



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

DARKNESS INTO LIGHT - DOMESTIC LIGHT OIL PROCESSING IN THE USGC: HAVE WE HIT THE LIMIT?

November 1, 2018

Refineries along the U.S. Gulf Coast (USGC), which account for half of the country's total refining capacity, are generally among the most sophisticated and complex anywhere, with configurations that enable them to break down heavy, sour crude oil into high-value, low-sulfur refined products. However, over the past eight years, the USGC has been flooded with increasing volumes of light, sweet crudes produced in the Eagle Ford, the Permian and other U.S. shale plays as new pipelines were constructed or reversed to the coast for domestic refining or export. Still more pipelines will be coming online over the next year. Today, we evaluate how much domestic crude oil has been absorbed into the USGC refining system, the implications to the overall crude slate qualities, and options for increasing domestic crude oil processing in the near term.

In September 2018, the Energy Information Administration (EIA) reported that the U.S. (black line in Figure 1) surpassed Russia (red line) to become the world's largest producer of crude oil; Saudi Arabia (orange line) is now in third place. Shale production, particularly from the Permian Basin, is leading the charge, and transporting this light sweet crude oil from West Texas to the Gulf Coast has created a flurry of logistics projects for midstream companies. The hefty spread between West Texas Intermediate (WTI) and Brent (about \$9/bbl at the time of writing) illustrates that the pipelines pointed towards the USGC, home of over half of the U.S. refining capacity and export terminals, have been filled. However, the new transport infrastructure being planned and built to relieve that constraint will eventually open the floodgates to the coast again, providing options for coastal refineries to increase domestic input or for the crude oil to be exported.

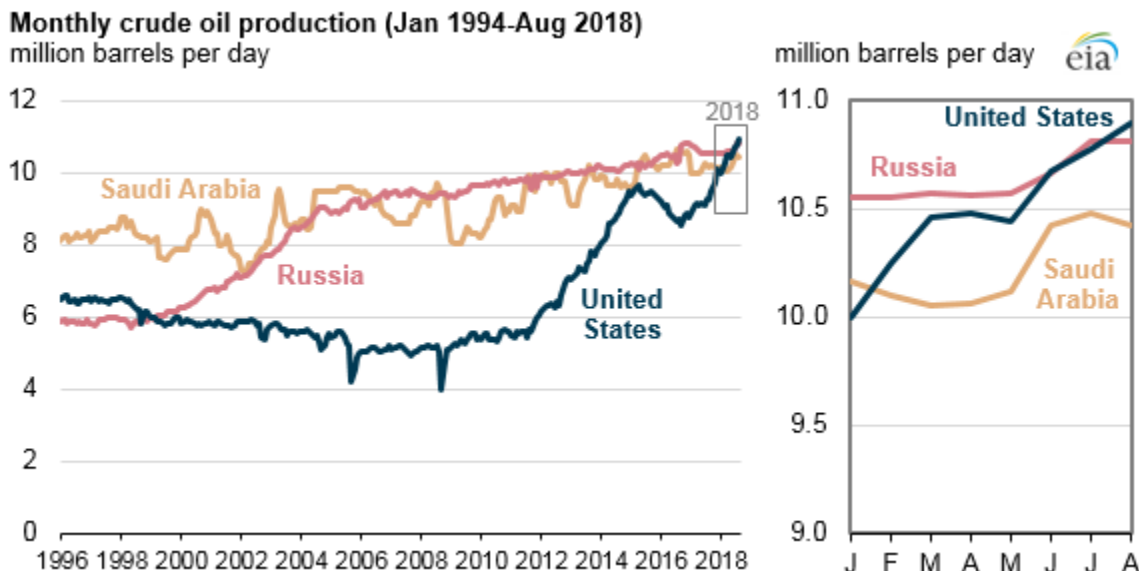


Figure 1. Source: EIA



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

Refiners and industry experts agree that the USGC refining system is generally not configured to process large quantities of light sweet crude oil. However, Gulf Coast refiners are processing significant amounts of domestic light sweet crude today. Between 2010 and July 2018, U.S. crude oil production grew on an annual average basis from 5.4 MMb/d to over 10.4 MMb/d. The majority of this growth is attributable to shale oil production, which tends to be very light (higher API gravity) and sweet (low sulfur content). As of the summer of 2018, the U.S. was exporting about 2 MMb/d, meaning that 3 MMb/d of this 5 MMb/d of production growth since 2010 has been absorbed into the U.S. refining system.

