits on sulfur oxide and nitrogen oxide emissions from ship exhausts, **creating a global cap of 4.5 percent m/m** on the sulfur content of fuel oil. Annex VI also contained a provision for the establishment of Emission Control Areas (ECAs) with more stringent controls on sulfur emissions near coastal areas.

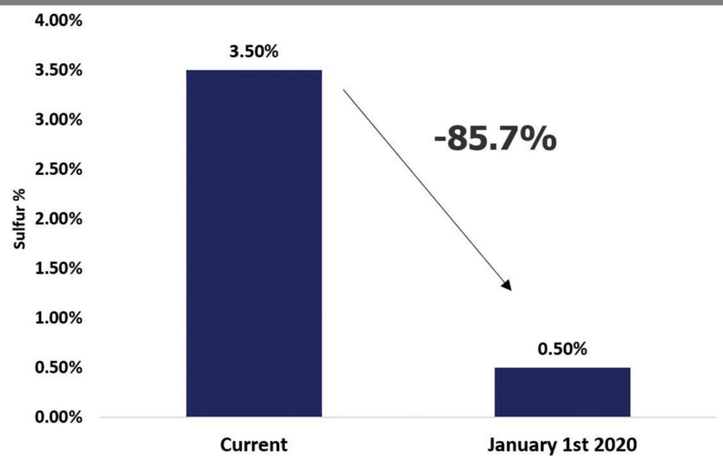
The 2020 deadline to reduce sulfur oxide emissions to 0.5 percent m/m is one of the most significant regulations impacting liner shipping in recent memory.

Broadly, Annex VI and subsequent revisions adopted in 2008, seek to control airborne emissions from ships including sulphur oxides (SOx), nitrogen oxides (NOx), ozone depleting substances (ODS), and volatile organic compounds (VOC). Release of these substances has been linked to local and global air pollution, human health issues, and environmental problems. In 2012 the limit was reduced from 4.5 percent m/m to the current 3.5 percent m/m, a 22.2 percent reduction.

IMO’s Marine Environment Protection Committee (MEPC 70), confirmed the pending changes in October 2016.

Under the new rules, ships operating outside of ECAs will be required to limit sulfur emission to 0.50 percent m/m from Jan. 1, 2020. This new limit is an 85.7 percent reduction from the current 3.5 percent m/m limit.

Fig. 1: Sulfur Emission Reduction After IMO 2020 Implementation



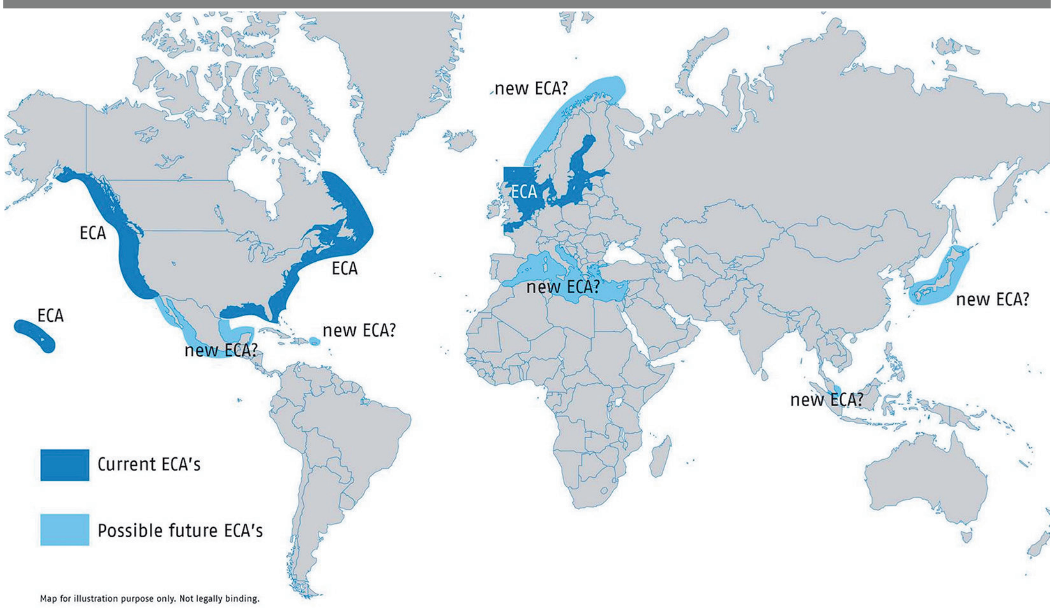
Source: Gemini / Seabury Maritime Analysis

Credit: Krispen Atkinson

Sulfur content standards are already more strict within certain Emission Control Areas. As of Jan. 1, 2015, the limit for sulfur emissions within an ECA was 0.1 percent m/m. The current ECAs are in North America and Northern Europe, as shown in the map below. Some other countries have been implementing their own limits in their territorial waters, or within port limits. As a result, some trade routes will be effected after 2020 more than others, depending on the share of time spent within ECAs during a voyage.

The **ECAs established under Annex VI covering the coastal waters of the United States and Europe will continue at the 2015 standard of 0.1 percent m/m** content.

Fig. 2: Map of 2019 Emission Control Areas (Current & Proposed)



Source: DNV GL

Sulfur content standards are already more strict within certain Emission Control Areas — 0.1 percent m/m has been the regulation within ECAs since Jan. 2015.

Authorities will validate carriers' use of low-sulfur fuel through audits of bunker delivery notes, vessel documentation, and bunkering sampling where infractions are suspected..

Fig. 3: Map of China's Domestic Emission Control Areas

Source: Ministry of Transport of the People's Republic of China

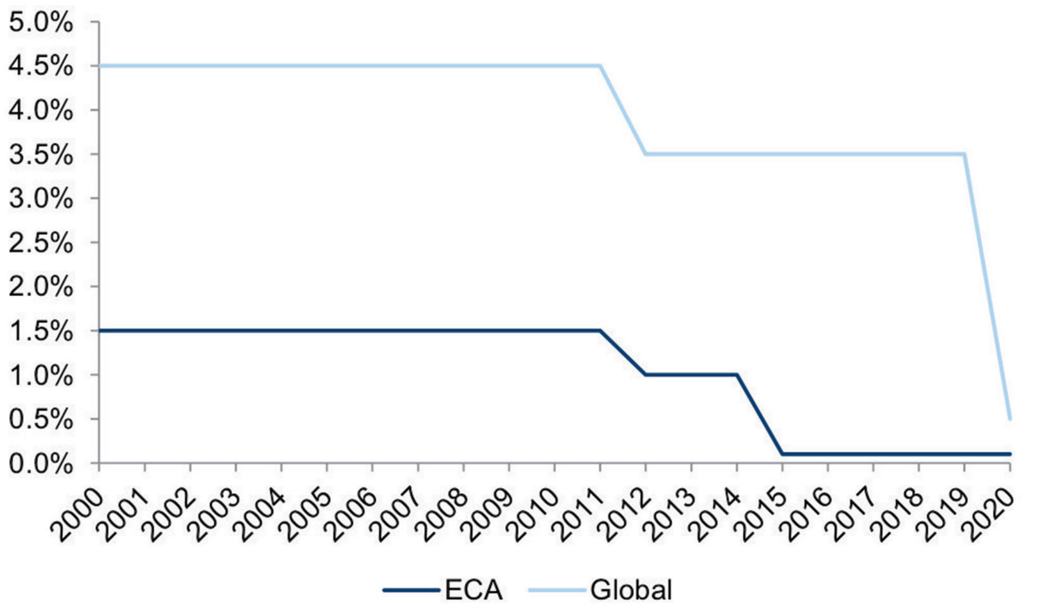
In support of current efforts to curb pollution, China adopted its own Domestic Emission Control Areas (DECAs) in 2016 with a phased approach to implementation.

