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STRANGE BREW – COVID-19 AND THE CRUDE OIL PRICE CRASH PUTS THE SCREWS ON U.S. REFINERS

March 23, 2020

The collapse in crude oil prices and COVID-19's very negative effects on global gasoline, jet fuel and diesel demand are putting an unprecedented squeeze on U.S. refiners. Even before the initial coronavirus outbreak in Wuhan, China, started to grab headlines around New Year's Day, refineries had already been incentivized to shift their refined products output toward diesel, which can be used to help make IMO 2020-compliant low-sulfur bunker. Now, with the COVID-19 pandemic spreading to Europe and North America and stifling consumer transportation fuel demand, the price signals are even stronger, pushing refineries to do everything they can to minimize their gasoline and jet fuel production and enter what you might call "max diesel mode." Today, we discuss how there are challenges and limits to what they can do, and a number of refineries may need to shut down due to lower demand, at least temporarily.

Last Monday, March 16, grumblings started among commodity traders regarding negative gasoline cracks — cracks being the price of gasoline minus the price of crude — on the NYMEX. By the end of that day's session, crack spreads for Reformulated Gasoline Blendstock for Oxygenated Blending (RBOB) — the benchmark for gasoline trading — had fallen almost 90% to settle below \$1/bbl (blue line, left graph in Figure 1). Gasoline prices crashed another whopping 30% on Monday, March 23rd. Ultra-low-sulfur diesel (ULSD) cracks remained strong at \$16/bbl (right graph in Figure 1), but the jet fuel crack spread (not shown), which is usually closely tied to diesel, closed at only \$8/bbl. Since then, regional crack spreads for gasoline around the U.S. hovered below \$5/bbl and then moved into negative territory.

