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LOUISIANA RAIN, PART 3 - EVOLVING CRUDE AVAILABILITY FOR SOUTHEAST LOUISIANA REFINERS

March 3, 2019

Increasing U.S. shale oil production has benefitted many U.S. refineries, but along the Gulf Coast, the primary beneficiaries have been in Texas. As production increased in the Permian and Eagle Ford plays, new pipelines were built to supply refinery centers in Corpus Christi, Houston, and Beaumont/Port Arthur. In contrast, the availability of shale crude by pipeline to refineries in Southeast Louisiana has lagged. However, new pipeline capacity to the crude hub in St. James, LA, is about to change the dynamic in a major way. Today, Amy Kalt from Baker & O'Brien continues RBN's series on St. James by discussing the Bayou State's refinery infrastructure and how new pipelines could impact refinery crude slates.

This is Part 3 of the series. In Part 1, RBN talked about how, with the onset of the Shale Revolution, growth in Alberta oil sands production in the 2010s, and the lifting of the U.S. crude export ban in December 2015, the St. James crude hub has been in a state of flux — and the changes have only just begun. Most importantly, the hub's long-standing role as a recipient and distributor of imported crude and Gulf of Mexico production to the Midwest has been fading, and St. James — located 60 miles upriver from New Orleans — is increasingly valued for its ability to receive and stage U.S. shale oil, Gulf of Mexico production, and Canadian oil-sands crude for delivery to area refineries and export docks. In Part 2, RBN looked at what St. James currently offers in terms of crude storage (about 38 MMbbl) and pipeline connectivity (inbound and outbound), as well as what expansion plans are afoot to reflect the hub's changing function.

Today, we shift our attention to refineries in the greater St. James area, and how plans to add new pipeline capacity into the region may provide new crude-supply opportunities to these refineries. The refineries of Southeast Louisiana (SELA) comprise approximately 2.6 MMb/d of capacity, which equates to about 30% of the total refinery capacity along the Gulf Coast. Geographically, the SELA refineries (see Figure 1 map) span from Delek US's Krotz Springs facility on the Atchafalaya River to Phillips 66's Alliance refinery in Belle Chasse, downriver from New Orleans. Capacity-wise, they range from 78 Mb/d (Delek Krotz Springs) to 566 Mb/d at Marathon Petroleum Co.'s (MPC) refinery at Garyville. (See capacity table in Figure 1; refinery sizes are based on the capacity of their crude distillation units, or CDUs.)



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Refineries of Southeast Louisiana

