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Maritime Fuel Regulations

On January 1, 2020, new, more stringent maritime emission regulations are scheduled to take effect for all ocean-going vessels. Implementing major industry regulatory reform can cause uncertainty and market disruption. As a result, investment plans and market supply and demand might be affected, leading to rapid price changes.

The International Maritime Organization

The International Maritime Organization (IMO) is a 171-member United Nations agency that, among other things, sets maritime fuel standards. The U.S. Environmental Protection Agency (EPA) participates on the U.S. delegation to the IMO. The Maritime Environment Protection Committee (MEPC) is a group of member nations within the IMO that is responsible for the prevention of maritime pollution. Maritime pollution standards are promulgated in the International Convention on the Prevention of Pollution from Ships, a treaty designated "MARPOL." Specifically, Annex VI of the treaty defines air pollution requirements for engines and vessels.

Air pollution standards under MARPOL were first adopted in 1997 and became enforceable in 2005. Those standards specified maximum allowable sulfur concentrations in maritime fuels and maximum nitrogen oxide emissions from engine exhaust. Annex VI of MARPOL was amended in 2008 to set tighter international sulfur standards. Additionally, at that time, the United States, Canada, and France requested the IMO to designate a North American Emission Control Area (ECA) of 200 nautical miles from the coasts of the United States, including Alaska and Hawaii, and large portions of Canadian coastal waters, as well as the French Islands of Saint Pierre and Miquelon. Later the United States petitioned the IMO for a similar ECA for the U.S. territories in the Caribbean including Puerto Rico and the U.S. Virgin Islands. The North American ECA was designated in 2010, and became enforceable in 2012. Designation as an ECA allows the relevant countries to specify tighter emission specifications on vessels operating in the ECA.

IMO international pollution standards apply to both U.S. and foreign vessels. In addition, the North American ECA maritime pollution standards apply to all vessels that enter the ECA, including U.S. as well as foreign flag vessels. In addition, U.S. vessels must also meet EPA fuel standards and engine emission standards as specified in the Clean Air Act.

Fuel Standards

International marine fuel sulfur standards, pre-2012, were set at 4.5% (mass-on-mass). The 2008 revisions of Annex VI of MARPOL, which became effective in 2012, lowered the international sulfur standard to 3.5%. The 2008 amendments also specified that on January 1, 2020, the international marine fuel sulfur standard would fall to 0.5%. However, the 2020 implementation date was contingent on an IMO review to ascertain whether sufficient supplies of low sulfur fuel would likely be available by the implementation date. The review determined that fuel supplies could be expected to be available, and in October 2016 the IMO decided to proceed with the January 1, 2020, implementation date. Other studies forecast significant fuel shortages at the implementation date.

The sulfur fuel standards for U.S. ships, as well as all ships operating in the North American and U.S. Caribbean ECAs, have been, and are, stricter than the international standards. Pre-2010, the standard was 1.5%, while from July 2010 through July 2015 the standard was 1.0%. In 2015, the allowable sulfur standard was reduced to 0.1%. As a result of the low sulfur content allowable for U.S. vessels, as well as all those entering the ECA, none of the new international standards, or their revisions, have affected those vessels directly.

Adjusting to the 2020 Standards

Fuel for marine vessels is referred to as bunker fuel. Bunker fuel is produced at oil refineries around the world. The refining process at those refineries, in brief, consists of heating a blend of crude oils. The lighter products, gasoline, diesel, and jet fuels, are boiled off and recovered. The remaining, heavier fractions, which also retain most of the impurities, including sulfur, are called vacuum tower bottoms (VTBs). These VTBs can be further processed into bunker fuel which varies in sulfur content depending on the sulfur content of the blend of crude oils entering the refining process. Alternatively, the VTBs can be processed in a coker unit to yield a blend of lighter products and petcoke. Whether the VTBs are processed into bunker fuel or are further processed in a coker unit depends on the economic value of the resultant mix of products.

Vessel operators have three main alternatives available to meet the 2020 international maritime sulfur limits. Operators can choose to purchase low sulfur fuels, install remedial devices like scrubbers, which remove pollutants from the ship's exhaust, or use non-oil based fuels, like liquefied natural gas (LNG). Each alternative offers a different set of potential costs to operators, although each can reduce sulfur emissions to the same extent, providing the same improvements in air quality.