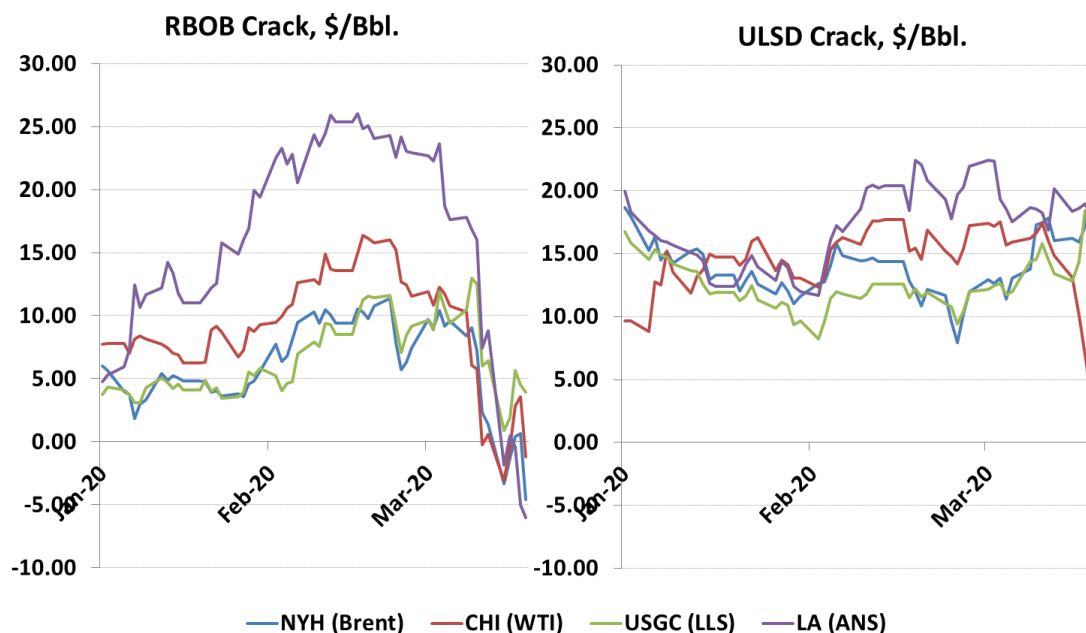


Figure 1. RBOB/Gasoline and ULSD Cracks. Source: Platts



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With strong price signals pushing refiners towards diesel production, they would have made immediate adjustments to tweak their refined product yields. However, as we said in our introduction, refiners through the second half of 2019 had already been given strong price signals to produce more diesel heading into the fourth quarter of 2019 and the first quarter of 2020 due to the IMO 2020-related need for low-sulfur bunker. Weekly Energy Information Administration (EIA) data released last Wednesday, March 18, indicated that the current distillate yield (diesel plus jet fuel) at U.S. refineries was around 48%, or three percentage points lower than the 51% peak over the last year. Therefore, the potential to swing from gasoline to distillate is likely limited. The larger swing that could take place would be to blend kerosene used for jet fuel production into diesel — in other words, optimize the two finished transportation fuels within the distillate pool.

To estimate this shift, we ran some simulations utilizing Baker & O'Brien's *PRISM*TM refinery model. Figure 2 lays out a step-change analysis for the entire U.S., toggling different options to reduce jet and gasoline production. This analysis assumes that immediate changes to the crude oil slate are not taken but could be an option for refiners to consider down the road as the ongoing crisis unfolds.

- **Base Case (First Column):** This was our starting point; it shows aggregate refinery production of gasoline, jet fuel and diesel as it stood in the summer of 2019; U.S. refinery utilization stood just north of 90% (black diamond at top of column).
- **Reduce Jet Yield (Second Column):** Given that jet fuel was the first commodity to experience a sharp reduction in consumption once the crisis started, we believe refiners would have adjusted their operations to maximize kerosene or jet fuel blending into the diesel pool. To do this analysis, we simulated every refinery in the U.S. using their 2019 crude slates, and eliminated the incentive to make jet fuel (red bar segment). This analysis yielded the maximum amount of jet fuel that we estimate can be blended into the diesel pool to produce on-spec product: about 65%, or enough to increase diesel production (green bar segment) by approximately 20%. Despite the modeling results, though, our gut tells us that a 65% shift of jet fuel to diesel may be too high, and we therefore have held the jet fuel production cut at 50%.
- **Reduce Diesel Production to 2019 Levels (Third Column):** This analysis tries to eliminate a problem created by moving jet fuel into diesel — namely, significantly out-producing actual demand. If we assume that U.S. demand and exports of diesel remain the same, which would be optimistic, this toggles total U.S. production and utilization downward by more than 14 percentage points.
- **Reduce Gasoline Production by 30% from 2019 levels (Fourth Column):** First, a caveat: this scenario is highly speculative. Given the current requirements for social distancing, the closure of schools and non-essential businesses and the like, how much could gasoline demand be reduced by? We have chosen 30%, but as more states enact “stay-at-home” mandates, that estimate could be low. Ignoring the impacts of storage fills or draws, ratcheting down refinery throughput to put gasoline supply (blue bar segment) and demand into relative balance would lower throughput to levels not seen since 1985.
- **Reduce Gasoline Production by 50% from 2019 levels (Fifth Column):** This analysis is similar to the fourth column, but assumes gasoline demand comes off by 50% for a period of time, which covers some of the sharpest reduction estimates we’ve seen forecasted.



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U.S. Refineries' Output Scenarios