- From **Jan. 1, 2016**, ports in the emission control areas can require ships at berth to use fuel oils with sulfur content **≤ 0.5 percent m/m**.
- From **Jan. 1, 2017**, ships berthing at core port areas within the DECAs are required to use fuel oils with sulfur content **≤ 0.5 percent m/m**, except for the first hour after arrival and the last hour prior to departure.
- From **Jan. 1, 2018**, ships berthing at any ports within the DECAs are required to use fuel oils with sulfur content **≤ 0.5 percent m/m**, except for the first hour after arrival and the last hour prior to departure.
- From **Jan. 1, 2019**, ships entering the DECAs are required to use fuel oil with sulfur content **≤ 0.5 percent m/m** at all times.

The progression of change in sulfur limits since 2005 has led to a dramatic reduction in sulfur emissions and the related effect on pollution.

Carriers have three choices for meeting IMO 2020 compliance.

Fig. 4: Sulfur Percentage Reduction in ECAs vs. Global, 2000-2020

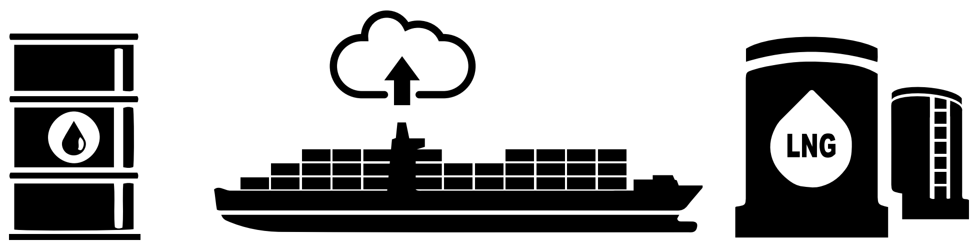


Source: Goldman Sachs

Despite some calls for the IMO to delay implementation, **nearly all industry participants have accepted that these rules will go into effect on Jan. 1, 2020**. Carriers are well down the path of planning for implementation of the new rules. Monitoring and enforcement of penalties for non-compliance is carried out by flag and port states. As part of monitoring and enforcement, flag states issue vessels an International Air Pollution Prevention (IAPP) certificate. The IAPP obligates carriers to uses fuel oil with a sulfur content that does not exceed the applicable MARPOL limits, documented by a bunker delivery note. Authorities will validate carriers' use of low-sulfur fuel through audits of bunker delivery notes, vessel documentation, and bunker sampling where infractions are suspected. Carriers found to have violated the rules risk significant fines, which in the United States can be up to $25,000 per day. Many question the standardization of enforcement across different flag and port states and suspect that levels of enforcement reliability will vary in different parts of the world.

Methods for IMO 2020 Compliance

Carriers have three choices for meeting IMO 2020 compliance:



Low Sulfur Fuel | **Exhaust gas cleaning systems (Scrubbers)** | **Liquid Natural Gas**

The maritime fuel market is going to see a major disruption in its way of doing business.

Each carrier will deploy a strategy that best meets their needs, and many carriers will use a combination of all three solutions both in the long and short term. Each solution brings certain features and trade-offs for the carrier to consider. Several diverse factors — including fuel availability, fleet age and makeup, charter versus ownership, capital cost, shipyard capacity, and implementation time — must be considered. For shippers, an understanding of the carriers' planned strategy will provide further insight into how these costs will manifest in fuel surcharges.

Marine Fuel Markets

The total annual global marine fuel demand is in excess of 400 million tons, with projected 2020 demand exceeding 500 million tons. The larger containerships (4,000 TEU and greater) account for approximately 20 percent of all marine fuel demand. Fuel costs typically represent more than 50 percent of the total running costs for a ship and are increasingly becoming the focus for improvements in order to gain a market advantage.

Stemming from the new sulfur regulations, the maritime fuel market is going to see a major disruption in its way of doing business. Up to now, marine fuel "bunkers" have been dominated by residual/heavy fuel oil (HFO), and to some extent distillate marine gas oil (MGO). HFO is the residue of the distillation process of crude oil, and it is the fuel grade most frequently used in shipping.

MGO is one of the highest marine fuel grades. It is more expensive because it is a lighter fraction and better quality than diesel fuel and is typically 0.1 percent sulfur content. HFO is the lowest cost fuel, while MGO typically has a 40-50 percent premium.

As of Feb. 8, 2019, global Top 20 port price averages are $420 versus $647 per ton for HFO versus MGO respectively. Forward price curves and general market consensus are projecting a price differential upwards of $180 per ton based on recent crude oil prices and projections.

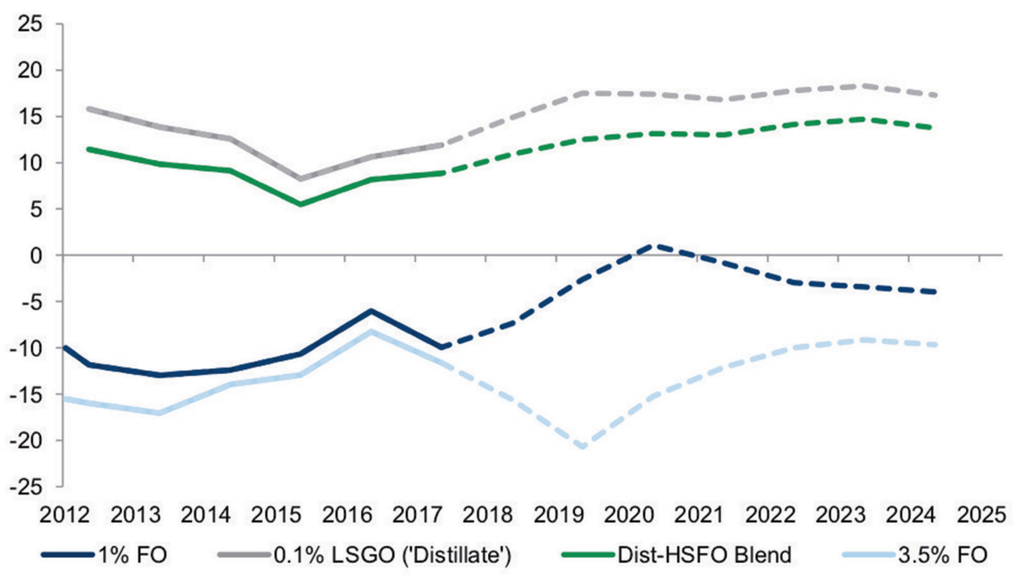
After the implementation of the sulfur regulations, the only vessels that will be permitted to continue burning HFO will be those fitted with exhaust scrubbers. All other ships will need to shift to MGO or other compliant fuels.

