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THE THUNDER ROLLS, PART 4 – IMO 2020'S EFFECT ON PRICES FOR CRUDE, REFINED PRODUCTS AND REFINERY RESIDUE

January 2, 2019

The implementation date for IMO 2020, the international rule mandating a shift to low-sulfur marine fuel, is less than 12 months away. It's anyone's guess what the actual prices of Brent, West Texas Intermediate (WTI) and other benchmark crudes will be on January 1, 2020, or how much it will cost to buy IMO 2020-compliant bunker a year from now. What is predictable, though, is that the rapid ramp-up in demand for 0.5%-sulfur marine fuel is likely to affect the price relationships among various grades of crude oil, and among the wide range of refined products and refinery residues — everything from high-sulfur residual fuel oil (HSFO, or resid) to jet fuel. The refinery sector is in for an extended period of wrenching change, and today we conclude our blog series on the new bunker rule with a look at the structural pricing shifts needed to support the availability of low-sulfur marine fuel.

As we said in Part 1, the International Maritime Organization (IMO) — a specialized agency of the United Nations — for a number of years now has been ratcheting down allowable sulfur-oxide emissions from the engines that power the 50,000-plus tankers, dry bulkers, container ships and other commercial vessels plying international waters. IMO 2020, the agency's latest rule, calls for the current 3.5% cap on sulfur content in bunker in most of the world to be reduced to a much stiffer 0.5% on January 1, 2020. [There is an even tougher 0.1%-sulfur limit already in place in the IMO's Emission Control Areas (ECAs), which include Europe's Baltic and North seas and areas within 200 nautical miles of the U.S. and Canadian coasts.] Baker & O'Brien's latest analysis of IMO 2020's impact assumes that current global demand for high-sulfur bunker (HSB; sulfur content of up to 3.5%) is about 3.2 MMb/d, and that by 2020, demand for the new fuel pool consisting of low-sulfur bunker (LSB; 0.5% sulfur or less) and HSB would be 3.4 MMb/d, with the incremental 0.2 MMb/d of demand representing a combination of demand growth and the lower energy density/bbl of the lighter LSB blends. Six primary factors — are seen as bringing the bunker market into something approaching balance over the following year or so: (1) some degree of non-compliance with IMO 2020, (2) on-ship "scrubbers" to capture sulfur-oxide emissions, (3) blending of existing low-sulfur fuel oil with distillate to make rule-compliant marine fuel, (4) refinery upgrades (to produce more low-sulfur products), (5) shifts in crude slates and crude oil flows (ditto), and (6) increased global refining throughputs (double ditto). Part 2 and Part 3 discussed those factors in some detail.

Two key bottom-line findings are that the global shipping industry will need an incremental 2 MMb/d of 0.5%-sulfur bunker come January 1, 2020, and that the worldwide demand for HSB (and the high-sulfur resid used to make it) will plummet. These big demand shifts will have significant effects on the demand for — and relative prices of — various grades of crude oil, lower-sulfur refined products used to make IMO 2020-compliant bunker, and higher-sulfur refined products and refinery residues.

All this needs to be viewed from a number of different perspectives. We begin with the differentials between low-sulfur distillates and HSFO/resid. Distillates like diesel, marine gasoil (MGO) and marine diesel oil (MDO) will be in-demand building blocks for rule-compliant fuel, and refineries — whether complex or simple — will be doing all they can (crude slate changes, operational tweaks etc.) to optimize their output of these products. The combination of increased distillate production, sharply



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higher demand for diesel and its distillate siblings, and plummeting demand for high-sulfur resid, will widen the distillate/HSFO price spread. This is already happening, as shown in the upper bar chart in Figure 1, which illustrates the \$/bbl differential between the futures prices of 3.5%-sulfur resid (HSFO) and ultra-low-sulfur diesel (ULSD; 15 ppm sulfur content) — with ULSD serving as a proxy for the broader class of low-sulfur distillates. In Figure 1, the lower chart shows the price of 3.5%-sulfur resid as a percentage of the price of ULSD to normalize the effects of absolute oil prices (the recent oil price collapse has compressed all product price differentials).

