

Fuels Institute

# Literature Review Summary



# IMO 2020

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**APRIL 2019**

INTERNATIONAL MARITIME ORGANIZATION'S  
2020 SULFUR REDUCTION RULE

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## ABOUT THE LITERATURE REVIEW SUMMARY

This literature review is not a peer reviewed Fuels Institute report, but rather, a summary of third party analyses of a market issue. For this summary, the Fuels Institute reviewed more than 30 reports, blogs, columns, presentations, email updates and other literature covering the projected impacts of IMO 2020. The reviewed material was identified through independent searches and recommendations from members of the Fuels Institute’s Board of Advisors. While the sources used for this review were informed by the Board, the ultimate report was not subject to the same rigorous peer review as is original work published by the Institute. A bibliography of resources is provided at the end of this paper. The following summarizes the content of these resources.

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Disclaimer: Due to the fact that terminology and methodologies used in the reports varied greatly (or were not well described), this summary does not contain specific numbers or details. However, it should provide readers with an overall sense of what is being written with respect to IMO 2020 and the commonalities and trends that exist in the literature. It is important to remember that none of the statements presented below are purported to be true or accurate. Furthermore, none of the statements made below are those of the Fuels Institute. The content is presented as a summary and overview of the literature reviewed.

# Introduction

## International Maritime Organization’s 2020 Sulfur Reduction Rule

**Come January 1, 2020, the maximum allowable sulfur content of marine fuel will be reduced to 0.5% mass/mass, and the industry is watching for impacts to the global shipping industry, marine fuel market and other refined petroleum products.**

In 2012, the International Maritime Organization (IMO) lowered the maximum sulfur content in marine fuels to 3.5% mass/mass (equivalent to 35,000 parts per million) with the intent to get it down to 0.5% mass/mass (5,000 ppm) between 2020 and 2025, dependent on an assessment of whether sufficient compliant fuel oil would be available to meet the 2020 date. (For comparison, ultra low sulfur diesel (ULSD) has a sulfur limit of 15 ppm). In 2016, a review conducted by CE Delft concluded that sufficient compliant fuel oil would be available to meet the requirements and that failing to lower the sulfur limit by 2020 would contribute to more than 570,000 additional premature deaths by 2025. Thus, the IMO 2020 (“Rule”) was born.

The Rule, which goes into effect January 1, 2020, requires all marine vessels operating outside of Emission Control Areas (“ECAs”) to consume fuels with a maximum sulfur content of 0.5%.

Those ships operating within ECAs are already required to use fuel with a maximum sulfur content of 0.1% mass/mass. (ECAs are designated under MARPOL Annex VI, which defines certain sea areas as “special areas” that require a higher level of protection from and prevention of sea pollution due to their oceanographical and ecological condition as well as their sea traffic. Within these areas, there are stricter regulations of NOx, SOx and particulate matter (PM) as well as stricter regulations of sulfur than exist for the rest of the world. (Currently, there are 4 ECAs: the Baltic Sea area, North Sea area, North America area, and the United States Caribbean Sea area).

**Market options for accommodating the Rule include:**

- 1. use compliant low sulfur fuel
- 2. do not comply with the Rule and continue using high sulfur fuel
- 3. install onboard scrubbers to reduce sulfur emissions and continue using high sulfur fuel
- 4. use alternate fuels like liquified natural gas (“LNG”).

The current composition of marine fuel is typically a mix of residual fuel oil (also known as “bunker fuel”) and high sulfur distillate (usually diesel). While there is no consensus on the exact ratio of residual fuel oil to diesel, marine fuel is composed of more than 50% residual fuel oil and less than 50% diesel. The reason diesel is blended in to high sulfur fuel oil is to make the fuel flow easier and burn faster. The current average sulfur content of marine fuel is 2.2% mass/mass, meaning vessels will have to reduce the sulfur in their fuel by 77% in order to comply with the Rule, assuming they seek compliance through the use of lower sulfur fuel rather than installation of scrubbers.

Reports of current global demand for marine fuel oil vary greatly and range from 3.2 million barrels per day (“mbd”) to 8 mbd. Depending on the demand of fuel oil that is reported, switch volumes also vary by report – the switch volume is the amount of high sulfur fuel that will need to be replaced with low sulfur fuel in order to comply with the Rule. Most reports agree that to achieve 100% compliance with the Rule, the market would need an estimated switch volume of about 3-4 mbd.