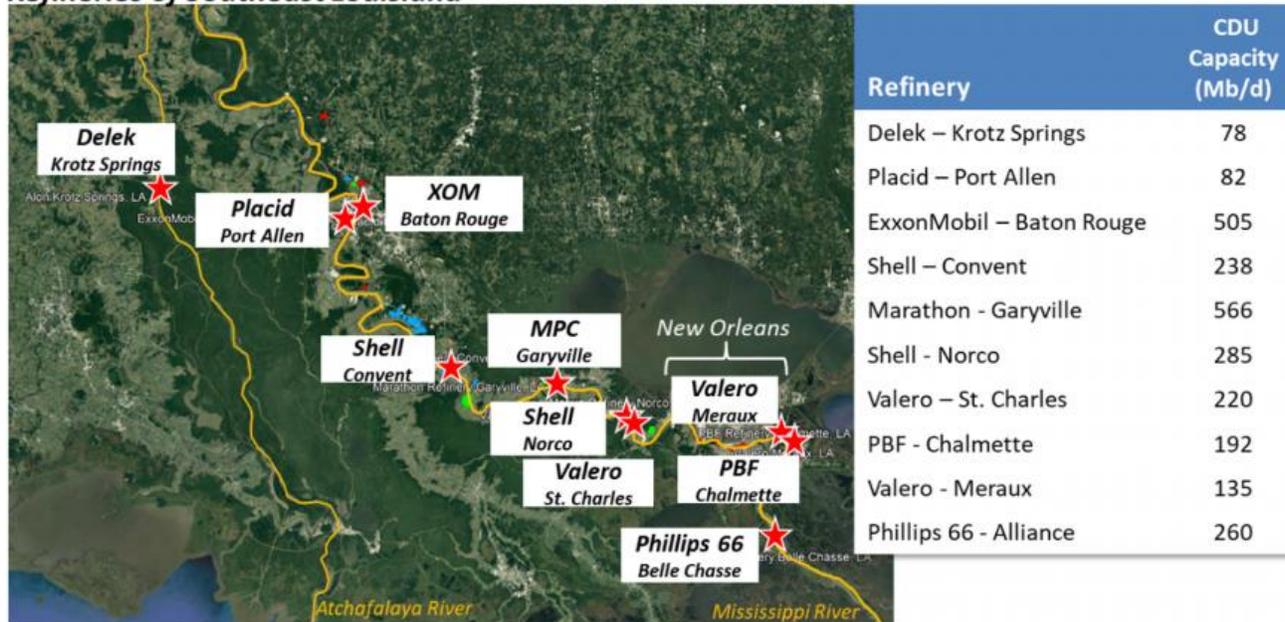


Figure 1. Southeast Louisiana Refineries. Sources: Baker & O'Brien PRISM, Google Maps

Most of the owners of these refineries also own other Gulf Coast refineries and some are able to optimize their systems through feedstock and intermediate product trade. For example, in addition to its large Baton Rouge refinery, ExxonMobil (XOM) has refineries in Beaumont and Baytown, TX; MPC also has the Galveston Bay refinery in Texas City, TX (a relatively recent integration of two refineries); Valero has refineries in Port Arthur, Houston, and Corpus Christi, TX; Shell, which owns two refineries on the river at Convent and Norco in Louisiana, also has its Deer Park partnership-refinery in Houston; and Phillips 66 has refineries in Lake Charles, LA, and Sweeny, TX.

Crude supplies in SELA traditionally came from the offshore Gulf of Mexico (streams such as Mars, Thunderhorse, and Poseidon); onshore state production — Light Louisiana Sweet (LLS) and Heavy Louisiana Sour (HLS) — and imports. Given the refineries' configurations, the average crude slate has tended to be of a medium sour quality. However, domestic shale crude production, which is of a lighter, sweeter quality, has become a larger component of the Louisiana refineries' crude diets due to pipeline connectivity from the shale basins, including the reversal of the Zydeco Pipeline in December 2013, the start-up of the first phase of the Bayou Bridge pipeline to Lake Charles in April 2016, and the extension of the Permian Express Partners pipeline to Baton Rouge in mid-2016.

Figure 2 provides a big-picture look at the domestic-vs.-imported sources of the crude slates of SELA refineries in 2010 and 2018, as well as the average API gravity of these domestic and foreign crudes. Be mindful that “domestic” for these refineries includes Gulf of Mexico production, which is heavier and more sour than the light sweet crude that most associate with U.S. oil today. The imported volumes processed (blue bar segments, left axis) fell by nearly half (47%) between 2010 and last year, and the typical imported barrel has become heavier (blue diamonds, right axis), while the volumes of domestic crude processed have more than doubled (red bar segments) and become lighter (red diamonds). Overall, the crude slate has become slightly lighter (black diamonds).