Baker & O'Brien's *PRISM* data shows that USGC refiners have absorbed the lion's share, boosting domestic crude oil throughput by 2.9 MMb/d — from just over 1.5 MMb/d in 2010 (red bar to left in Figure 2) to just over 4.4 MMb/d in 2018 (red bar to right). We can group how they accomplished this into three main categories (green bars in Figure 2, from left to right): (1) a reduction in imports of light sweet (LS) grades; (2) a reduction in imports of medium grades; and (3) increased capacity and utilization.

Increasing USGC Domestic Crude Oil Input, 2010 – 2018 YTD

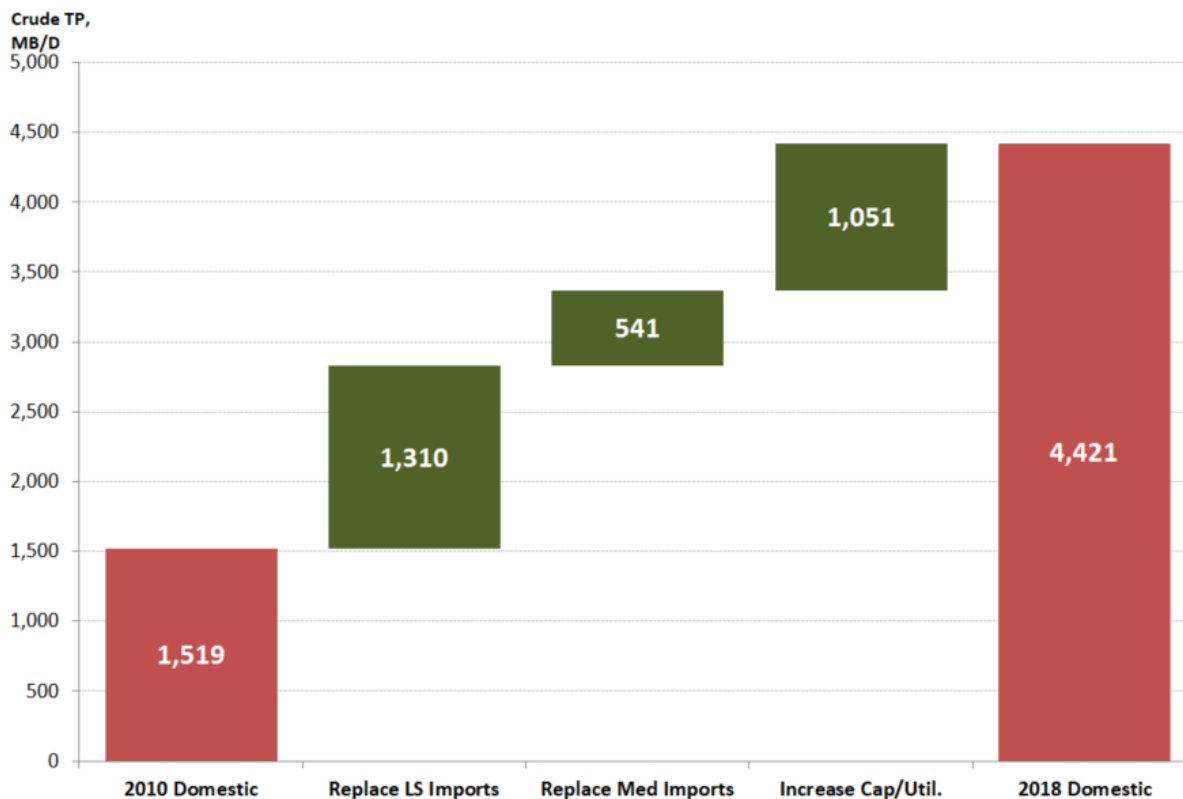


Figure 2. Source: Baker & O'Brien analysis. Note that the timing of these changes is not necessarily sequential and that some refineries have made configurations changes that are not captured separately.