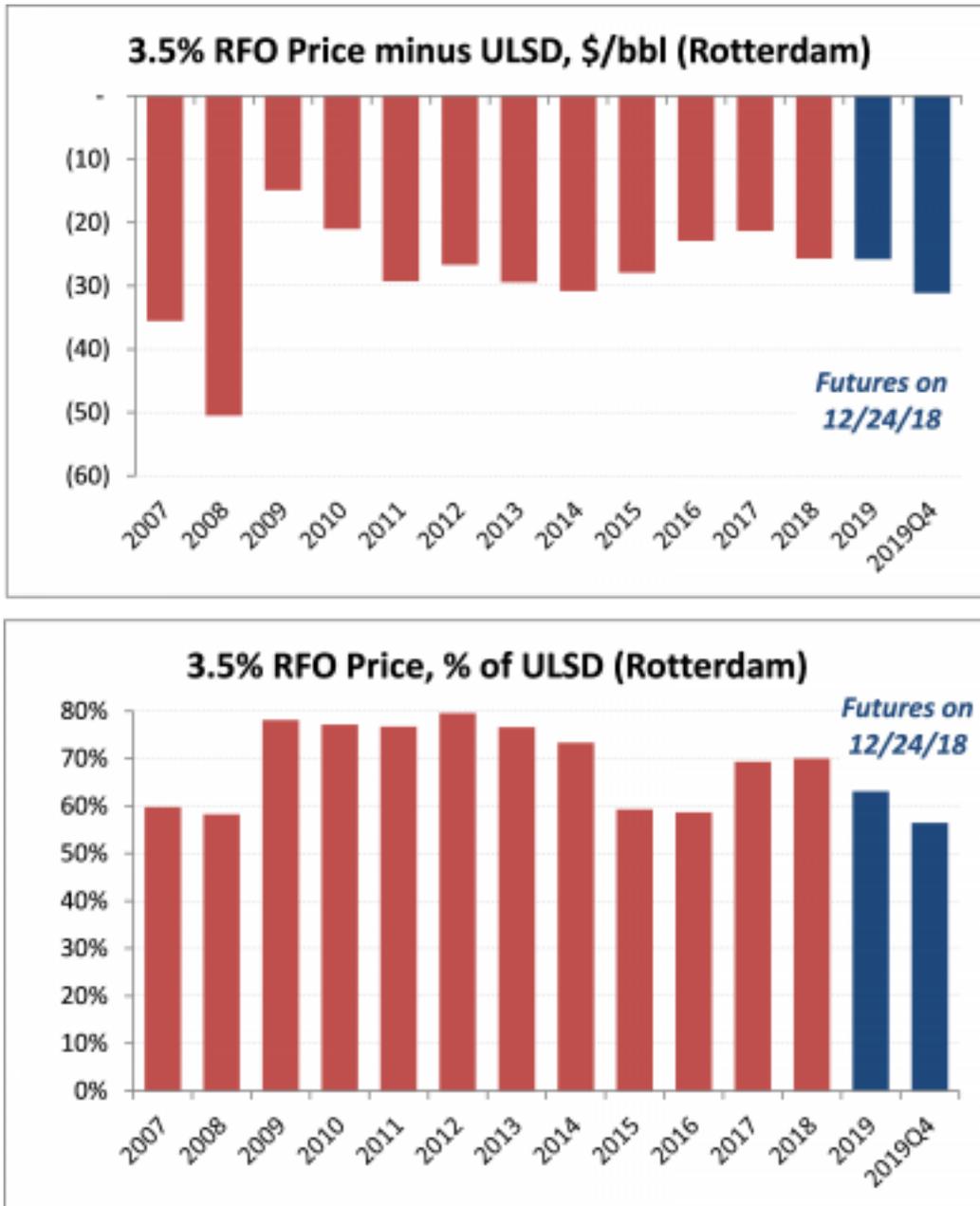


Figure 1. HSFO Pricing Trends. Sources: Platts for historical pricing, CME for futures prices; RFO futures based on Rotterdam barges



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Futures prices indicate a spread between 3.5% resid and ULSD of approximately \$26/bbl for 2019 as a whole (right near the prompt market), and \$35/bbl for the fourth quarter of 2019. The widely differing levels of absolute prices over history and the most recent prices distort the dollar-per-barrel spreads to some degree. Looking at these same price differentials on a percentage basis provides cleaner insight: by the fourth quarter, the futures market has a barrel of HSFO in Rotterdam selling at only 56% of the price of USLD; during the first 11 months of 2018, 3.5% resid was selling at 70% of ULSD, on average.