Oil majors and refiners are already moving towards creating new low-sulfur fuel blends (ULSFO) to meet the 0.5 percent sulfur limit. These will be cheaper than MGO and physical properties closer to those of HFO. Most of these new low-sulfur fuel blends so far are experiencing compatibility and stability issues, as any blending of fuels can create problems including potential engine failure at sea. These ULFSO fuels will typically be a blending of MGO and HFO, and will likely be priced accordingly between the two options.

Initially, lack of scrubber installations will translate to most ships shifting to MGO use. **Approximately 2,000 ships are expected to be scrubber fitted by 2020** that will continue to use HFO. Increasingly, consumption of ULSFO is expected to replace MGO. As more ships have scrubbers installed, the demand for HFO will again increase.

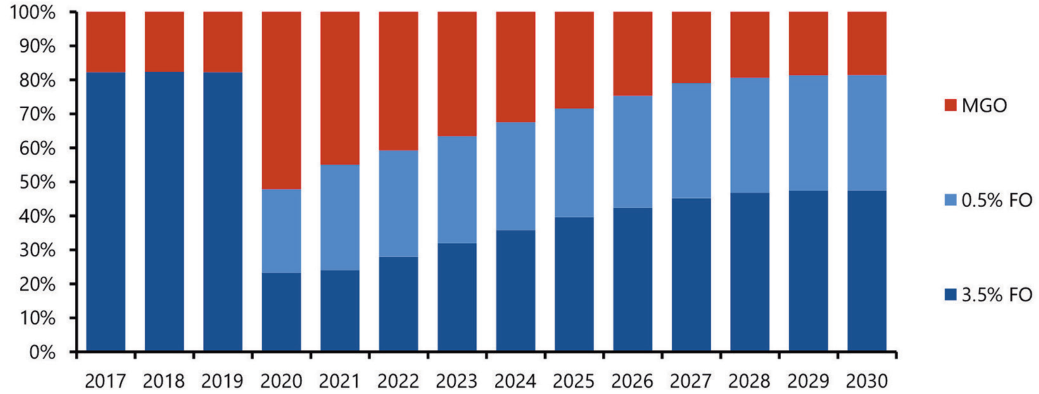
Consumption of ULSFO will slowly replace MGO, and as more ships have scrubbers installed, demand for HFO will rise.

Fig. 5: Forward Price Change Projections for Different Fuel Grades



Source: Goldman Sachs

Fig. 6: Projected Marine Fuel Oil Market Share



Source: Argus Media

New fuel blends and alternative fuels will inject diversity and open up the simple two-option marine fuels market.

Additionally, alternative fuels are also increasingly being adopted, with Liquified Natural Gas (LNG) being the alternative fuel of choice for various newbuildings since 2014. LNG is significantly lower cost than MGO and even HFO. However, the fueling infrastructure is not yet widely developed beyond just a handful of key bunkering ports. Additionally, the cost of LNG-dual-fuel-capable ships is significantly higher than installing a scrubber and regular diesel engines, due to the higher cost of machinery as well as the higher costs and size of LNG fuel storage tanks.

The sudden shift and drop in demand for HFO post 2020 is expected to drive its price down significantly. Additionally, there is still uncertainty as to whether refiners will be able to position sufficient MGO in the key bunkering ports in time for 2020, which would expectedly drive those prices up.

This upcoming major shakeup to the marine fuels market will open new opportunities for investments in scrubbers, new eco ships, and other fuel efficiency technologies, as well as in alternative fuels and related infrastructure, starting with LNG and, over time, shifting to other candidates such as ammonia, hybrid electric and battery, hydrogen, methane, and other biofuels. This is expected to create complexity in the marine fuels market, moving away from a simple market of just two main fuels.

Implementation Factors for Carrier and Shipper Consideration

Due to the still-uncertain price differential between HFO and MGO or ULSFO, as well as other technical or regulatory considerations, carriers and ship owners have widely displayed caution about big investments in scrubbers or other alternative fuels. This “wait and see” approach is further exacerbated by the potential of non-availability of compliant low-sulfur fuels in smaller ports on the switchover date, as well as some ports and states banning the water discharge from some scrubbers. The question of how a carrier will compute and pass the added fuel costs to their customers is still a big uncertainty. This is a major reason for the big discrepancies in the Bunker Adjustment Factors (BAF) that we see in the announcements carriers are making.

Of the three main compliance methods, the alternative fuels option is likely to have the smallest uptake in the first few years post implementation, and we will therefore not focus on this option in this paper. However, some carriers, such as CMA CGM and Hapag Lloyd, are on the path to LNG and other alternative fuel use on some ships.

Switching to MGO

Of the compliance options, **switching to MGO is the most straight-forward solution,** requiring the least upfront capital investment, and the least technical changes. Ships are already used to using this fuel within ECAs, with crews able to accommodate this switch fairly easily.

However, MGO is also the highest cost option, by a high margin. It also increases the lube oil costs. MGO has a higher caloric content than HFO, thus consuming about 5 percent less by weight compared to HFO, slightly lowering the price gap.

Consumers should expect that at least for the first period post 2020, most of their containers will be on ships using MGO.

ULSFO is a cheaper option to MGO, however due to the lower availability, and fuel stability issues risking total engine failure, we do not expect that this fuel will be used too broadly at first. This may eventually replace more of the MGO, which should help lower the BAF that shippers are asked to pay.

Switching to Scrubbers

Scrubbers are air pollution control devices that remove most sulfur and particulate matter from the exhaust. Scrubbers have been used widely on land at power plants and are therefore not considered a new technology. However, the harsh marine environment does pose some difficulties when designing the systems for use on ships. Scrubbers allow a ship to continue burning lower-cost HFO, removing the harmful substances on the ship as opposed to at the refinery stage.

Although this may seem worse for the environment, scrubbed HFO is actually cleaner than ULSFO or MGO because of the lower particulate matter content, removed by the scrubbers. In addition, although it would seem intuitively better to remove the sulfur at the refinery level in terms of total emissions and energy use, the extra shipping of crude oil to refineries capable of hydrocracking the fuel, and then back to the supply locations around the world, counterbalances most or all of the CO2 emitted from the extra energy consumed in building, installing, and using a scrubber on a ship. Using a scrubber results in an increased fuel consumption of about 1.5 percent-2 percent. Simply put, **there is no free ride to reducing emissions**, since reducing sulfur increases the CO2 emitted, both for scrubbers and for MGO. The 2020 regulation is solely an air pollution control regulation and is not related to climate change.

