

REFINING INDUSTRY IN FOCUS

Baker & O'Brien, Inc.

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Q3 2020

Baker & O'Brien and RBN Energy announce the launch of *U.S. Refinery Billboard*



Baker & O'Brien, Inc. and RBN Energy are pleased to announce the launch of the *U.S. Refinery Billboard*, a one-of-a-kind, weekly review of refining industry operations and economics. This report provides key market insights for U.S. refinery activity, performance, and impacts on market fundamentals and economics. The *U.S. Refinery Billboard* provides a comprehensive data set of regional crude and refined product price spreads, crude oil netbacks,

and indicative margins for refineries leveraging Baker & O'Brien's *PRISM*[™] refinery modeling system.¹ For pricing and subscription information, please visit RBN Energy [here](#).

Q3 2020: U.S. Refining Margins Driven Downward by COVID Impact

Houston, November 16, 2020

Baker & O'Brien, Inc.'s third quarter 2020 *PRISM* update highlights the continued decline in U.S. refining cash margins during the COVID pandemic. Compared to 20Q2, three PADDs saw lower cash margins compared with little change in PADD 2 or PADD 4 margins. The U.S. lock down in

20Q2 led to historically high inventories of refined product as refiners adjusted to curtailed demand for products. While demand for gasoline and diesel fuel were near or within historical ranges during 20Q3, jet fuel demand remained weak at about 60% of historical levels. When compared to the previous

PRISM Cash Margins vs. Previous Periods (\$/Bbl.)

	<u>20Q3 vs 20Q2</u>	<u>20Q3 vs. 19Q3</u>
PADD 1	-4.95	-13.14
PADD 2	0.49	-12.49
PADD 3	-3.27	-10.94
PADD 4	0.17	-13.92
PADD 5	-2.28	-10.27
U.S. Overall	-2.17	-11.36

year 19Q3, double-digit declines in cash margins spotlight the dramatic impact of the COVID pandemic on refining industry cash margins.

With implementation of the IMO 2020 sulfur specifications in January 2020, the switch from HSFO to VLSFO marine fuels was expected to result in increased light-heavy spreads and improved economics for coking refineries. However, the impact of COVID on demand has been so overwhelming that the light-heavy spread was below that in 2019. As illustrated in the table

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below, the 20Q3 LLS – Maya price differential has declined by \$1.40/Bbl compared to the average for 2019 and almost \$2.50/Bbl from the previous quarter. The depressed LLS–Maya differential contributed to the continued decline in PADD 3 margins in 20Q3.

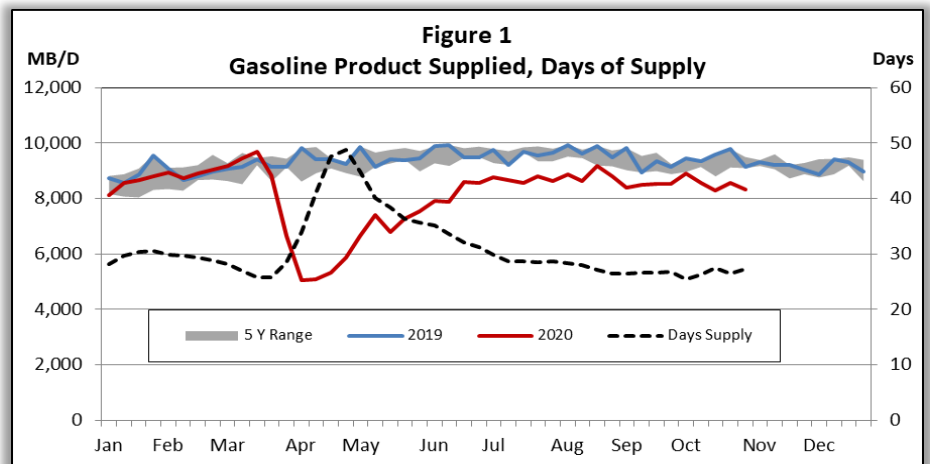
Key Refining Margin Metrics, \$/Bbl.					
	2020 Sept.	2020 Q3	2020 Q2	2019 Annual	2018 Annual
WTI	39.59	40.91	27.80	57.02	64.92
LLS	41.03	42.47	30.07	62.67	69.96
Brent	40.82	43.02	28.69	64.29	71.06
LLS – Maya	3.06	3.27	5.66	4.67	7.49
USGC LLS 321	6.88	6.66	5.88	10.82	11.29
USGC LLS 6321	5.26	5.21	4.56	7.91	8.27
Chicago WTI 321	8.27	9.14	7.96	17.54	17.40

Overall refined product inventories have fallen from their mid-summer peaks but still remain relatively high in a weak margin environment. With the return of gasoline and diesel fuel demand and drawdown of inventories, refinery margins may have reached a bottom. In this month's Special Topic, we review how oil refineries are adjusting to the demand rebound and inventory situation over the past few months.