The deep discount for high-sulfur resid is enhanced by the facts that an estimated 0.5 Mb/d of the stuff will no longer be needed to produce HSB when IMO 2020 kicks in, and that there are only very limited alternative markets for HSFO. Namely, if it's not used for bunker, HSFO can either be used for power generation or possibly in asphalt markets, given that we have already accounted for barrels that are likely to be upgraded by complex refineries. Asphalt markets are likely to contribute only a relatively small amount of help, although we do think it is possible that asphalt will gain market share relative to concrete for road paving, as the price becomes much more attractive. Therefore, we expect that power generation will set the marginal price of HSFO and the price of high-sulfur resid will need to drop low enough to encourage at least some coal-to-HSFO switching. Current levels of fuel oil burning to generate electricity (primarily in Asia, the Middle East, South America and Africa), are on the order of 2 MMb/d. This amount of consumption would have to expand by 25% if all of the stranded RFO is to be consumed in power generation.

In the soon-to-arrive IMO 2020 era, refiners' desire to produce as much low-sulfur distillate as possible and to minimize their production of HSFO will (as we said in Part 2) result in changes in the types or blends of oil that refineries choose to process. Many simple "topping" and "cracking" refineries — that is, those lacking the equipment to break down resid — have been able to get away with processing light sour crudes; after all, they've been able to use the relatively large volumes of high-sulfur resid they end up with to produce 3.5%-sulfur marine fuel. With the shift to 0.5%-sulfur bunker, though, these relatively simple cracking plants (think Mediterranean refineries processing Urals) will require steep discounts in the prices of their sour feedstocks in order to maintain positive processing margins.

At the same time, sweet cracking refineries (think Philadelphia-area refineries such as Philadelphia Energy Solutions and Monroe Energy) — that is, refineries with fluid catalytic crackers (FCCs) that already run very low-sulfur grades — will compete with new buyers for these premium grades, thus bidding up the price. These types of refineries will also be needed to operate (in a global context) in order to supply incremental distillate demand. Crude oil pricing for both light-sweet and light-sour grades will need to reach equilibrium levels that allow all of these refineries to continue operating. Figure 2 highlights Baker & O'Brien's assessment for the equilibrium pricing that will likely be necessary to allow both sweet and sour cracking refineries to remain operating with a positive margin post-IMO 2020 implementation. Crude oil price differentials relative to Brent (39 API, 0.4% sulfur) for light-sour grades Arabian Light (35 API, 1.6% sulfur) and Russian Urals (32 API, 1.4% sulfur) are shown for a Base Case (no IMO 2020; blue and red bars to left) along with two IMO 2020 scenarios: one in which current futures pricing is an accurate predictor of price spreads (middle bars), and one in which a much more severe discounting of HSFO prices is necessary to clear the power generation market (bars to right).



