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Coronavirus Reverses Sulfur Expectations

IMO 2020, Tier III, and sweet-sour spreads defy trends.

Morningstar Commodities Research
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Data Sources for This Publication
EIA
CME Group
EPA

Decadeslong Battle

We begin our review of the crude and refining market in 2020 with three examples concerning ongoing efforts to remove sulfur from refined products. Naturally occurring in crude, sulfur is undesirable in finished products since it leads to toxic emissions. Regulators have engaged refiners in a decadeslong battle to remove sulfur from products by tightening specifications. Markets now routinely place a premium on low-sulfur products and discount sulfur-rich heavy sour crudes. This analysis looks at how coronavirus pandemic-induced lockdowns disrupted long-standing market expectations about sulfur prices and penalties for refiners.

IMO 2020

New shipping regulations imposed by the International Maritime Organization from Jan. 1, known as IMO 2020, were expected to dramatically affect refiners worldwide this year. The regulations call for ships to limit toxic emissions by using very-low-sulfur fuel oil or installing exhaust scrubbers to capture emissions from high-sulfur fuel oil. The IMO regulation is the culmination of a series of standards set in motion in October 2008. The new rules threaten to remove up to 3 million barrels/day of high-sulfur fuel oil demand from the market. That makes less sophisticated refiners that can't process fuel oil into more valuable products vulnerable to narrowing margins. Even sophisticated refineries worried they might not make enough compliant fuel to meet shipping demand without risking supplies of the lighter products needed to blend very-low-sulfur fuel oil.

Scrubber Install Payback

Our February analysis (IMO 2020 Scrubber Payout Less Than One Year) showed that soon after the IMO 2020 regulation came into force, compliant low-sulfur fuel prices skyrocketed and heavy sulfur prices tanked, as the market expected. The sulfur spread widened to an average $210/metric ton or $33/barrel for forward deliveries at the Gulf Coast during January, according to CME Group. That wider spread had consequences for shipping companies looking to contain costs under the new regime. Complying with the regulations by using low-sulfur fuel began to look expensive versus investing in scrubber equipment allowing the continued use of high-sulfur fuel oil. We estimated the payback period for investing in scrubbers in early February would be under a year for a very large crude tanker used for an industry typical number of voyage miles, assuming a scrubber investment cost of $2.7 million.

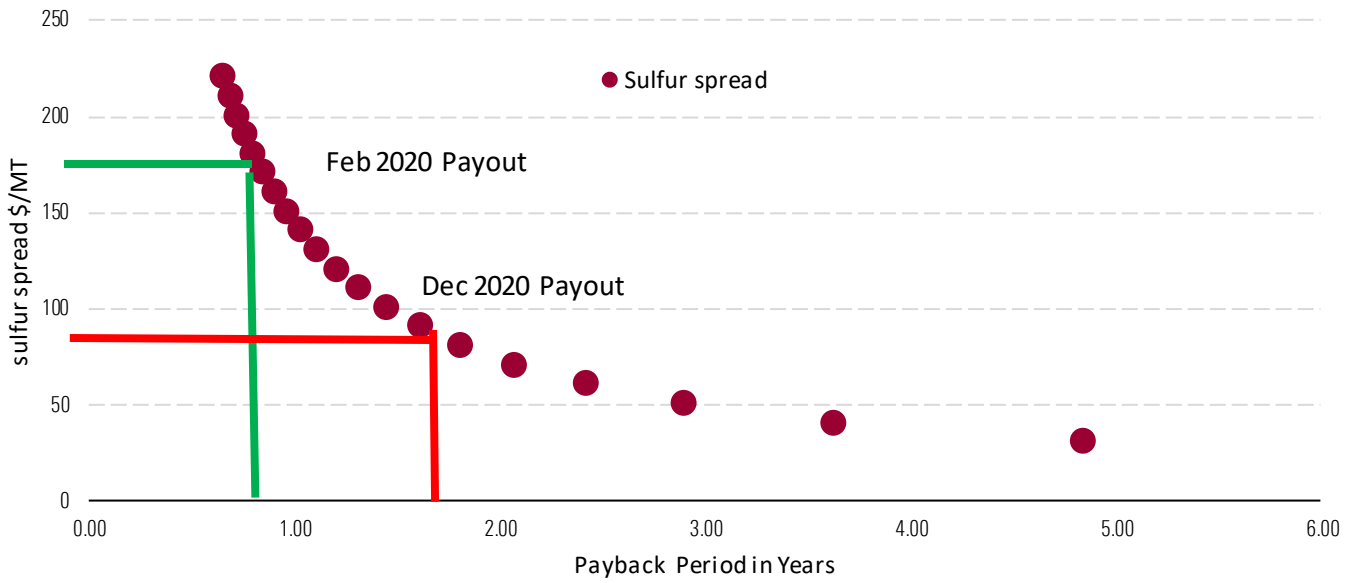
Those calculations were turned on their head after the coronavirus pandemic took hold in March, causing demand destruction for transport fuels such as gasoline, diesel, and jet fuel under widespread lockdowns. As we detailed in an April note (2020 Refining Armageddon!), refining margins were