Focusing on the USGC, Figure 3 below shows the quantity of domestically produced (red bar segments) and imported (blue bar segments) crude oil processed in 2010 (full year) versus 2018



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

(through the third quarter) at four key USGC refining centers: Corpus Christi, Houston/Texas City/Sweeny, Port Arthur/Lake Charles, and Southeast Louisiana. Some key observations are:

1. USGC refineries increased total crude oil input by 1.2 MMB/d between 2010 and 2018, with increases seen in each of the region's four refining centers. The surge in throughput, which is almost equal to the entire refining capacity of the Northeastern U.S., came through a combination of capacity additions and increased utilization. (Note that these throughput increases do not include new, standalone condensate splitters in Corpus Christi and Houston.)
2. The share of domestically produced crude oil has also increased in each location (red bar segment as a proportion of total input), and currently makes up 57% of the USGC crude diet (vs. 23% in 2010). This domestic crude oil is predominantly light sweet grades from the Permian and Eagle Ford, with smaller amounts from the Bakken and the Niobrara. Crude imports into the USGC dropped by about one-third, from 5.1 MMB/d to approximately 3.4 MMB/d.
3. The resultant average crude quality (expressed as API gravity) has become lighter in each refining center (Figure 3, black lines, right axis). Corpus Christi, where two refiners made investments to handle large amounts of Eagle Ford crude, saw the largest API gravity increase (from 31.8 to 38.5 degrees). The Houston area, which has become well connected to most shale production areas, had the second-largest increase in API gravity.