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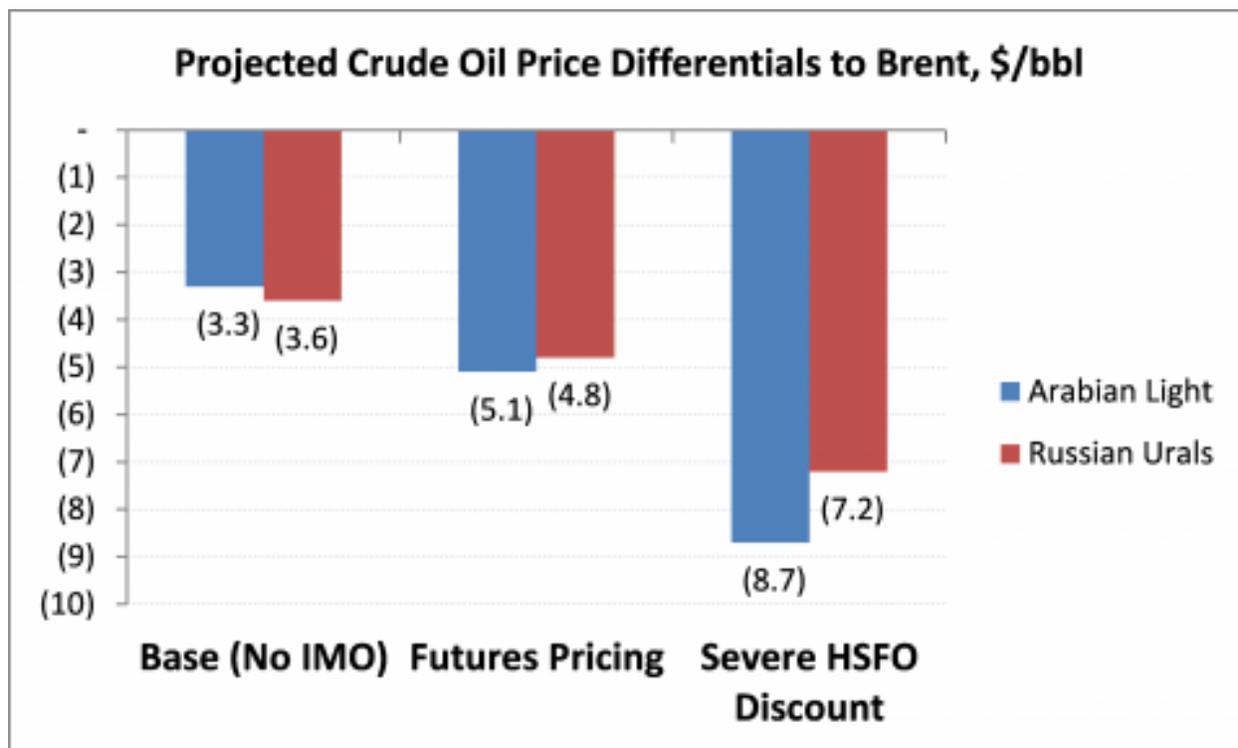


Figure 2. Equilibrium Price Spread Between Brent and Light-Sour Crudes. Sources: Baker & O'Brien analysis, Platts pricing

As shown, light-sour to light-sweet crude oil differentials will need to increase on the order of \$1.20 (Urals) to \$1.80/bbl (Arab Light) based on futures pricing, yet potentially widen by \$3.50 (Urals) to over \$5/bbl (Arab Light) in a case where HSFO is heavily discounted to where its price approaches that of coal on a per-Btu basis.

Refinery runs will need to increase to further goose the production of diesel and other low-sulfur distillates that can be used to make LSB. As we said in Part 3, the new analysis suggests that to meet the incremental needs for low-sulfur distillates when IMO 2020 becomes effective, diesel production will likely need to climb slightly to 28.6% of total output, with a diesel-to-gasoline production ratio of 1.10:1 — again, up just a bit from the current ratio. That would result in incremental diesel production of approximately 0.5 MMb/d, while gasoline production would be maintained near the same level as it is currently — a good thing, given that global demand for gasoline is seen remaining flat. [A primary mechanism to avoid gasoline production and fulfill LSB volume requirements under IMO 2020 will be to bring low-sulfur vacuum gas oil (VGO; straight-run or hydrotreated) into the bunker fuel pool; VGO prices are expected to be driven up toward their fluid catalytic cracker (FCC) feedstock breakeven value.]

Global diesel prices have recently strengthened after being relatively soft from 2015 to 2017. As the market prepares for the IMO 2020 transition, higher prices for diesel relative to gasoline are anticipated through 2019, based on NYMEX futures, which then continue to trade in relatively the same seasonal range through 2023 (see Figure 3 in Part 3.)

Obviously, a question of high interest is the likely price for new, low-sulfur bunker fuel: LSB.



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While a specific \$/bbl would be impossible to predict in today's volatile crude oil market, a conceptual pricing range for LSB is shown in Figure 3 below.