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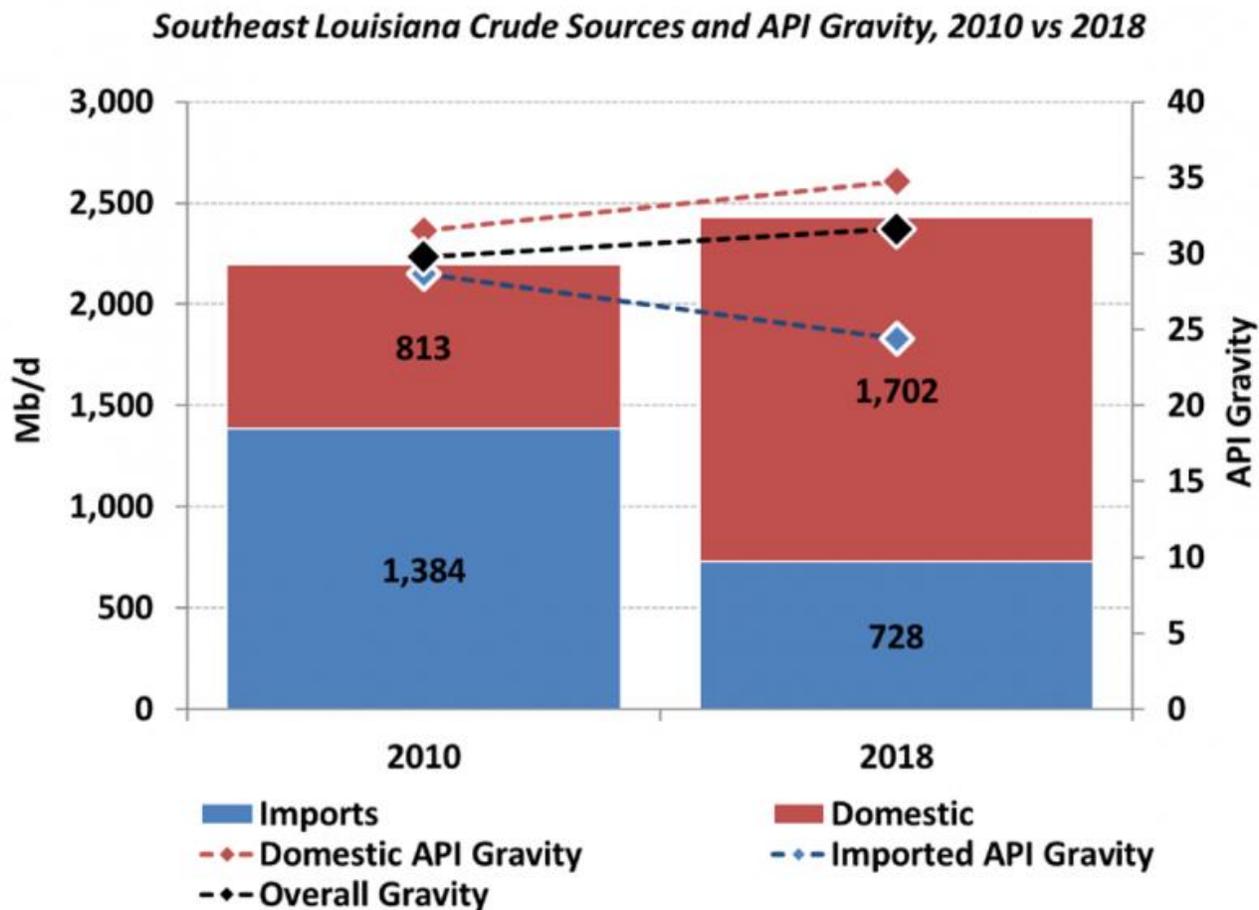


Figure 2. Southeast Louisiana Crude Sources and API Gravity. Source: Baker & O'Brien Analysis

How did the SELA refineries double their processing of domestic oil? The answer to that question is in the bridge graph in Figure 3 below. The green segments represent each of the factors that enabled refineries' use of domestic crude to increase from ~800 Mb/d in 2010 (navy-blue bar to the left) to 1.7 MMb/d by 2018 (navy-blue bar segment to the right). In general, these fall into four broad categories:

- The refineries reduced their reliance on light crude oil imports by utilizing newly-built/repurposed pipelines and by barge deliveries of Permian and Eagle Ford crude oils, contributing to a ~310-Mb/d increase in domestic crude use (green bar segment to left).
- The refineries reduced their medium imports and replaced them with about 340 Mb/d of GOM-produced barrels of similar quality (next green segment). The increase in SELA refinery processing of GOM production is tied to reduced requirements for Capline shipments up to the Midwest due to increasing Bakken and Canadian crude oil availability in that market, which increased the quantity of GOM barrels available in SELA.
- Heavy import volumes have been largely unchanged (third green bar segment from left); however, (as noted) the average barrels imported have become heavier.
- Overall capacity and utilization increased in SELA over the time period. This new capacity and increased utilization was filled with ~230 Mb/d of domestically produced barrels (green bar



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segment to right).