Changing Quality of USGC Refinery Crude Oil Inputs, 2010 – 2018 YTD

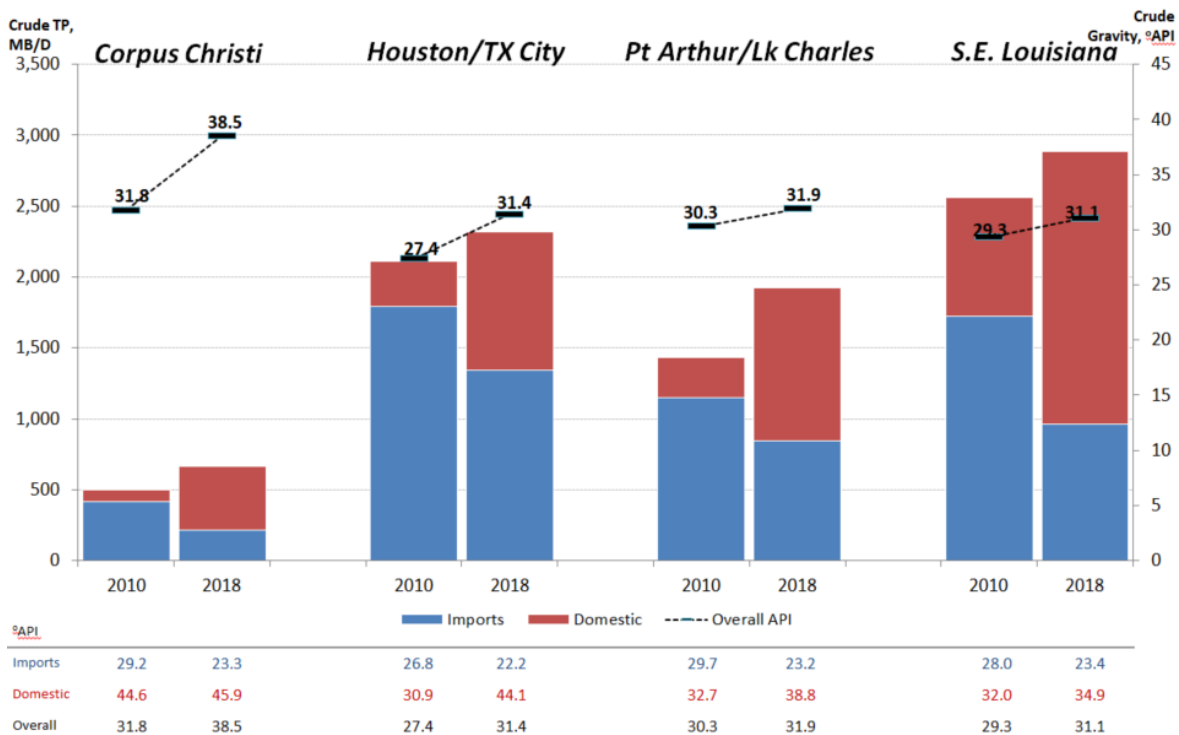


Figure 3. Sources: Baker & O'Brien and EIA.



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

Could USGC refineries process even more domestically produced light sweet crude oil? Perhaps, but the light-end systems (naphtha and lighter) in many Texas coastal refineries are probably near their physical limits and increases in light sweet crude runs could result in decreases to overall refinery utilization. Therefore, any material increases in light sweet crude oil processing capacity would require significant capital investment (e.g., pre-flash towers, new distillation capacity, saturated gas plant expansions). To remove these light-end mechanical constraints, the economics of running lighter grades and displacing heavier grades, with the resultant under-utilization of fluidized catalytic cracking units (FCCs) and cokers, would have to be compelling. Further, in order to incentivize the capital investment required to process more of these light grades, the reduction in conversion margin (i.e. reduced net output) would have to be reflected in a lower price for domestic sweet grades such that gross refinery realization would not suffer. Said another way, it's only worth the refiners' while to make a change if they end up making more money in the long run.

There are a couple of upcoming projects that could incrementally increase domestic light crude oil processing along the USGC include: 1) the start-up of the Lake Charles-to-St. James (LA) section of Energy Transfer Partners and Phillips 66 Partners' 480-Mb/d Bayou Bridge pipeline in early 2019. (The Nederland-to-Lake Charles part of Bayou Bridge went into service in April 2016.) This will enable more light sweet crude to flow to the St. James hub, which connects to a number of Louisiana refineries and further increases import displacement in that region; 2) the potential expansion of ExxonMobil's Beaumont refinery, assuming it is built to process domestic light sweet crude oil. While each of these two projects provides an incremental step-change in USGC domestic light crude processing, they come nowhere near the projected incremental production that will flow to the USGC once new pipelines are online.

In general, USGC refiners will be hard-pressed to keep up with increasing U.S. production of light sweet crude. As a result, incremental production in the red-hot Permian is increasingly heading onto the water and is spurring numerous crude oil export projects. There are certain regions, such as Europe that will be looking for more light, sweet crude oil with IMO 2020 — the International Maritime Organization's mandate for much lower sulfur emissions from international ships — looming, since their refining configurations generally do not lead to full conversion of the heavy end of the barrel. At the same time, USGC refineries may back off on domestic light sweet processing as they become incentivized to process heavier grades, potentially leading to a partial reversal of the trends highlighted in Figures 2 and 3.

"Darkness into Light" is a track on reggae singer Matisyahu's third studio album, Light, which was released in 2009. Matisyahu, which is Hebrew for "gift of God," is the stage name of Matthew Paul Miller, a Jewish-American reggae singer, rapper and beatboxer. Miller also performed for more than a year under the name MC Truth. Matisyahu to date has released six studio albums and four live albums, including two recorded at Stubb's Bar-B-Q in Austin, TX.

Note: The article was authored by Amy Kalt of Baker & O'Brien and published on RBN Energy's Daily Energy Post on November 1, 2018.

This article is copyrighted © 2018 by Baker & O'Brien, Inc. and publication or distribution of this article without the express written consent of Baker & O'Brien, Inc., is prohibited.