Low sulfur bunker fuel can be provided to the shipping industry either by investing in facilities at refineries that further process VTBs to lower the sulfur content, or mixing higher value distillates (diesel, gasoil, or home heating fuel) to lower the mass-on-mass sulfur content. In either case, the cost of bunker fuel is likely to rise. The Energy Information

Administration (EIA) provided an example to suggest the possible magnitude of the cost increase associated with low sulfur bunker fuels. The EIA examined the relative cost of low-sulfur gasoil (a distillate with 0.1% sulfur content) and high-sulfur residual fuel (3.5% maximum sulfur content) at the Amsterdam-Rotterdam-Antwerp trading and refining hub in 2016. The EIA found that low-sulfur gasoil was persistently priced over $20 per barrel more than the high-sulfur residual. If the two fuels were mixed to meet the 2020 international sulfur standards, the cost increase for the resulting compliant fuel would reflect the proportions of the two mixed fuels.

Meeting the 2020 sulfur standards through the use of scrubbers is an alternative that offers the possibility of more fuel choice flexibility to vessel operators. Four main types of scrubbers are available. Seawater scrubbers (open loop) use untreated seawater that possesses a natural alkalinity to neutralize the sulfur in the vessel's exhaust gas. Seawater is drawn from, and replaced to, the ocean. Freshwater scrubbers (closed loop) use caustic sodas mixed with water. The circulating water is re-processed for further use. The closed loop system uses about one-half the water, by flow volume, of the open loop system. Hybrid scrubbers allow for either open or closed loop operation. Open loop operation is typically used when the vessel is in the open ocean, while closed loop operation is typically used in harbors or other areas where discharge is prohibited. Dry scrubbers use no liquids, but clean exhaust gases by passing them through hydrated lime-treated granulates. This system produces no discharges from the vessel and the process produces a residual which can be used in the production of wallboard.

As a result of the small number of installed marine scrubbers in operation, detailed cost studies are not available. However, it is likely that retrofits will be more expensive than new systems and closed systems are more expensive than open systems.

Vessel operators, especially if their vessels are relatively new, might convert them to use LNG. Also, newly constructed vessels might utilize LNG or biodiesel dedicated propulsion.

The results of a survey concerning ship owner's intentions for meeting the 2020 sulfur requirements indicated that 74% intend to purchase low-sulfur fuel, 19% intend to purchase a scrubber, 5% intend to switch fuels to LNG, while 2% had other, unspecified plans. These survey results are likely to be provisional in that the precise relative costs of meeting the sulfur standards are not known.

Affected Industries

While global marine fuel demand is only about 4% of total world oil demand at 3.9 million barrels per day in 2018, it is expected that important effects may exist for many sectors of the oil and petroleum products industry, as well as other industries.

Because of the expected shift in relative prices, with high sulfur product prices falling and low sulfur products rising, it is likely that simple refineries that specialize in producing high-sulfur fuels will experience lower profitability, while complex refineries that can produce larger product streams of low-sulfur products may experience higher profits. Capital investment in the refining sector is likely to increase to allow refiners to maximize their returns to reflect the evolving relative prices of high and low-sulfur petroleum products.

Crude oil prices, which reflect sulfur content, are likely to adjust in favor of low sulfur grades while penalizing high-sulfur grades, making the heavy, high-sulfur crude oils produced by Venezuela and Canada, for example, less profitable in the face of declining demand. However, the light, low-sulfur crude oil grades produced in the Bakken fields of North Dakota and the Eagle Ford and Permian fields in Texas may become more profitable as their demand increases. Some pessimistic observers see the IMO regulations, in conjunction with other factors, affecting the oil market in 2020 resulting in a price of $200 per barrel for crude oil and $6 to $10 per gallon for gasoline.

Costs to the shipping industry are likely to rise, but the magnitude of the increases might vary widely. The cost results depend on what the size of the price premium for low-sulfur fuel over heavy-sulfur fuel settles at and whether fuel access is unconstrained, or whether fuel shortages develop. Published annual cost estimates range from $5.8 billion to $52.6 billion, depending on the chosen values for cost variables. Neither of these estimates include the cost of scrubbers; they only reflect the cost increases for those vessel operators that choose to use low-sulfur fuels. Increased shipping costs are likely to be passed through as higher shipping rates that are likely to affect consumer prices for all goods shipped by sea.

A wide variety of non-oil sector industries might also be affected by the shifting product mixes of refiners that face differing economic incentives for high and low-sulfur petroleum products and alter their product slates in response.

On-road transportation costs are likely to rise due to the IMO regulations, with diesel fuel prices increasing. Again, land shipping cost increases are likely to occur which will be passed on to consumers. If refineries, at least initially, respond to the IMO regulations by changing the gasoline and diesel fuel mix in favor of more diesel, gasoline prices may escalate sharply.

Issues for Congress

The IMO regulations for cleaner maritime fuels will go into effect on January 1, 2020. Considerable uncertainty exists as to the availability of the required clean fuels as well as the price effects of the fuel conversion. If diesel, gasoline and maritime fuel prices increase sharply, shipping costs may rise, leading to price increases in many industries.

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