squeezed by falling crude and product prices in the wake of rampant oversupply. Lower margins and demand dented refinery throughput by an average 14% between January and December versus the same period in 2019, according to weekly data from the Energy Information Administration.

Sulfur Spread Narrows

As a result, IMO 2020 concerns vanished when the sulfur spread narrowed in April and stayed low for the rest of the year. There was little sign of the market disruption and shortages many had expected. That's because lower refinery throughput reduced supplies of residual high-sulfur fuel oil into the market, and an abundance of lighter transport fuels like diesel and jet kerosene were blended with heavier oil to make very-low-sulfur ship fuel. With ample supplies of low-sulfur fuel being blended and less high-sulfur fuel available than expected, the Gulf Coast sulfur spread narrowed from an average $22.90/barrel in February to $9.11/barrel in July and averaged about $14/barrel between Dec. 1 and Dec. 14. That $14/barrel sulfur spread translates to a longer 1.64-year payback period for installing scrubbers on a VLCC tanker, discouraging shippers from making the investment (Exhibit 1).

Exhibit 1 VLCC Scrubber Installation Payback Periods



Source: CME Group, Morningstar.

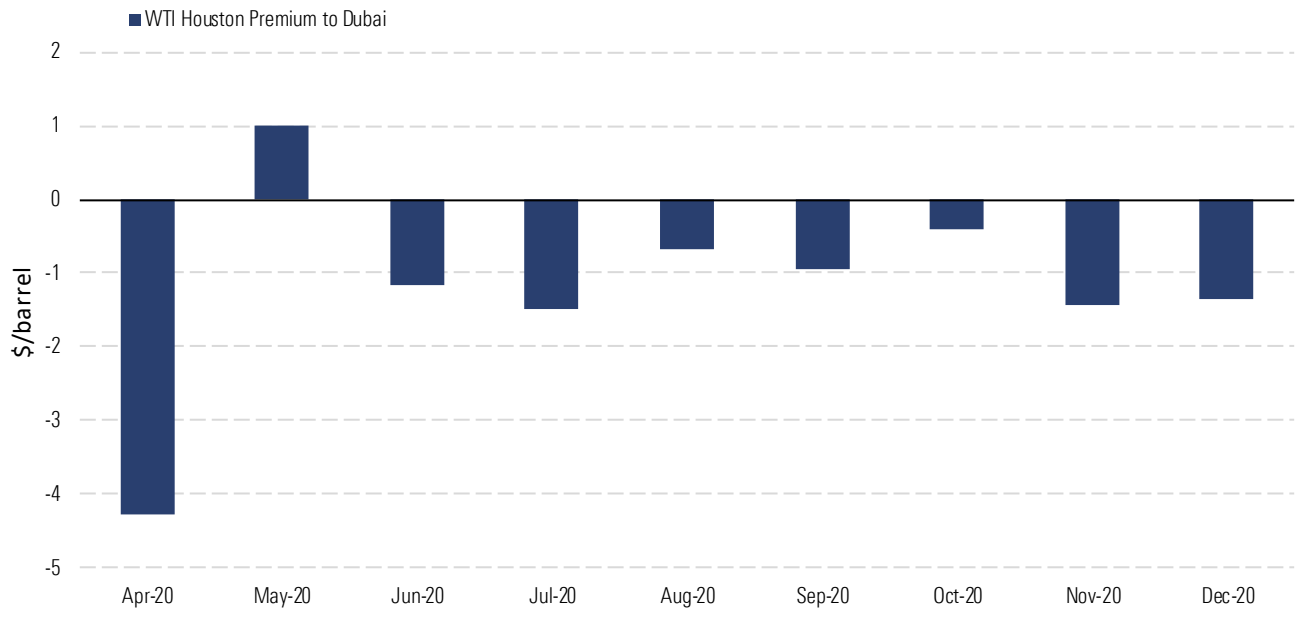
Sweet and Sour

While lower fuel oil sulfur spreads reflected an abundance of very-low-sulfur fuel supplies for shipping, they were also affected by higher prices this year for heavy crudes that contain high-sulfur fuel oil relative to light sweet, low-sulfur grades like U.S. benchmark West Texas Intermediate.