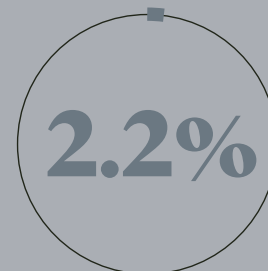
SULFUR CONTENT IN FUEL AND RECENT REGULATIONS:



MAX SULFUR CONTENT

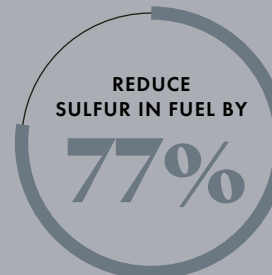
<b>IMO 2012 Rule</b>	<b>3.5% MASS/MASS   35,000 PPM</b>
<b>IMO 2020 Rule</b>	<b>0.5% MASS/MASS   5,000 PPM</b>
<b>Ultra Low Sulfur Diesel ULSD</b>	<b>0.0015% MASS/MASS   15 PPM</b>

CURRENTLY

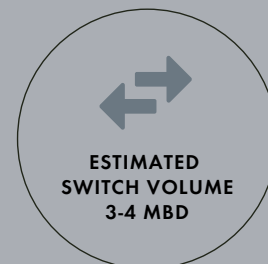


Current average sulfur content in marine fuel oil **2.2% mass/mass** 22,000 PPM

VESSEL COMPLIANCE

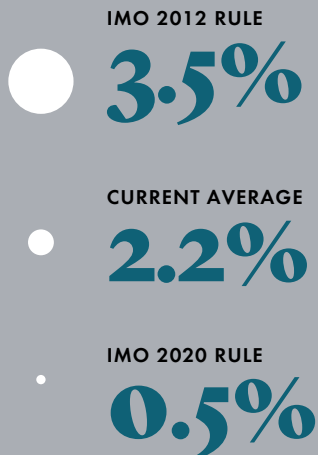


In order to comply, **vessels will have to reduce the sulfur in their fuel by 77%**, assuming they seek compliance through the use of lower sulfur fuel rather than installation of scrubbers.



Most reports agree that to achieve 100% compliance with the Rule, the market would need an estimated **switch volume of about 3-4 mbd**.

MARINE FUEL SULFUR CONTENT BY MASS/MASS





### IMO 2020 OUTLOOK

As mentioned above, the IMO relied upon the CE Delft study when setting the IMO 2020 Rule. The CE Delft study analyzed whether there would be a sufficient amount of compliant low sulfur fuels available by 2020. To accomplish this, the study projected high and low sulfur fuel demand in three different scenarios that varied in terms of projected transport growth, fleet renewal and LNG/scrubber uptake through 2020. The scenarios were the following:

- **Base Case – transport growth, fleet renewal, LNG/scrubber uptake all in line with (then) current projections; 3,800 ships projected to have scrubbers by 2020.**
- **High Case – high transport growth rate, high fleet renewal rate, and low scrubber uptake compared with Base Case; 1,200 ships projected to have scrubbers by 2020.**
- **Low Case – low transport growth rate, low fleet renewal rate, and high scrubber uptake; 4,100 ships projected to have scrubbers by 2020.**

Projected demand of high and low sulfur fuel was then compared to a refinery supply model, which

included expected expansions and closures by 2020. The analysis found that in all three scenarios (base, high, and low cases), it would be possible and economically viable to produce enough low sulfur marine fuels while simultaneously satisfying demand from other sectors by 2020.

To ensure its analysis was done conservatively, the authors limited capacity utilization in its refinery model to 90% of stream day capacity. They also used conservative efforts of sulfur removal rates and set sulfur contents of marine fuels 10% lower than required. CE Delft based its findings on expected growth of complex refinery capacity to meet the expected fuel demand: (1) they expected crude distillation units would grow in capacity, thereby producing larger quantities of fuel oil; (2) hydrocracking would expand, increasing the potential supply of low sulfur gas oil that could be blended with heavy fuel oil to lower overall sulfur content in the finished fuel; and (3) hydroprocessing units would increase, helping to lower sulfur content in middle distillates and heavy fuel oil, and contributing to the overall pool of low sulfur fuel.