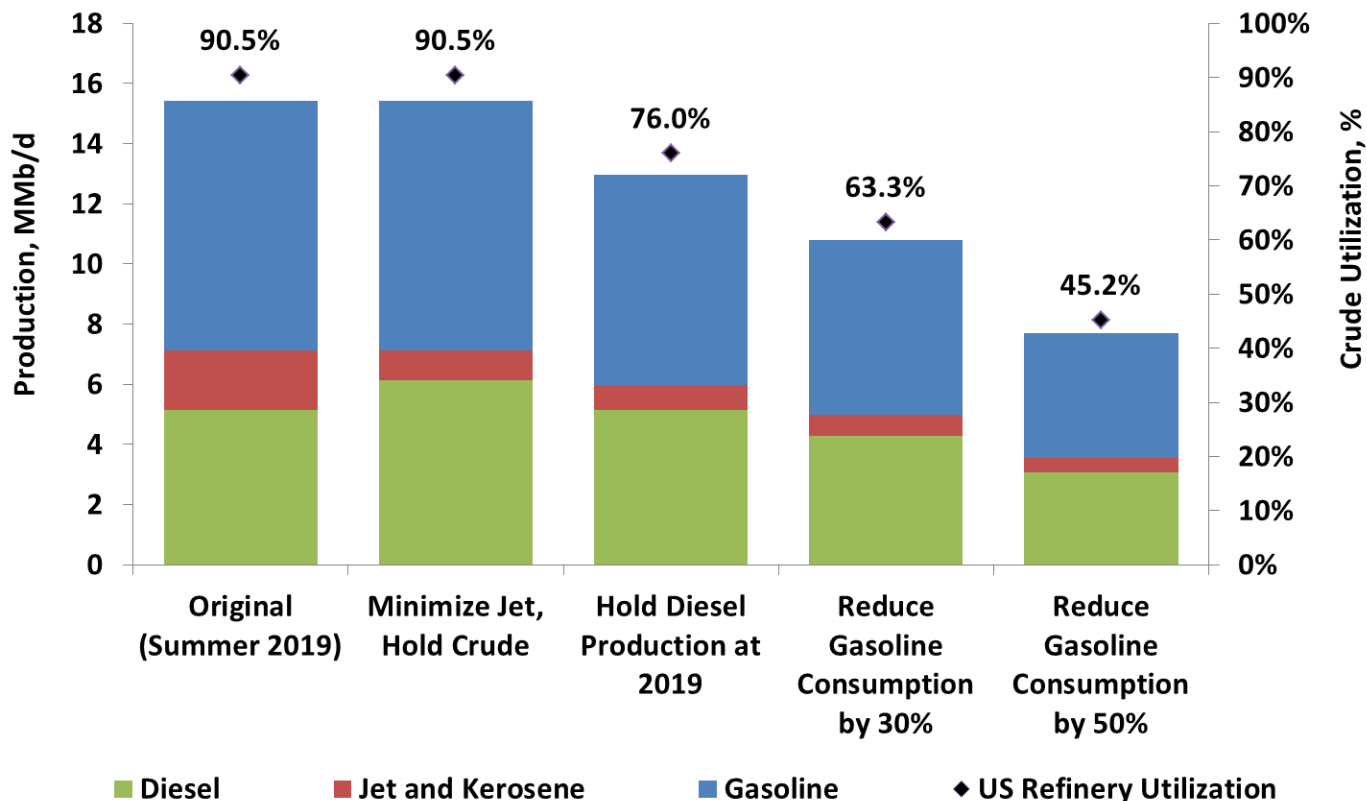


Figure 2. Base Case and Four Scenarios for U.S. Refineries' Output. Source: Baker & O'Brien

The final column in Figure 2 paints a very dire situation, with aggregated refinery utilization at about 45%. In our experience, crude throughput in the 60% to 70% range is approaching the minimum rates that a refinery can operate without completely shutting down units. The above analysis is focused on the U.S. in aggregate and does not account for the nuances of each refinery (or refining operator) and every region other than the analysis of the quantity of jet that could move to diesel.

In reality, not every refinery can or would ramp down to 45% or 55% under our worst-case scenario. If that situation were to come to fruition, some refineries would have to shut down while others would maintain a higher utilization. So, which refineries are at risk? We assessed this based on two primary factors (though there are many other variables that refiners would have to account for): (1) which refineries produce a higher yield of gasoline and jet fuel versus diesel, and (2) which refineries have access to outlets for their products through either excess storage or export markets.

Starting with the yields, crude slates and refinery configuration are strong influencers on the quantity of gasoline and jet produced. Figure 3 shows our estimated aggregate gasoline and jet yields for the U.S.'s 130-plus refineries by PADD after pushing all the jet possible into the diesel pool. (The width of each refinery's bar reflects its capacity.) In this chart, the farther to the left a refinery sits, the more gasoline and jet fuel the facility makes in this scenario. The refineries in the left-most quarter of the chart would be the most at risk, since they would require huge — and possibly unfeasible — crude rate reductions to remain in gasoline/jet "containment mode." In contrast, the refineries in the right



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half of the chart would appear to be in a much better position, if offtake and/or storage are available for their excess products.