There are various types of scrubbers, with the main used on ships being “wet scrubbers.” In a

Scrubbers are air pollution control devices installed on ships that remove most sulfur and particulate matter from the exhaust and allow lower-cost HFO use, removing more harmful pollutants at sea than can be removed at the refinery stage.

wet scrubber, water is sprayed on the exhaust gasses in order to neutralize the sulfur oxides and remove most of the particulate matters. The method of treatment of the water then sub-categorizes scrubbers into three main groups:

- Open Loop
- Hybrid
- Closed Loop

These designations refer to how the used wash water is treated.

Currently, the most widely used is Open Loop, which releases the diluted water back into the sea, and is the lowest cost to install and operate. The water is treated to remove heavy metals and other particulate matter, and then is released into the sea. This method is only safe in high alkaline waters, which includes any open sea. There is a big debate lately about the safety of the water released back into the sea. Properly designed open-loop scrubber systems have been shown not to release harmful substances back into the sea. However, as more scrubber manufacturers enter the market, some systems are being shown to be less effective at removing the chemicals and heavy metals from the water, potentially not meeting the required standards. The IMO is likely to consider closer requirements on approvals of scrubber manufacturers, as it has done on other technology regulations. Some ports and countries are unilaterally banning the discharge of scrubber wash water in their port or territorial waters, such as Singapore and Fujairah, with Chinese ports expected to follow suit. Such bans are expected to be implemented by more ports in the near future, while more discussions are held at the IMO level and with independent scientific reports. Such bans will have limited impact on the financials of an open loop scrubber on a containership.

The 2020 regulation is solely for air polution and is not related to climate change.

For waterways like rivers and lakes with lower alkalinity, a Closed Loop is preferable. This method uses fresh water with special additives in order to treat the exhaust, and then the used water is treated, and the waste kept on board to dispose of on land. Closed loop scrubbers are the least utilized and are the most expensive.

As the name implies, a hybrid scrubber can work in an open loop as well as a closed loop setting, offering maximum flexibility. The current debate about Open Loop scrubbers might lead to hybrid systems gaining more traction, however, the design of Open Loop systems as "Hybrid-ready," able to easily convert to hybrid systems with an extra future investment, is an opportunity for the two options to converge.

How much does it cost, and how is it installed?

Scrubber costs can vary greatly, depending on manufacturer, type of scrubber, and size of ship and engine configuration. Presently prices vary between $1.0 million and up to $6.0 million for the largest ships with complex engine setups. Installation costs are also a major factor when retrofitting ships with scrubbers. For **small to mid-size ships, the installation costs are approximately equal to, or even higher than, the cost of the scrubber itself**, bringing total costs to around $2 million-$8 million per ship. As shipyards and engineering companies become more experiences in installing scrubbers, the costs and time to retrofit are coming down.

Most scrubbers are several stories tall and take up a significant part of the engine room. Their installation is a major shipyard engineering task. If it's during a regularly scheduled maintenance drydock and the planning is properly managed in advance, then time loss is minimal. In a time crunch, and if the ship-owner decides to retrofit the scrubber outside of the planned maintenance cycle, the ship would be out of service for at least 3-4 weeks, including the time in repositioning the ship to the shipyard and back to the regular trade-route.

Due to the recent rush in scrubber orders, many manufacturers are out of available delivery slots prior to 2020. Consumers should therefore expect that most ships, even in cases where scrubbers are planned to be installed, will be consuming MGO or ULSFO at the start of 2020. Similarly, shipyard capacity is expected to pose an issue in global installation capacity.

Around 2,000 scrubbers are expected to be installed on the global fleet of around 90,000 ships prior to 2020. Typically, any containership under 15 years old is a candidate for a scrubber. The younger the ship, the more attractive the financial return.

Retrofitting a scrubber outside of planned maintenance could place a ship out of service for 3-4 weeks.

How much will a scrubber ship save in fuel costs?

With all time and costs included, including potentially hiring a substitute ship in the route, the fuel consumed during repositioning and testing, all engineering work, etc., based on the current HFO and MGO price projections, the payback time for an Open Loop scrubber is less than 2-3 years, and around 3-3.5 years for a hybrid scrubber.

This payback time also accounts for the added operating costs for the scrubber (upwards of $80,000 per annum for an 8,500-TEU ship), and the extra 1.5 percent-2 percent of fuel consumed when operating the scrubber.

All-in estimated cost for an 8,500-TEU ship would conservatively be around $5 million. For an 8,500-TEU ship, assuming a 5-year amortization on a hybrid scrubber, approximately 95 tons daily fuel consumption at 17-18 knots, 12 tons of fuel per day while in port, around 275 days sailing per year, **the savings of a scrubber compared to using MGO are at least $4.2 million per year.** These savings are higher for larger ships due to economies of scale, and change depending on the price differential. The breakeven for a scrubber would be less than $45 per ton, easily justifying the decision to install one purely from an economics perspective.

It is important to note that a large percentage of ships operated by the main carriers are chartered long-term from shipowners, rather than owned outright by the carriers. In that case, the full savings will not be actualized by the carriers themselves and will have to be shared with the ship owners making the investment. Typical figures are around 25 percent-50 percent of the total savings being kept by the carriers. This adds further complexity to BAF formula calculations.

Given the many unknowns, including various ship sizes and types, chartered percentage of the fleet, and more, the path forward post-2020 is not straightforward. These factors also explain the uncertainty around carriers' drafting of bunker adjustment factors. This paper aims to clarify the metrics behind these calculations to help shippers and consumers better understand what to expect from each carrier's 2020 strategy and fleet mix.

Fuel Surcharge 101: What Goes Into the Calculator

For shippers and carriers, a clear understanding of the methodology for the creation of a fuel surcharge is paramount. While each carrier, and each loop they operate, will have its own unique characteristics shaping its aggregated fuel spend, fuel surcharge computation — both before and after Jan. 1, 2020 — follows the basic formula of:

Trade Factor × **Fuel Price** = **Fuel Surcharge**

Prior to the June 2017 cessation of TSA fuel formula publication, the methodology used to determine surcharge components was clearly explained. With the disbandment of the TSA and the introduction of IMO 2020, carriers now have to create their own methodologies for their specific trade factors. Lack of clarity around these details have created a genuine shipper distrust of the appropriateness of carrier fuel surcharges. To avoid calls for a return to the days of all-in pricing, carriers need to clearly define the factors that comprise their specific trade factor. A clear understanding on the assumption for some of the key variables noted below is imperative to understanding the potential effects fuel price changes will have on overall cost.

To avoid calls for a return to all-in pricing, carriers need to clearly define the factors that comprise their specific trade factor.