There are many dissenting and contrasting views about CE Delft’s findings that refinery capacity will

be able to meet low and high sulfur fuel demand come 2020. Those with differing opinions or findings point out factors like:

- Adding secondary processing units (i.e. upgrading refining capacity) typically takes four to five years to build;
- Producing low sulfur fuel blends by desulfurizing fuel oil would be difficult and costly;
- CE Delft’s base case projected 3,800 scrubbers would be installed by 2020, but as of June 2018, only 600 (approximately) had been installed.
- A 10% increase in global refining capacity would result in only 2.6 mbd of distillates, while many reports indicate that 3-4 mbd will be required.

When considering whether demand will be met, understanding refining operations and capacity is key. There are three main types of refineries, defined by their ability to convert residual materials (such as heavy fuel oil) into lighter products (such as diesel). The three types of refineries are:

- **Topping refineries** – these refineries are the least complex; they typically produce a lot of residual fuel oil since they do not have the capacity to break it down into lighter products.

- **Cracking refineries** – these refineries are moderately complex; they typically utilize catalytic cracking or hydrocracking to produce lighter products.
- **Full conversion refineries** – these refineries are the most complex; they produce only a small amount of residual material, as they are able to break down most heavy products into lighter ones; some are even able to switch between diesel and gasoline, depending on demand and product margins.

Most reports agree there are moderate to low cost options for upgrading refining capacity, including: switching to sweet crudes (which have a lower sulfur content than sour crudes), revamping existing hydrocrackers, adding distillation units, and adding secondary processing units. Reports also agree that the price incentives to implement these upgrades will exist. One report stated that low cost refining solutions should create 1.35 mbd of compliant low sulfur fuel oil, leaving only an additional .8 mbd of distillate/blended marine fuel needed to meet projected demand. However, this would be a total of 2.15 mbd in contrast to many other reports indicating projected switch volume demand is more like 3-4 mbd of low sulfur fuel.



**Overall, estimates of price impacts to gasoline and diesel range from about 25 cents to 75 cents. However, most reports agree that the impact will be limited to a 2 to 3 year window.**



Complex refineries are deemed “winners” of IMO 2020 due to their high production of clean products and ability to crack cheaper heavier crude, which will only become cheaper as markets respond to demand changes. U.S. refineries are among the most sophisticated in the world, leading some to believe the Rule will put American fuel in high demand and that the U.S. will become a major supplier of low sulfur marine fuel globally. Some have even questioned whether exports will increase so much that there will be less low sulfur fuel available for U.S. consumption.

In contrast, topping refineries are deemed “losers” of IMO 2020, as they produce the most volume of high sulfur residual products. These refineries will have to find new outlets for the high sulfur fuel oil they produce or switch to sweet crudes, which are naturally lower in sulfur. European refiners stand to be at a disadvantage come 2020 because they have one third of the heavy oil upgrading capacity that America does and produce about four times more residual fuel.

Cracking refineries will also be affected, as the majority of current marine fuel comes from cracking refineries that process sour crudes. These refineries will have to come up with a plan for alternate disposition of their residual materials or switch their product yield. Many are optimistic cracking refineries will “win” in the end since they have more options than topping refineries to produce other products.

### IMPACT OF IMO 2020 ON FUEL SUPPLY AND PRICE

Reports adamantly agree that IMO 2020 will result in a global impact on crude and petroleum product prices. Sweet crudes, like American West Texas Intermediate and European Brent will benefit from rising prices while sour crudes, like those from Mexico, Venezuela and Canada will be adversely affected by falling prices. In turn, market prices for low sulfur marine fuel oil will increase while prices for high sulfur fuel oil will fall. High sulfur fuel oil may even fall toward parity with coal, incentivizing its use in power plants. Overall, estimates of price impacts to gasoline and diesel range from about 25 cents to 75 cents. One report stated diesel prices could rise 20-30% by 2020; another report suggested crude prices could rise as much as 50%. However, most reports agree that the impact will be limited to a 2 to 3 year window.



## FUEL INDUSTRY IMPACT

### ESTIMATED PRICE IMPACTS VARY



Estimates of price impacts to gasoline and diesel range from about 25 cents to 75 cents.



One report stated diesel prices could rise 20-30% by 2020



Another report suggested crude prices could rise as much as 50%



Impact will be limited to a 2 to 3 year window.