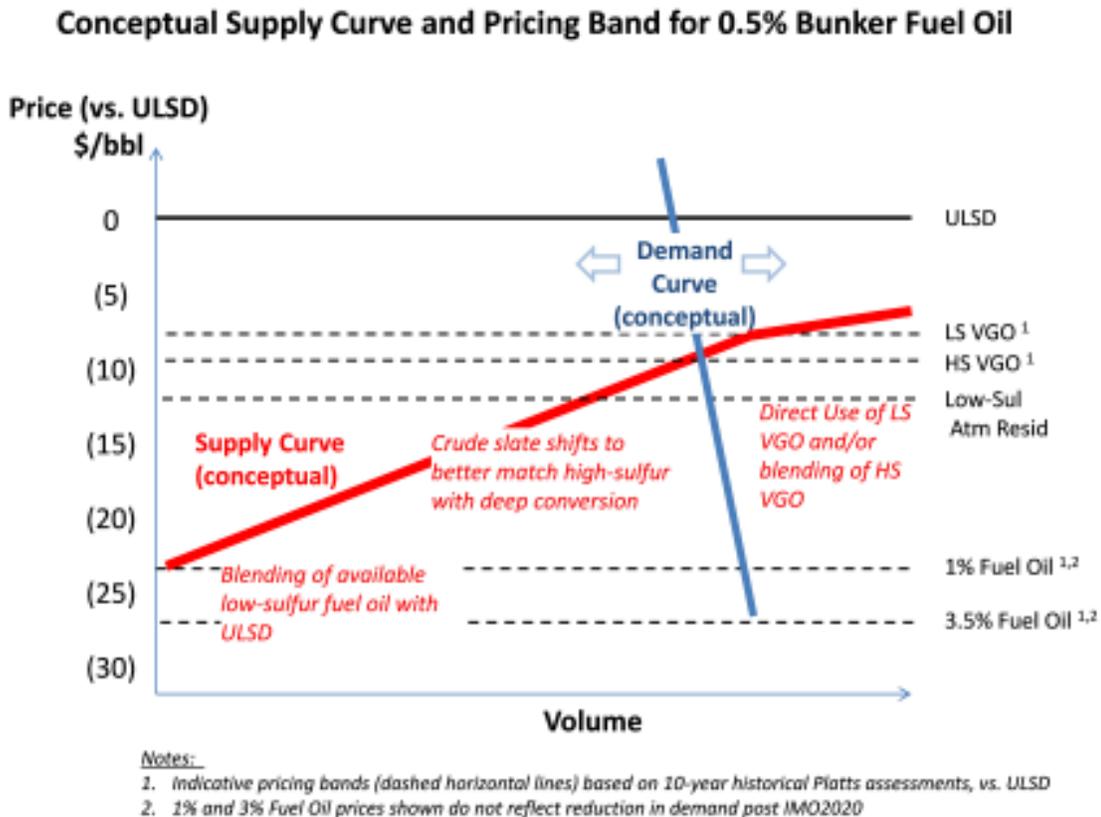


Figure 3. Conceptual Pricing Range for LSB. Sources: Baker & O'Brien, Platts

The upward-sloping red line in the graph shows that the supply of IMO 2020-compliant marine fuel will increase as more and more costly means of producing LSB are employed. Low-cost supply is fulfilled first by blending available less-than-1%-sulfur fuel oil with ULSD, followed by crude oil slate shifts to better match sour crude with the refineries that can break it down (supported by wider light-heavy price differentials), ultimately leading to low-sulfur VGO blending. At some point, the red supply curve crosses the blue demand curve (also difficult to predict, given compliance and scrubber installation assumptions, as discussed in Part 1), and the likely price range for LSB is established. Depending on the various supply and demand factors discussed earlier, the price for LSB is expected to exceed the historical pricing for 1%-sulfur fuel oil and approach the low-sulfur VGO price.

As challenging as the flip-of-a-switch transition from 3.5%-sulfur bunker to 0.5%-sulfur marine fuel may be, odds are that the global refining sector will find a new equilibrium in the first year or two of the IMO 2020 era. As it does, expect to see some price-spread relaxation, as well as more ship-scrubber installations and more refinery upgrades designed to make the most of the new market realities.



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“The Thunder Rolls” was a #1 hit single for country music star Garth Brooks in 1991. The song, off of Garth’s No Fences album, was co-written by him and Pat Alger. It was originally recorded by Tanya Tucker, but her version was not released until 1995 as part of a self-titled box set.

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