Trade Factors for Consideration

- **Voyage Length:** Time to complete a round-trip voyage.
- **Ship size:** Average ship operating on the trade or loop.
- **Sea Days:** Number of total days of voyage spent at sea.
- **Port Days:** Number of total days of voyage spent in port.
- **ECA Days:** Number of days operating in Emission Control Area waters.
- **Speed:** Average speed used to calculate fuel consumption per day. Fuel consumption increases at a cubed ratio to speed, therefore an increase of even 3-4 knots can double fuel consumption.
- **Fuel Consumption:** Tons of IFO 380 (per Jan. 1, 2020) 0.5 percent m/m and 0.1 percent m/m low-sulfur fuel used based on average time and ship speed.
- **Basic Cost Embedment:** In the past, some formulas have had a basis assumption of a standard cost per ton included in the basis ocean freight whereby bunker would only be assessed when prices go above the embedded price.
- **Asset Utilization:** Capacity of ship assumed to be used. Can be based on carrier-specific or industrial load factors.
- **Imbalance factor:** What percent of costs are being attributed to the backhaul (in the trans-Pacific, westbound cargo).

Fuel Price Factors for Consideration

- Bunker Location: Bunker costs vary by port. Carriers will reference the prices of specific ports to monitor fuel prices.
- Reporting period: Carriers can monitor bunker prices several ways, including taking simple averages of prices of a week, month, or quarter, or they can use brackets or triggers that affect changes when a price in a period rises or falls by a specific amount.
- Fuel Surcharge Timing: **The timing of a 2020 BAF implementation is also a factor, and it is not just a random choice by carriers.** In order to properly comply with the emissions requirements on **Jan. 1, 2020**, a vessel's fuel tanks will need to be fully cleaned and flushed of any HFO, so that none of the high-sulfur remnants are mixed into the MGO. This process needs to start a few months prior to regulation implementation date. Although the IMO and Port States are likely to show some leniency in the first few months, carriers are unlikely to risk reputational damage and will start the switching process early.

Jan. 1 compliance will require fuel tanks be fully cleaned and flushed of any HFO so that no high-sulfur remnants are mixed into the MGO .

A Model for Fuel Surcharges in 2020

Overall assumptions

Seabury Maritime, in cooperation with Gemini Shippers Group, has developed a model for calculating the added fuel costs per container for any global route. The model can be tailored to take into account all the factors impacting a carrier's BAF calculations to help demystify the process for shippers. In some cases it will highlight problematic fuel-factor calculations, but in others it will educate shippers on the reasons a rate is what it is for a specific carrier or route.

For this paper, the results are tailored for the Asia to US West Coast routes. As this is meant to show a more generic analysis for an average ship and route, the assumptions used for each factor are based on generic ships. **The assumptions are purposely conservative, given the many unknowns when attempting to provide an average viewpoint.**

Primary assumptions

- **42 days** round-trip voyage, of which **32** days are at sea, and **10** in port.
- **15 percent** of sailing time within ECA, and **40** percent within ECA within port.
- **90 percent** utilization for the head haul.
- **40 percent** utilization for the back haul.
- **21 days** "off hire" for scrubber installation.
- **12 percent** finance cost for scrubber investment.
- **5-year** amortization for scrubber.
- **95 percent** MGO consumption compared to HFO.
- **1.5 percent** extra HFO consumption with scrubber installed.
- Average ship in the trans-Pacific West Coast route is **8,121 TEU** as of **Q4 2018.**

The base case vessel used is an 8,500-TEU ship. The model will also show how a smaller and larger vessel, and slower or faster speeds, would impact the BAF calculation.

Fig. 7: Assumed Data (8,500 TEU) For Surcharge Model

8,500 TEU
$20,000 charter rate (for "off hire" calculation)
$5 million scrubber capex
$50,000 extra lube oil used annually if switching to MGO
$90,000 extra annual operating expense for a scrubber
12 tons per day consumed while in port
95 tons per day slow steaming (base case)
160 tons per day when slow steaming at 21-22kn (for comparison)
250 tons per day when full speed at 24kn (for comparison)

Fig. 8: Assumed Data (4,500 TEU & 13,100 TEU) For Model Comparison

4,500 TEU	**13,100 TEU**
$15,000 charter rate (for "off hire" calculation)	$30,000 charter rate (for "off hire" calculation)
$3 million scrubber capex	$6 million scrubber capex
$40,000 extra lube oil used annually if switching to MGO	$60,000 extra lube oil used annually if switching to MGO
$50,000 extra annual operating expense for a scrubber	$110,000 extra annual operating expense for a scrubber
8 tons per day consumed while in port	14 tons per day consumed while in port
55 tons per day slow steaming (base case)	110 tons per day slow steaming (base case)
95 tons per day when slow steaming at 21-22kn (for comparison)	190 tons per day when slow steaming at 21-22kn (for comparison)
165 tons per day when full speed at 24kn (for comparison)	270 tons per day when full speed at 24kn (for comparison)

Each carrier may have their own base fuel cost included in their base rate.

The assumptions in this model about fuel consumption and scrubber costs can very drastically. **Ships with the same carrying capacity can have in excess of 20 percent fuel-consumption differences, especially at the slower speeds** for the newer ships designed specifically for performance at those speeds. The data shown here is meant to represent a typical ship.

The largest ships regularly operating in the trans-Pacific West Coast trade are 15,300 TEU.

Findings

The results portrayed in this paper are for the expected increase in fuel surcharge for 2020, and do not aim to examine the BAF as a whole. Insofar, the results shown are for the low sulfur to HFO fuel differential. This is because each carrier may have their own base fuel cost included in their base rate.

Below are the tabulated results from this model based on the 8,500-TEU vessel, assuming 100 percent of the factor is passed to the head haul/eastbound only:

Fig. 9: Fuel Surcharge Model Findings (8,500 TEU, MGO With Slow Steaming, 17-18kn)

HFO-MGO price differential $/ton	Annual Fuel Increase	Added Cost Per TEU, HH
100	$2,212,419.69	$33.28
150	$3,293,629.53	$49.54
200	$4,374,839.38	$65.80
250	$5,456,049.22	$82.07
300	$6,537,259.06	$98.33
350	$7,618,468.91	$114.59
400	$8,699,678.75	$130.86
500	$10,862,098.44	$163.38

Source: Gemini / Seabury Maritime Analysis

For the expected $200/ton of fuel price differential, the added cost per TEU would be in the range of $66/TEU for an eastbound container.

Head haul versus back haul ratio

Carriers have been releasing vastly different ratios for head haul to back haul splits, with APL at full head haul, Maersk at 70/30 percent, and Hapag Lloyd at 50/50 percent. This report is assuming 100 percent for the head haul, to highlight the total added fuel cost per container. This can then be tailored for each carrier's split as needed.

Additionally, it is important to note that given the 90 percent versus 40 percent utilization rate for head haul and back haul respectively, assuming an equal surcharge both ways still means that the head haul containers end up paying for the majority of the total added cost. Backhaul shippers in the Pacific trade have historically not paid their share of ship operating costs.