### LIKELY IMPACT ON SUPPLY



**SWEET CRUDES** will benefit from rising prices (American West Texas Intermediate, European Brent, etc)



**SOUR CRUDES** will be adversely affected by falling prices (Mexico, Venezuela and Canada)



Market prices for **LOW SULFUR MARINE FUEL OIL** will increase



Prices for **HIGH SULFUR FUEL OIL** will fall. High sulfur fuel oil may even fall toward **PARITY WITH COAL**, incentivizing its use in power plants

Price differentials will fall over time due to several factors, including: conversion facilities and refining capacity buildouts, improvements in scrubber technology, slow steaming, and increased use of LNG. In the shorter term, there should be more clarity on fuel pricing in late 2020 as compliant fuel blends become more common. A balance in the global fuel markets will be achievable due to the redirection of crude flows, which will help reduce the amount of higher refinery runs and yield shifts needed as well as ongoing refinery capacity additions.

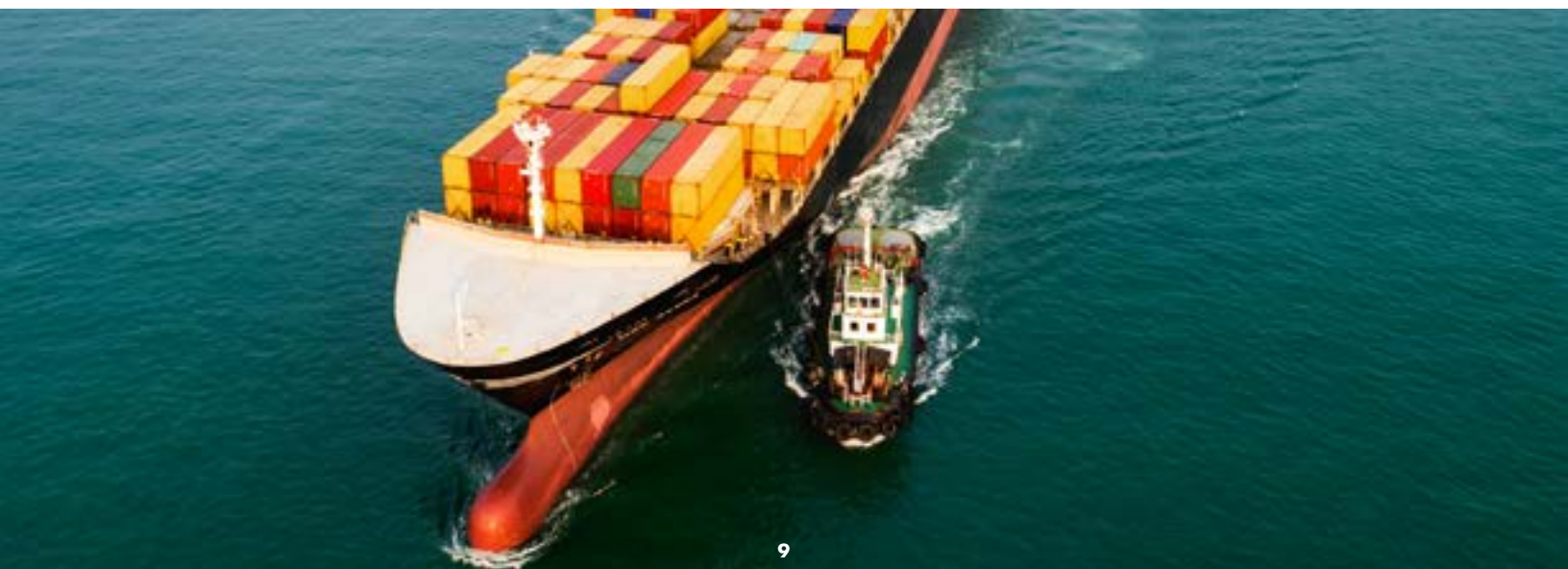
There are many sensational reports indicating IMO 2020 will be the most disruptive event to ever happen in the oil industry. Headlines such as, “[o]ne of the most disruptive changes to ever affect the refining and shipping industries – global impacts totaling in excess of \$1 trillion over 5 years” and “[c]onsumers could be hit by \$240 billion by 2020” have no doubt grabbed the industry’s attention. Yet, it is important to point out that most of these reports take into account more than just the price of oil or fuel when making such statements. For example, other impacts discussed include those on shipping and freight costs, the costs of capital goods (such as iron ore and aluminum), aluminum production costs (due to the increase in anode coke prices), revenue under threat for heavy sour crude producers, revenue opportunity for scrubber manufacturers, impact on hydrogen demand (since hydrogen is

used in hydrocracking to produce distillate fuel oil), the reduction in cost for road builders and miners, etc. Because these factors are so inter-related, it is possible that the impact on certain elements are accounted for more than once, helping to lead to the extraordinarily high cost estimates associated with the Rule’s overall impact.