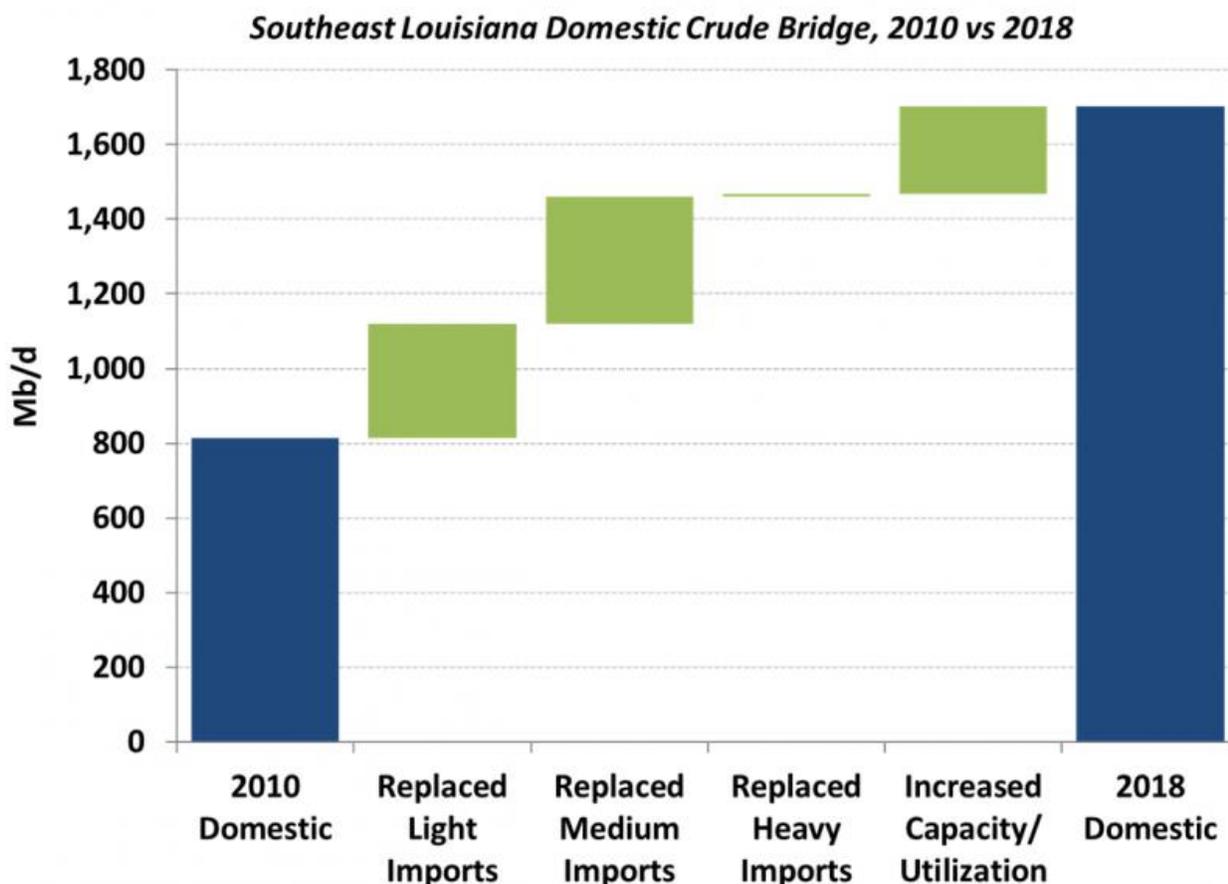


Figure 3. Southeast Louisiana Refineries’ Domestic Crude Use. Source: Baker & O’Brien Analysis

As mentioned in Part 2, several new trunkline pipelines into St. James are under development, as well as new pipeline connections from SELA crude oil hubs to the regional refineries. These pipelines include the Bayou Bridge extension from Lake Charles to St. James; the Seahorse pipeline from Cushing (OK) to St. James; the Capline pipeline reversal from Patoka (IL) to St. James; the planned Swordfish Pipeline from St. James to the Clovelly (LA) hub; and the proposed ACE Pipeline from St. James to the Belle Chasse, Chalmette, and Meraux refineries.

So will these pipelines benefit SELA refiners? Or will they primarily enable increased exports from the region? The answer to both questions is most likely “Yes” and, as always, economics will decide. Since these pipelines may bring in crude oil at both ends of the spectrum (light sweet and heavy sour), we’ll discuss each of these possibilities in turn.