Heavy, high-sulfur crudes normally sell at a discount to light sweet grades because the latter are easier to process and contain more valuable components. This year, that convention reversed as heavy crudes traded at a premium to lighter barrels in the Asia market after the coronavirus triggered an April crude price collapse in the United States. Negative crude prices occurred as a result of a storage squeeze at the Cushing, Oklahoma, delivery point for CME WTI futures contracts (see our April note Crushing Cushing: Wider Impact of Negative Crude). The WTI price collapse was countered in May by a record 9.7 mmb/d production cut by members of the OPEC + producer group, trying to stabilize prices and restore balance to an oversupplied market. Most OPEC+ members produce heavy sour crudes that are favored by Asian refiners. So, when demand began to recover in Asia, a shortage of heavy crudes pushed their price to a premium over lighter grades.

Exhibit 2 shows monthly average premiums since April for WTI delivered to Houston versus Mideast Dubai crude, the benchmark for OPEC heavy crude sales to Asia, based on CME Group pricing. Houston WTI normally trades at a premium to Dubai based on quality, but for eight of the past nine months, it traded at an average discount of $1.19/barrel to the Asian marker. Higher prices for heavy crude in Asia created an arbitrage window for U.S. exports of sour grades such as Mars that's produced offshore in the Gulf of Mexico and even prompted rare exports of Alaska North Slope crude to Asia from the Valdez port in southern Alaska (see our June note Export Prospects Increase As Alaska's Output Drops).

Exhibit 2 WTI Houston Premium (Discount) to Dubai



Source: CME Group, Morningstar.

Tier III Collapse

At the start of this year, refiners faced heavy compliance costs for an Environmental Protection Agency program to reduce sulfur content in gasoline to a maximum 10 parts per million. The regulations—known as Tier III—came into force in 2014 but included waivers and credits giving refiners six years to prepare. In 2020, refiners must either comply by averaging 10 ppm over the year or purchase credits to offset higher sulfur levels. Tier III sulfur credits were changing hands for upward of $3,500 for 1 ppm in December 2019 (see our December 2019 note Tier III Gasoline Compliance Challenges). That worked out to roughly 2.6 cents/gallon for refiners achieving the 2019 annual average sulfur level of 17.5 ppm but needing credits to get to 10 ppm. This year, sulfur credit prices evaporated from a high of $3,075 for 1 ppm in April to $167 for 1 ppm in early December, according to Petroleum Argus price assessments. The collapse in credit prices reduced compliance cost to a minuscule 0.125 cents/gallon in December.

Tier III sulfur credit prices fell after coronavirus-induced lockdowns in March reduced gasoline demand. Total U.S. gasoline consumption fell 12% between Jan. 1 and Dec. 11 compared with the same period in 2019, according to weekly EIA data. That meant refiners didn't need to produce as much gasoline. Available Tier III sulfur credits accrued by compliant refiners in prior years were therefore adequate to meet demand in 2020, defusing the expected hike in compliance and gasoline prices.

Octane Spread

Tier III regulations increase refiners' costs to make premium gasoline because sulfur removal reduces the octane content in blending components. Higher-octane premium gasoline improves performance and efficiency and is increasingly recommended by high-end auto manufacturers to help them meet EPA Corporate Average Fuel Economy standards. Adding octane is expensive and in recent years has driven up the spread between premium and regular gasoline. The annual average discount for regular gasoline versus premium increased from 27 cents/gallon in 2010 to 62 cents/gallon in 2019, according to annual EIA refiner product price data. That spread widened again to 64 cents/gallon between January and September 2020 even as overall gasoline prices fell.

COVID-19 Impact

These examples demonstrate how dramatically COVID-19 has affected refining. A reversal in the expected fuel oil sulfur spread after IMO 2020, unusual premiums for heavy sulfur crudes over lighter grades, and a collapse in sulfur credit prices to meet Tier III gasoline regulations would all have attracted long odds this time last year. Instead, refiners faced urgent challenges from low margins and reduced capacity this year that render 2019's expected hiccups harmless by comparison.

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