### ALTERNATIVE STRATEGIES

Nonetheless, there is no doubt that IMO 2020 will cause an impact in the oil and petroleum products markets, particularly if 100% compliance is met. There are some reports, however, questioning the role non-compliance could have on the Rule’s impact. IMO states it will require ships using fuel oil to obtain a bunker delivery note stating the sulfur content of their fuel. They also state samples may be taken and sanctions may be issued for non-compliance. However, there is no “IMO police” – enforcement is left to state governments and is suspected to be sparse at best. One report stated cheating could account for up to 10% of total fuel consumption, but most reports state non-compliance will have a limited impact on bunker fuel demand because of the reputational risk of getting caught.

In a recent Fuels Institute contributor-only webinar given by Beth Brown of S&P Global Platts, she



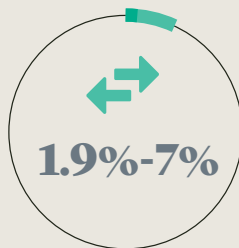
ALTERNATIVE STRATEGIES

SCRUBBERS



Reports estimate that the **number of scrubbers by 2020** will be anywhere from 3% to 15% of marine vessels.

LNG



Current estimates of **switch volumes from high sulfur fuel to LNG** in 2020 are anywhere between 1.9% and 7%.

SLOW STEAM



**10% reduction in speed drops fuel consumption by 25%**; and reducing speed by a few knots can reduce fuel consumption between 25% and 50%.

suggested that reports of high rates of non-compliance are actually misleading because a very small percentage of shipping companies make up a very large percentage of the existing fleet. Consequently, even if a lot of the smaller companies or independent vessels choose not to comply, it would only take a couple of the larger companies complying to make non-compliance of the others moot. Larger shippers who feel the most pressure to comply will strongly advocate for a robust enforcement mechanism in order to keep a level playing field and enforcement may improve later in 2020.

Scrubbers are universally mentioned in reports on IMO 2020. Aside from changing fuel specifications, shippers may comply with the Rule by installing scrubbers, which would allow them to continue using high sulfur fuel. Reports state that scrubbers are similar to mini refineries and take about 4 to 6 months to install and can cost upward of \$5 to \$10 million, not to mention the lost profits during the ship's down time for installation. There is a payback period after a few years, but the economics are daunting, particularly now when the price incentives associated with fuel costs are not quite clear and have not been realized yet. Due to their long installation time and cost, scrubbers are more practical for newbuilds. One report stated that as of June 29, 2018, only 591 ships had scrubbers on board. At least one report is optimistic that installation will ramp up now that new scrubber

manufacturers have come to market and many reports believe installation will ramp up come 2020 and beyond. However, there is some concern over the long-term viability of scrubbers given the potential for stricter NOx and GHG regulations for marine vessels in the future.

**Reports estimate that the number of scrubbers by 2020 will be anywhere from 3% to 15% of marine vessels.**

The use of alternative fuel, like LNG, is also being discussed but LNG ships are very expensive and have a long lead time. In addition, some have raised the point that the LNG infrastructure currently is insufficient to meet potential demand. Most agree LNG will have a negligible effect on the Rule's impact come 2020 but may be more impactful in 2025 and beyond. Current estimates of switch volumes from high sulfur fuel to LNG in 2020 are anywhere between 1.9% and 7%.

Another compliance option is slow steaming. Many reports indicate slow steaming will be an attractive option to offset higher fuel costs. One report stated that a 10% reduction in speed drops fuel consumption by 25%; another report stated that reducing speed by a few knots can reduce fuel consumption from anywhere between 25% and 50%.