Light Crude Oil

The three new trunklines (Bayou Bridge, Seahorse, and Capline reversal) will all most likely bring domestic light crude oil into the St. James market from places such as the Permian, the Eagle Ford, the Bakken, and the Denver-Julesburg (D-J) Basin. While there are nuances in the gravity and sulfur of these crude oils, the production is predominantly in the 40-45°API range and less than 0.5%



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sulfur. Let's look at where we might be able to squeeze some more light sweet crude oil in:

- **Replace Light Sweet Imports?** A like-for-like replacement with an imported light sweet crude oil is not possible for these refineries — that move has already been accomplished. Even a stretch to a medium-sweet crude oil replacement does not appear to be in play, since imports in that quality range are also non-existent in the SELA market.
- **Replace Medium Sour Imports?** The next option, assuming the price is right, would be to back out some medium sour imports. Interestingly, SELA refineries imported an average of 258 Mb/d of crude oil with greater-than-29o API in 2018. If a refinery has spare light-ends handling capability, there would potentially be an opportunity to increase runs of lighter crude oil — again, it all would come down to the landed price.

For some refiners, the new pipelines may not necessarily increase domestic shale throughput, but would allow those crude oils to be accessed at a more advantageous price. While the pipes that came online over the past five years increased availability of domestic shale oil in the SELA market, some refiners are still reliant on barge deliveries of crude for a portion of their crude slates. Some of these barge deliveries are from St. James to riverfront refineries, while others are deliveries from Corpus Christi or other ports in Texas. Enabling increased pipeline access to refineries such as Valero Meraux and PBF Energy Chalmette through the Swordfish and CAM pipelines or through ACE should alleviate some of the barge requirements.

In general, the new light crude oil pipeline capacity coming into the St. James market will give SELA refiners increased optionality on crude slate selection and potentially increase domestic shale processing in the SELA market, but the increment will likely be small relative to the market capacity.

Heavy Crude Oil

Certain refineries in SELA are configured to process heavier sour crude slates, such as PBF Chalmette, Valero St. Charles, ExxonMobil Baton Rouge, and MPC Garyville. Some Canadian heavy crude oil currently makes its way to the SELA market through rail and barge deliveries. However, the bulk of the heavy crude imported in 2018 came from Venezuela and Mexico.

Reversing Capline could, over time, enable increasing volumes of heavy Canadian crude to flow south to St. James and beyond. Currently, there are Canadian crude pipeline bottlenecks, so a reversed Capline would be expected to initially target light sweet crude oils. But if and when the Canadian constraints ease, heavier Canadian crude oil flows could become an option. In the discussion regarding Figures 2 and 3, we noted that the quantity of heavy crude oil (<22.3°API) imported in the SELA market was generally unchanged between 2010 and 2018. Approximately 380 Mb/d of heavy crude oil was processed in SELA in 2018, which could likely be replaced by heavy Canadian crude oil if the landed price is competitive with imported alternatives. In addition, both MPC Garyville and PBF Chalmette are considering coker expansions:

- The Garyville Coker 3 project will increase the coking capacity at the facility by 50% to 150 Mb/d by the fourth quarter of 2021. The feed for the new coker could come through a significant increase in heavy crude oil processed at Garyville or through opportunistic purchases of coker feed from other refineries with limited bottoms upgrading. The latter option may be the near-term solution due to IMO 2020 — the impending rule for much cleaner marine fuels —



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which is expected to cause a surplus of high-sulfur fuel oil in the market. However, after the initial shock of IMO 2020 is behind us, a shift in the crude slate may become the more likely solution.

- PBF Energy has approved a project to restart an idled 12-Mb/d coker at its Chalmette refinery; this unit is expected to be in service by the end of 2019. Similar to Garyville, feedstock for the new coker may initially come from opportunistic purchases but may eventually require some additional heavy crude feedstock.

To sum up, the new pipeline capacity being planned into and out of St. James will definitely benefit the SELA refineries to some degree, as they are likely to lower average landed costs and increase each refinery's options for optimizing its crude diet. However, these benefits are expected to be mostly of an incremental nature — that is, they won't be game-changers. The biggest positive impact is likely related primarily to the Capline reversal, which would change the dynamic for delivery of heavy grades in the region, assuming Canadian crude constraints north of Patoka can be eased. Notwithstanding these refinery benefits, as the U.S. just hit a new milestone of 12 MMb/d of crude oil production, the primary driver for these projects is to get crude to the water where it can be exported.

Note: The article was authored by Amy Kalt of Baker & O'Brien and published on RBN Energy's Daily Energy Post on March 3, 2019.

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