Some carrier loops do slightly slow down on the back haul westbound, which when combined with less cargo carried, highlights that the fuel consumption westbound is slightly less. In that case, an equal surcharge both ways is likely not to be implemented by most carriers, especially when considering the lower base rates on the back haul.

Ship size impact

For comparison, the figures for the 4,500-TEU and 13,100-TEU ships highlight how the size of the ship in the route can affect the fuel surcharge, with **bigger ships offering significant economies of scale.**

Fig. 10: Fuel Surcharge Model Comparison By TEU

	4,500 TEU		13,100 TEU	
HFO-MGO price differential $/MT	Annual Fuel Increase	Added Cost Per TEU, HH	Annual Fuel Increase	Added Cost Per TEU, HH
100	$1,297,402.19	$36.86	$2,564,401.88	$25.03
150	$1,926,103.28	$54.72	$3,816,602.81	$37.25
200	$2,554,804.38	$72.59	$5,068,803.75	$49.47
250	$3,183,505.47	$90.45	$6,321,004.69	$61.69
300	$3,812,206.56	$108.31	$7,573,205.63	$73.91
350	$4,440,907.66	$126.17	$8,825,406.56	$86.13
400	$5,069,608.75	$144.04	$10,077,607.50	$98.36
500	$6,327,010.94	$179.76	$12,582,009.38	$122.80

Source: Gemini / Seabury Maritime Analysis

Size of the ship in the route can affect the fuel surcharge, with bigger ships offering significant economies of scale.

Impact of Changing Speeds

Similarly, for the 8,500-TEU ship, when comparing to the faster speeds, the fuel surcharge can dramatically increase from the current 17-18kn norm. It would be a similar effect if simply comparing a less efficient to a more efficient ship at the same speeds. This impact is likely to incentivize carriers to operate more fuel-efficient vessels, and to likely maintain the current slower speeds to prevent the surcharges from skyrocketing.

The impact of speed on surcharge amount is likely to incentivize carriers to operate more fuel-efficient vessels.

Fig. 11: Slow Steaming Impact on Fuel Price

	MGO with slow steaming, 17-18kn		MGO with slow steaming, 21-22kn		MGO with full speed, 24-25kn	
HFO-MGO price differential $/ton	Annual Fuel Increase	Added Cost Per TEU, HH	Annual Fuel Increase	Added Cost Per TEU, HH	Annual Fuel Increase	Added Cost Per TEU, HH
100	$2,212,419.69	$33.28	$3,649,265.00	$54.89	$5,638,743.13	$84.82
150	$3,293,629.53	$49.54	$5,448,897.50	$81.96	$8,433,114.69	$126.85
200	$4,374,839.38	$65.80	$7,248,530.00	$109.03	$11,227,486.25	$168.88
250	$5,456,049.22	$82.07	$9,048,162.50	$136.10	$14,021,857.81	$210.91
300	$6,537,259.06	$98.33	$10,847,795.00	$163.17	$16,816,229.38	$252.94
350	$7,618,468.91	$114.59	$12,647,427.50	$190.24	$19,610,600.94	$294.98
400	$8,699,678.75	$130.86	$14,447,060.00	$217.31	$22,404,972.50	$337.01
500	$10,862,098.44	$163.38	$18,046,325.00	$271.45	$27,993,715.63	$421.07

Source: Gemini / Seabury Maritime Analysis

What if a scrubber is installed?

If a carrier owns the vessel and decides to install a scrubber, the savings are quite drastic. In this case, a linear increase on the fuel surcharge based on the MGO pricing would not be equitable for the shippers. However, considering that not all ships in a route will have scrubbers at the same time, and not all ships will be owned by the carriers, **we expect the surcharges to remain based on the MGO price, at least for the short- to mid-term.**

For these three ships, a comparison of base annual cost per TEU (assuming a $400 HFO/$600 MGO price and for head haul only) would break down as follows:

Fig. 12: Comparison of scrubber option cost by ship size

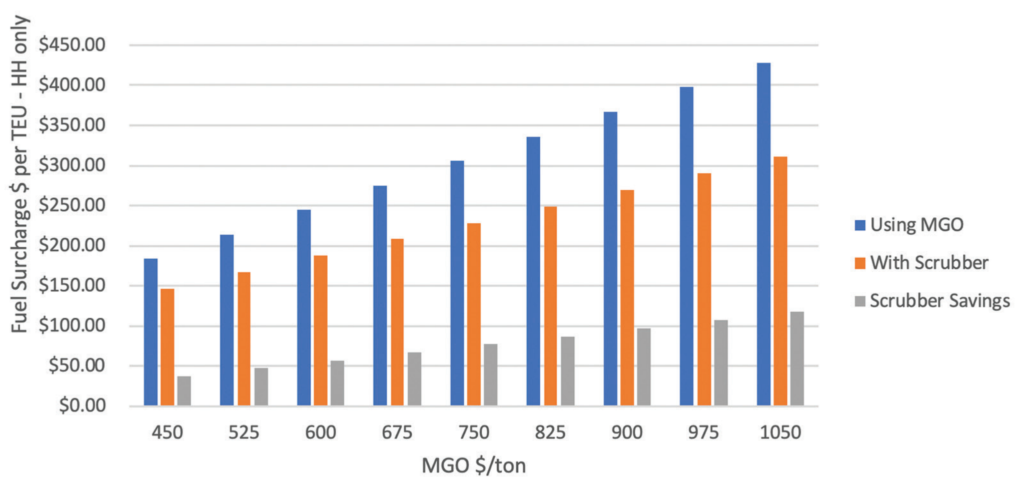
Ship Size	Added Annualized Scrubber Cost	Cost per TEU, HH only – with Scrubber	Cost per TEU, HH only – with MGO
8,500 TEU	$1.756 million	$26.41	$65.80
4,500 TEU	$1.079 million	$61.31	$72.59
13,100 TEU	$2.118 million	$30.66	$49.47

Source: Gemini / Seabury Maritime Analysis

In the future, as entire routes have scrubbers deployed on all ships, we expect that pressure will be put on carriers to adjust their surcharges downward for those routes. Rather than the linear increase compared to fuel prices starting from 0 for a 0 fuel price, it would instead be a fuel surcharge with a base factor at 0 fuel price, for the capitalized cost of the scrubber per TEU, and then a linear surcharge above that and based on HFO instead of MGO prices. This means that for very low fuel-price differentials, the surcharge for the MGO and the scrubber routes would be similar, but as the HFO-MGO differential increases, the increase to the scrubber route would be at a much slower rate compared to MGO use.

Below is a sample total fuel surcharge comparison of scrubber versus MGO:

Fig. 13 Fuel Surcharge Comparison, Scrubber Use vs. MGO (8,500 TEU)



Source: Source: Gemini / Seabury Maritime Analysis

As fuel compatibility issues are slowly overcome and use of ultra-low-sulfur fuel oil (ULSFO) becomes more prevalent, its fuel surcharge will become lower than MGO. Savings from using a scrubber would then be even lower.