# Summary

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**In the words of a recent Global Sachs report, the consensus is that IMO 2020 is “challenging but solvable.” Yes, there will be some shuffling around both in refining operations and in global fuel disbursement, but the capacity to meet demand exists.**

When reviewing IMO 2020 reports, it is important to consider the source. Many of the reports stating the impacts will be the greatest tended to be either opinion/blog type pieces or financial outlooks. For the opinion/blog type pieces, it is nearly impossible to know the author’s background or depth of knowledge, and the “shock wave” headlines written by investment banking institutions took into account every single monetary opportunity and threat posed by the Rule – so they were not strictly reporting about the projected impact on crude or diesel

prices. Many of the reports stating the impacts will be substantial but manageable tended to be written by consultants, but they too have a vested interest in their reporting – perhaps in catering toward those that stand to benefit by the Rule.

Despite the diversity of authors of the literature subject to this review, the consensus out there is that there will be “winners” and “losers” of IMO 2020. Those that produce low sulfur crudes and complex refineries producing low sulfur fuel stand to benefit from the Rule while those that produce high sulfur crudes and less complex refineries that produce less or no low sulfur fuel will be disadvantaged by the Rule. Impacts will be felt worldwide, but most believe the impacts will be temporary and not as extreme as some headlines have suggested. Most agree IMO 2020 is not akin to the 2008 crude price spike and that markets will rebalance (both in product flow and price) within a couple of years at most.

# Sources

1. Ralph Grimmer, James Ahrens, & Leigh Noda, “IMO 2020 Rule: Refiners’ Perspective.” *Stillwater Associates* (March 26, 2018).
2. Alan Apthorp, “IMO 2020 – What It Means for Fuel.” *Mansfield Energy Corp* (August 1, 2018).
3. R. Dean Foreman, Ph.D., “IMO 2020: Presentation to the Diesel Technology Forum.” *API* (July 18, 2018).
4. Jan Othman & Sigurd Jenssen, “In Depth: Interview: Scrubbers Winning Owners’ Hearts ahead of 2020 Sulphur Cap.” *World Maritime News* (July 25, 2018).
5. Aspen Tech, Patrick Garrett, “Asset Optimization Before, During and After the Coming Low-Sulfur Regulations.” *Aspen Tech* (July 12, 2018).
6. Shell Global, “Key Steps for Refiners Ahead of IMO 2020.” <https://www.shell.com/business-customers/global-solutions/industry-focus/key-steps-for-refiners.html>
7. Colin Birch, Hedi Grati, Kurt Barrow et al., “Refining and Shipping Industries Will Scramble to Meet the 2020 IMO Bunker Fuel Rules.” *IHS Markit* (August 4, 2017).
8. Jack Jordan, “Fuel oil forward curve not fully pricing in 2020 IMO impact: Platts Analytics.” *S&P Global Platts* (April 12, 2018).
9. Mary Hogan, “Expected IMO 2020 sulfur cap could shift demand to domestic sweet grades.” *S&P Global Platts*, (February 27, 2018).
10. Nick Cunningham “How Changes in Maritime Fuels Markets Will Affect Demand, The Oil Industry.” *The Fuse* (April 18, 2018).
11. Martin Tallett, “Marine Fuels MARPOL Annex VI 2020: Impacts on US and Canadian Crudes, Refining and Markets.” *EnSys Energy & Navigistics Consulting Presentation* (February 22, 2018).
12. Gary Devenish, “Q2 2018: Refining Margins Continue Steady Move Upward; Special Topic: IMO2020 – Part 2, Can European Refiners Navigate the Marine Storm?” *Baker & O’Brien Inc.* (August 1, 2018).
13. Edgar Ang, “IMO 2020 Mandate May Lead to \$200-\$400 Billion Negative Impact on Consumers [eang@opis.net](mailto:eang@opis.net) (July 27, 2018)
14. “Assessment of Fuel Oil Availability: Final Report” *CE Delft, Stratas Advisors, et. al.*, (prepared for IMO July 2016).