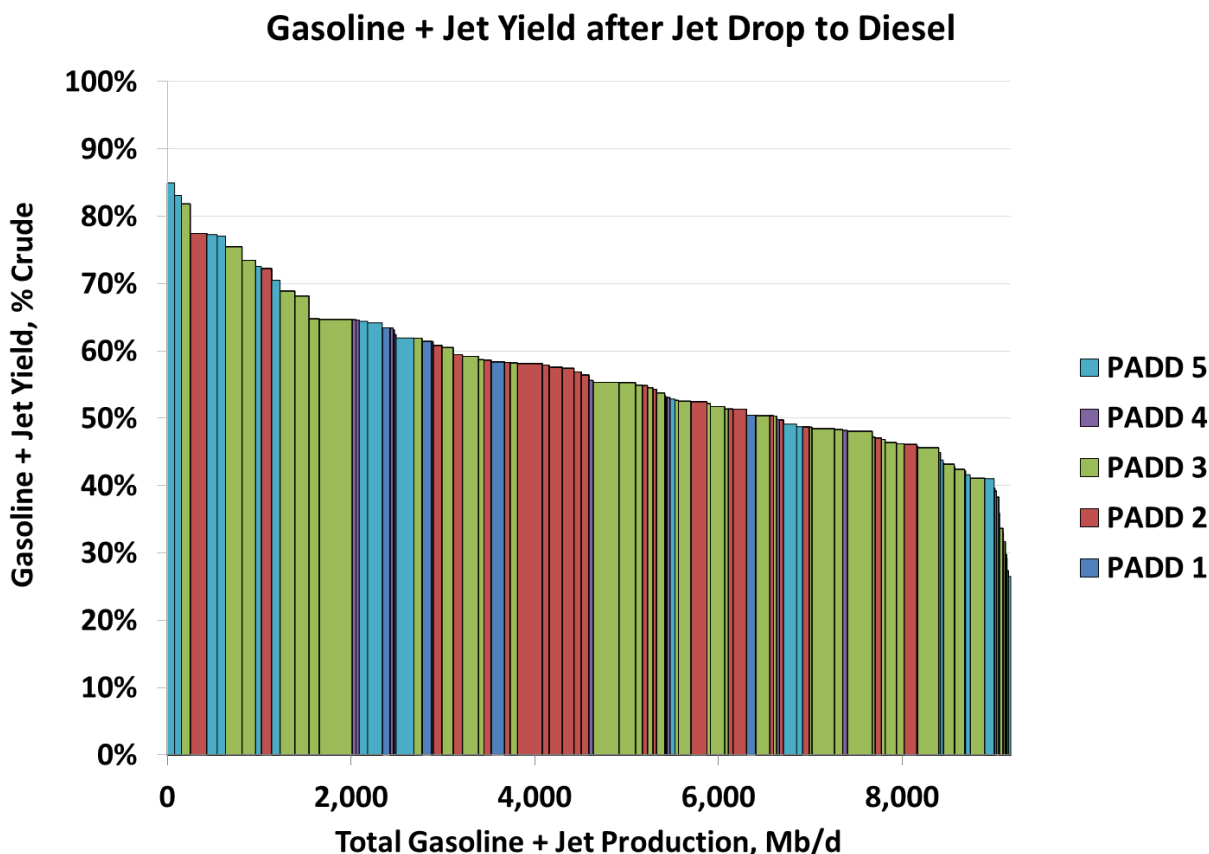


Figure 3. U.S. Refineries' Gasoline and Jet Fuel Yield in "Max Diesel Mode." Source: Baker & O'Brien

The next issue relates to location — that is, if a facility can't sell all its gasoline and jet in its immediate region, does it have sufficient access to storage and to ancillary markets for sale to keep supply and demand in relative balance? This nuance puts refineries in PADD 2 (the Midwest) and PADD 4 (the Rockies) at higher risk of reduced utilization rates or shutdowns. The current refined pipeline network in the U.S. is configured to move products from PADD 3 (Gulf Coast) into the Midwest and Rockies, but not the other way around. Therefore, if consumers in PADDs 2 and 4 severely cut back on consumption, refineries in those regions would be left at the mercy of storage capacity before their utilization rates have to be cut. Unfortunately, storage of gasoline in PADD 2 tends to peak in late February of every year, with a maximum inventory of ~63 MMbbl over the last five years. Storage of gasoline components in PADD 2 as of March 18 was ~57 MMbbl (blue bar segment in Figure 4). EIA's 2019 estimate of total working storage capacity in PADD 2 was ~77 MMbbl, and we assume storage levels can rise to ~90% of the working storage level, or about 69.3 MMbbl (blue plus red bar segments). That would leave less than 20 days of incremental stockpiling capacity if demand were to drop by 30%. The situation is similar in PADD 4.