As fuel compatibility issues are slowly overcome and use of ultra-low-sulfur fuel oil (ULSFO) becomes more prevalent, its fuel surcharge will become lower than MGO. The smaller fuel price differential means savings from using a scrubber would be even lower. Similarly, for a chartered vessel the scrubber fuel surcharge would be higher than for a vessel owned by the carrier.

From an academic standpoint, we have illustrated the need for complete transparency by the carriers. As each carrier undertakes this process independently the potential for a significant spread in surcharges among carriers is possible. Further, **many shippers and industry consultants will pressure test carrier assumptions and, to ensure the acceptance of surcharges, it is imperative they mirror actual operational costs.** Philip Damas, Drewry's head of supply chain advisors, noted that the "BAF formulae of the major carriers are substantially above bunker costs" and "BAF levels of carriers on the same trade lane vary by a factor of 3.6, which cannot plausibly be explained by different cost levels between carriers."

Impact to the shipper

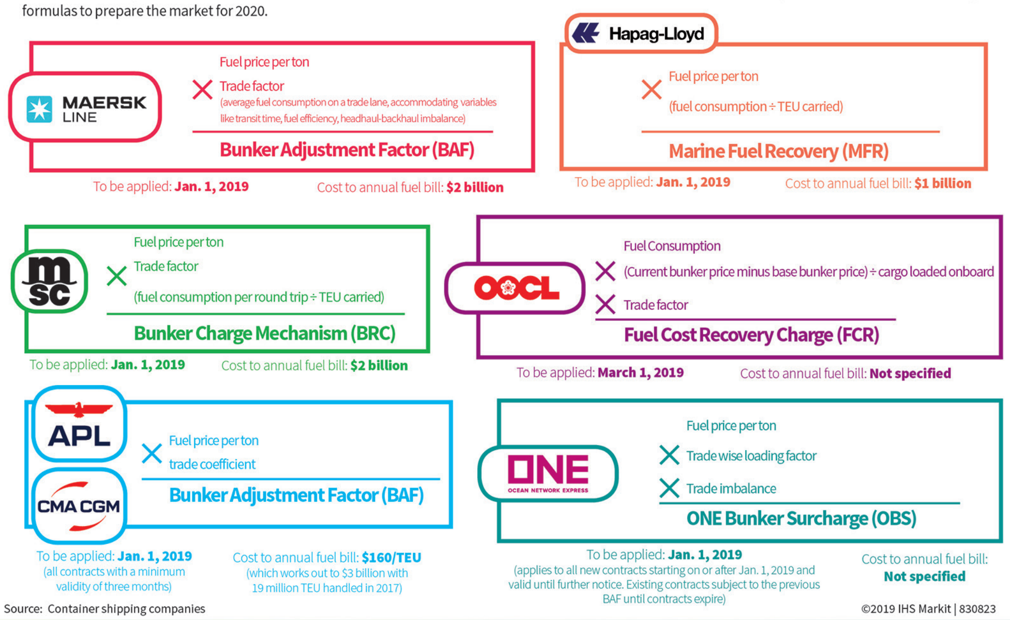
With trans-Pacific contracting season quickly approaching, many shippers continue to press carriers to explain how IMO 2020 bunker costs will be reflected in contract rates and surcharges. Given the standard May 1 to April 30 cycle of trans-Pacific contracting, shippers negotiating rates this spring must take the increased fuel costs into account for the period from Jan. 1, 2020 thru the end of their 2019-2020 contract.

Many shippers and industry consultants have criticized the lack of transparency and uniformity in carriers' recent BAF announcements. Industry consultants from Alphaliner stated in a Loadstar article, "A longstanding criticism from shippers is that the carriers' methods of calculating BAF remain non-transparent, lack uniformity, and could involve an

> “A longstanding criticism ... is that the carriers’ methods of calculating BAF remain non-transparent, lack uniformity, and could involve an element of revenue generation...”

Container lines push low-sulfur fuel fees

Bunker surcharges have been revised by carriers to mitigate the effect of the IMO sulfur cap of 0.5 percent from Jan. 1, 2020, which could add up to $15 billion to container shipping’s annual fuel bill. Carriers have no option but to directly pass on the costs to shippers and have already begun to phase in the new surcharge formulas to prepare the market for 2020.



Source: Container shipping companies

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element of revenue generation, rather than serving only to recoup actual bunker costs and help carriers cope with unexpected fuel price fluctuations.” For shippers, the need to project costs for budgeting purposes across a range of carriers and trade lanes is hampered by a lack of a standard bunker surcharge that considers the new low sulfur requirements.

Issues related to lack of standardization

Historically, fuel surcharges in the trans-Pacific were standardized under the Transpacific Stabilization Agreement. Started in 1989, the TSA published a detailed accounting of its fuel surcharge, including the methodology for computation and a scale for surcharges based on ranges of input costs. The TSA went on to adjust surcharges with the introduction of the first low-sulfur mandate and the introduction of ECAs. TSA leadership has frequently contributed to IHS Markit’s TPM Conference, and in 2013, they presented a detailed view of surcharges, including the introduction of the low-sulfur component in 2011 and the inland component added in 2013. While many shippers contested parts of the methodology, shippers and carriers alike enjoyed the effects of a standardized output across carriers for a given underlying commodity price. This standardization allowed shippers to make apples-to-apples comparisons across a range of carriers throughout the contract year.

In June 2017, the TSA abandoned the publication of a fuel surcharge citing, “rapidly changing market conditions, sailing characteristics, and cost structures made it impractical to continue publishing a single TSA recommended guideline formula.” **The TSA went on to disband operations in February 2018, leaving each carrier to determine its own method to track and publish surcharges.**

The lack of standardization of fuel surcharge methodology could lead to fuel surcharges becoming a competitive factor in liner shipping pricing as opposed to the intended purpose; a surcharge that reflects the underlying movement of commodity prices. This spring, carriers and shippers will begin their annual process of quoting rates for the upcoming contract year. In most cases, shippers will request an all-in price at time of quotation and then, at the time of contract filing, have the bunker broken out into a formula of ocean freight plus bunker. Looking at 10 of the largest carriers operating on the Pacific trade, a rate of $1,400 would be reflected in contracts as follows, based on their current fuel surcharges for the trans-Pacific eastbound trade:

Fig 14: Contracting Base + Bunker Sample

All in Rate: 1400

	Base Ocean		Bunker		Total
Carrier 1	1010	+	390	=	1400
Carrier 2	980	+	420	=	1400
Carrier 3	951	+	449	=	1400
Carrier 4	951	+	449	=	1400
Carrier 5	951	+	449	=	1400
Carrier 6	927	+	473	=	1400
Carrier 7	917	+	483	=	1400
Carrier 8	914	+	486	=	1400
Carrier 9	891	+	509	=	1400
Carrier 10	790	+	610	=	1400

Source: Gemini / Seabury Maritime Analysis

Lack of standardization of methodology could lead to fuel surcharges becoming a competitive factor in liner shipping pricing.