15. “Assessment of Fuel Oil Availability: Final Report.” *CE Delft, Stratas Advisors, et. al. Presentation*, (October 3, 2016).
16. “IMO 2020 Update – Channel Checks & FAQ Answers.” *Citigroup* (June 25, 2018).
17. Antoine Halff, “Slow Steaming to 2020: Innovation and Inertia in Marine Transport and Fuels.” *Columbia SIPA: Center on Global Energy Policy* (August 2017).
18. “The 2020 Global Sulphur Limit: Frequently Asked Questions.” [IMO.org http://www.imo.org/en/MediaCentre/HotTopics/GHG/Documents/FAQ\\_2020\\_English.pdf](http://www.imo.org/en/MediaCentre/HotTopics/GHG/Documents/FAQ_2020_English.pdf)
19. “What Does the IMO’s Initial Strategy Mean for Fuels?” *Future Fuel Strategies, Monthly Report to Future Fuels Outlook Members* (May 2018).
20. “Making Waves: The final countdown to IMO 2020; Bunker specification changes will impact shipping, refining and consumers by over \$1 trillion.” *S&P Global Platts* (2018).
21. Nikhil Bhandari, Neil Mehta & Vinit Joshi et al., “The IMO 2020: Global Shipping’s Blue Sky Moment” *Goldman Sachs Equity Research* (May 30, 2018).
22. Nikhil Bhandari, Neil Mehta & Vinit Joshi et al., “The Future of Refining.” *Goldman Sachs Global Energy* (July 24, 2017).
23. Damien Courvalin, Christian Lelong & Justine Fisher et al., “IMO 2020: Challenging but Solvable.” *Goldman Sachs Commodities Research* (September 5, 2018).
24. Jonathan Robins, “Refiners poised to fall short.” *IHS Markit Fairplay* (August 2, 2018).
25. Experience Nduagu, Evar Umeozor & Alpha Sow et al., “An Economic Assessment of the International Maritime Organization Sulphur Regulations on Markets for Canadian Crude Oil.” *CERI: Canadian Energy Research Institute Study No. 175* (July 31, 2018).
26. Philip Verleger, “Limit Sulfur in Shipping Fuel, But Not So Fast: A 2020 deadline would cause oil prices to spike.” *Bloomberg Editorial Column* (April 18, 2018).
27. Tim Fitzgibbon, Alan Martin & Agnieszka Kloskowska, “MARPOL Implications on Refining and Shipping Markets.” *McKinsley & Company Energy Insights* (December 2017).
28. Justin Ziebart, “Which Refiners Win From Strict Fuel Regulations?” [Oilprice.com](http://oilprice.com) (August 26, 2018).
29. Dr. Edmund Hughes, “Understanding IMO Tier III Requirements and Further Emissions Reduction Legislation.” *Marine Environment Division, IMO Presentation* (June 1, 2012).
30. Ralph Grimmer, “IMO 2020: A Sea Change is Coming” *Stillwater Associates Presentation* (April 24, 2018).
31. John Kemp, “Corrected – Column – Maritime Rule Change Stirs Fears of Diesel Shortage.” *Reuters Column* (October 25, 2018).

# About the Fuels Institute

The Fuels Institute, founded by NACS in 2013, is a 501(c)(4) non-profit research-oriented think tank dedicated to evaluating the market issues related to vehicles and the fuels that power them. By bringing together diverse stakeholders of the transportation and fuels markets, the Institute helps to identify opportunities and challenges associated with new technologies and to facilitate industry coordination to help ensure that consumers derive the greatest benefit.

The Fuels Institute commissions and publishes comprehensive, fact-based research projects that address the interests of the affected stakeholders.

Such publications will help to inform both business owners considering long-term investment decisions and policymakers considering legislation and regulations affecting the market. Research is independent and unbiased, designed to answer questions, not advocate a specific outcome. Participants in the Fuels Institute are dedicated to promoting facts and providing decision makers with the most credible information possible, so that the market can deliver the best in vehicle and fueling options to the consumer.

For more about the Fuels Institute, visit [fuelsinstitute.org](https://fuelsinstitute.org)

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## FUELS INSTITUTE STAFF

### JOHN EICHBERGER

Executive Director

[jeichberger@fuelsinstitute.org](mailto:jeichberger@fuelsinstitute.org)

### AMANDA APPELBAUM

Director, Research

[aappelbaum@fuelsinstitute.org](mailto:aappelbaum@fuelsinstitute.org)

### DONOVAN WOODS

Director, Operations

[dwoods@fuelsinstitute.org](mailto:dwoods@fuelsinstitute.org)

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(703) 518-7970  
FUELSINSTITUTE.ORG  
@FUELSINSTITUTE

1600 DUKE STREET  
SUITE 700  
ALEXANDRIA, VA 22314