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PADD 2 Gasoline Storage

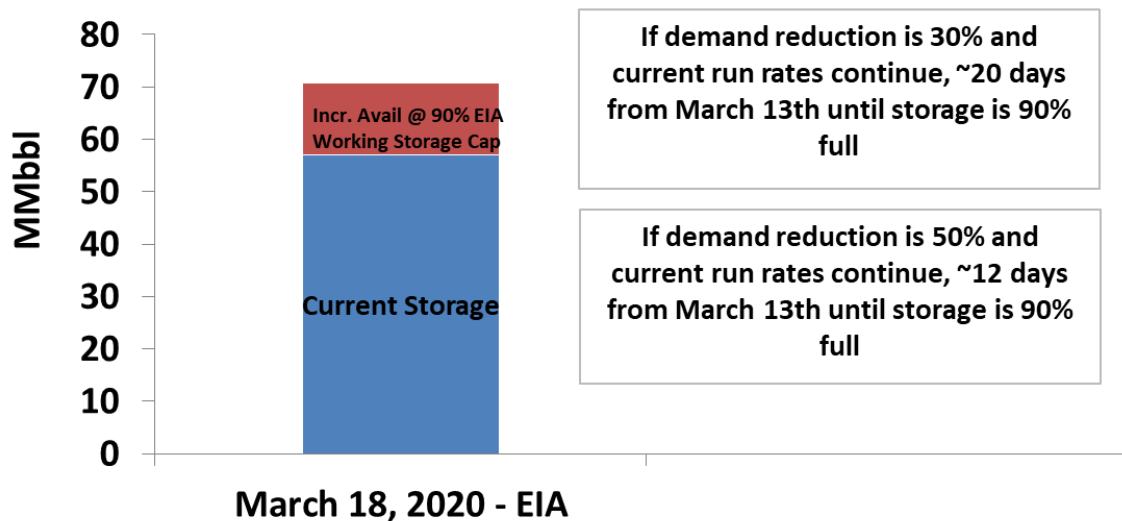


Figure 4. PADD 2 Gasoline Storage Level and Available Space. Sources: EIA and Baker & O'Brien Analysis

The three other PADDs, which are predominantly near the water and have access to export markets, have more options to place barrels, but reduced run rates and shutdowns would probably come their way as well if the situation becomes bad enough. PADD 5 (the West Coast), for example, has some of the highest gasoline and jet yields in the country — note the number of aqua bars in the left half of the Figure 2 chart — and also happens to be a region that has been hit particularly hard by COVID-19. With the entire state of California essentially in lock-down mode, refineries there will likely see widespread utilization reductions over the coming weeks. Similarly, there are a number of stay-at-home mandates in place in PADD 1 (the East Coast), another hard-hit region. That leaves PADD 3 — again, the Gulf Coast, and the location of about half of total U.S. refining capacity. If shipments on the Colonial and Plantation refined pipelines from the PADD 3 to PADD 1 drop due to dwindling East Coast demand, can those excess barrels be placed on the water? In our opinion, probably not all of them.

This is an extreme situation facing the globe and the near-term impacts may well be dire, but it's one that will eventually end — the question is when. While some refining assets may have to throttle back utilization for a period of time and some may even shut down temporarily, we are hopeful that over time, things will return to normal for refiners, and everyone. But it's a situation that we will continue to monitor.

Note: The article was authored by Amy Kalt of Baker & O'Brien and published on RBN Energy's Daily Energy Post on March 23, 2020.

"Strange Brew" was written by Eric Clapton, Felix Pappalardi and Gail Collins. The song appears as the lead track on side one of Cream's second studio album, Disraeli Gears.

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