This basic difference in bunker formulas has the potential to create significant disparity in all-in pricing over time, depending on the sensitivity and rate of change of fuel surcharges based on input commodity prices. In the above example, even assuming a constant percentage increase across all carriers would lead to a 3 percent difference in all in rates based on 20 percent increase in fuel surcharges. In a modeled example using this data, and assuming carriers have a deviation of sensitivity of 10 percent, we noted that all-in rates could vary by up to 12 percent across the carriers, assuming a constant fuel-cost price. This potentially leads to the risk for all parties that a carrier's rate attractiveness might be determined not on its quoted price but by the rate of change of its fuel surcharge formula. This lack of clarity is diametrically opposed to the initial carrier goal of introducing floating fuel surcharges. "We know that ocean carriers have announced new BAF formulae and tables ahead of the introduction of the IMO 2020 fuel rule and are telling BCOs that they now are against all-in rates that do not have floating charges. Carriers are keen to ensure that they are compensated fairly for the additional costs caused by this regulation, but they have, so far, failed to provide evidence of the actual vessel fuel consumption on which their BAF formulae are based. Without being transparent, carriers will find it hard to convince shippers to pay up without asking questions," Damas said.

This quest for rate transparency benefits carriers equally with shippers. Carriers have worked tirelessly for the past decade to convince shippers to share the risks of fluctuating fuel costs. Without transparency carriers risk backlash from shippers to accept future floating surcharges. "I don't believe any shipper takes issue with floating fuel surcharges as long as they are transparent and correlate to a measurable change in commodity input prices and the underlying cost basis of voyage economics," Gemini Shippers Groups' Ken O'Brien said. "For carriers, there is no reason not to fully explain these costs to their customers and to ask them to share in that underlying uncertainty."

This lack of standardization also plays a role in confusion on rating of carriers' bills of lading noted by Bill Aldridge, president of Allport Cargo Services. "Lack of BAF standardization will require increased focus and attention by the BCO and their logistics providers to ensure timely, accurate communication and application of these charges. Technology will likely be the key enabler to managing these changes given the fluidity and complexity in this new environment," he said.

The Path Forward: Managing the Fuel Component of trans-Pacific 2019-2020 Contracting Cycle

Seabury Maritime urges carriers to open up their books a bit more ... to help move the issue to a fact-based discussion with detailed fuel or cost data to support it.

As the trans-Pacific contracting period quickly approaches, it is vital that shippers integrate IMO 2020 regulations and BAF into their thinking. While the underlying price of low-sulfur fuel will not be known until next year, shippers can seek further clarity on the components of trade factors in the new formula. "Seabury Maritime agrees with Gemini Shippers Group, that transparency is key to creating trust that the carriers are truly just passing these new costs in an equitable way. Most fuel data may seem like an important trade secret, but more transparency can actually lead to deeper relationships and less pushback from rightfully suspicious customers, while better highlighting carriers' efforts to improved fuel efficiency and lower costs as a result. Lack of clarity can even cause undue blowback to carriers in some cases, simply because of the lack of understanding of the metrics, a self-inflicted wound for carriers. Seabury Maritime can help both shippers and carriers in creating mutual trust by analyzing the data from an independent advisor's vantage point", Nikos Petrakakos, Seabury Maritime's vice president and head of environmental innovation, said.

Shippers should be prepared to share in the risk of changing fuel prices thru the assessment of reasonable and transparent fuel-surcharge calculations. According to Gemini Shippers Group, "Carriers who offer a clear, transparent, and reflective formula should be rewarded with commitments by their customers. If carriers cannot explain or justify their formulas, then shippers should be wary."

Key steps needed

- Request a detailed explanation of how your carriers' trade factors are calculated.
- Be able to validate the assumptions including ship size, speed, and industrial utilization against industry benchmarks.
- Understand the timing for your carriers' implementation of the new fuel formula. Will it go into effect in January 2020 or sooner?
- Understand the impact for each carriers' all-in rate (ocean plus bunker) based on future changes in the fuel price, both up and down.
- Ensure contracts address failure to come to agreement on how future

fuel surcharges will be dealt with as well as protections in place for space commitments and price from time of implementation until the end of contract.

- Be prepared to offer your own fuel formula to carriers where there is a lack of clarity.
- Ensure your own formula is fair for both sides.
- Engage industry experts where needed to provide analytical support for validation and negotiation.
- Reward carriers that offer clarity and transparency with commitments for cargo.

Conclusion

All parties benefit when there is a clear understanding of the underlying costs for carriers to provide their services to shippers. Shippers rely on carriers to maintain the integrity of their transportation network to move their good to market. Both parties share in the risk of the movement of underlying commodity prices. A transparent method to calculate fuel surcharges and the impact of low-sulfur fuel is imperative to securing the financial health of carriers and shippers supply chains.

A transparent method to calculate fuel surcharges and the impact of low-sulfur fuel is imperative to securing the financial health of carriers and shippers supply chains.

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Gemini Shippers Group is a Shippers Association changing the way companies procure transportation. As a not-for-profit organization, Gemini has become a leading logistics player by serving its members for nearly 100 years. Gemini offers members access to competitive global ocean freight contracts, long term rates, and space allocation with a wide variety of top tier ocean carriers by utilizing collective bargaining power and complete cost transparency. Gemini goes beyond the role of a typical shippers association and aims to streamline the process between quote request and shipment arrival by providing members with rate search, tracking & tracing, rate audit, and data analytics tools. Our mission is to aid companies, regardless of size and experience, in navigating the complex environment of transportation procurement. Our team of transportation and supply chain executives is focused on providing our members with neutral competitive intelligence built on delivering measurable service and cost improvement.

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Seabury Maritime is a leader in the Maritime Environmental and Fuel Efficiency field, offering a commercial perspective as related to IMO 2020, GHG Emissions, and beyond. Our team navigates customers through the impact that environmental regulations and associated risks can have on their business, while helping them take advantage of the commercial opportunities that these changes offer. Since its founding in 1995, Seabury Capital has taken ownership stakes in software and asset management businesses servicing the aviation and travel industries. Within the last few years, Seabury Capital has expanded its portfolio by investing in early stage startup companies within the financial technology industry and structured investment products. In addition, Seabury Capital owns and operates FINRA and FCA regulated investment banking services firms in the U.S. and U.K., respectively, serving external clients as well as assisting the companies in which Seabury Capital has invested. Seabury Capital has operations in New York, Amsterdam, Berlin, Chicago, Cordoba, Dallas, Dublin, Durban, Edison (NJ), Hong Kong, Houston, Jersey City, London, Los Angeles, Manila, Minneapolis, Singapore, Summit (NJ), Stamford (CT), and Tokyo. www.seaburycapital.com

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