Special Topic: The Endless Summer for U.S. Refiners

In our previous *PRISM* Newsletter Special Topic, we addressed the devastating consequences of the COVID pandemic on demand for transportation fuels. In this Special Topic, we consider the dilemma confronting refiners regarding the misalignment of refined product inventories with demand and refinery utilization.

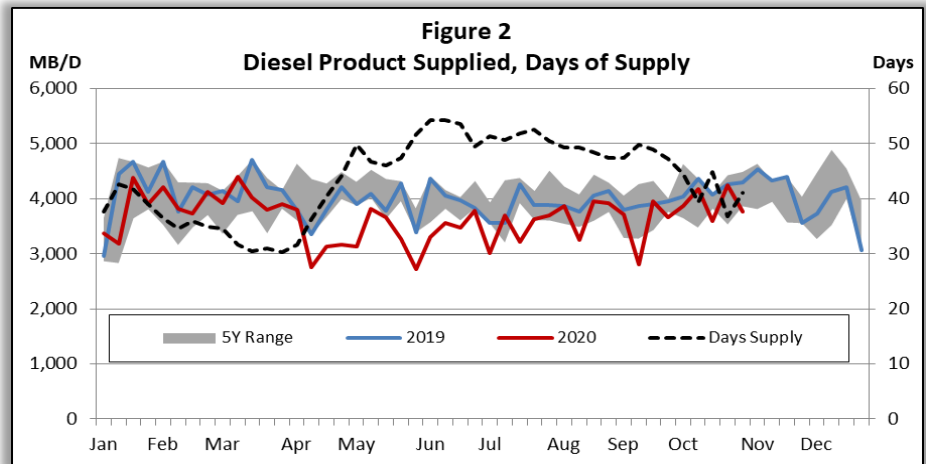
U.S. demand for gasoline has been above 8 million B/D since June (**Figure 1, red line**). While not at pre-pandemic levels (**blue line**) or even above five-year lows, 2020 gasoline demand has increased to about 90% of 2019 demand during 20Q3. Cuts in



refinery crude runs have helped to offset the huge increase in gasoline inventories (indicated as

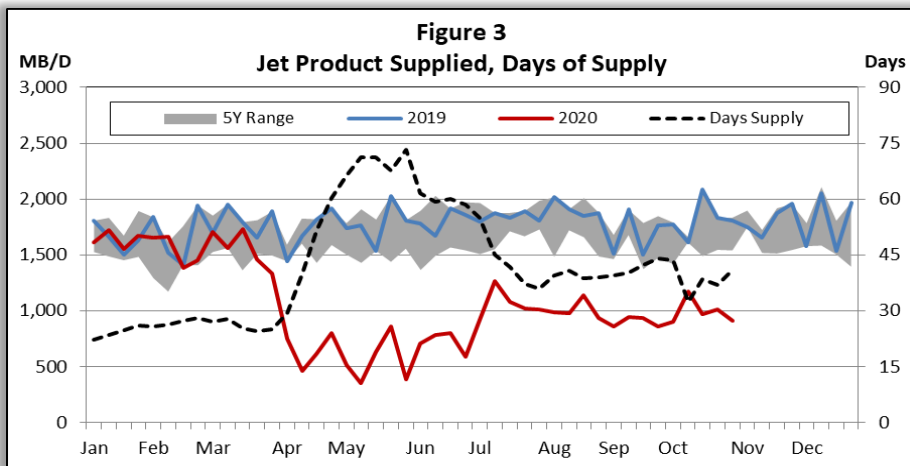
Days of Supply, right axis) seen at the onset of quarantine measures. Continued low refinery utilization and the recovery in demand have worked the Days of Supply down to less than 30 days, levels last seen prior to the pandemic-related lockdowns.

U.S. demand for diesel has gradually trended upwards since June, as freight markets have remained relatively strong (Figure 2). After a slight demand lull during the summer, diesel consumption and inventories have recovered to their five-year ranges. Diesel fuel Days of Supply have also trended downwards from a peak of about 55 days to near 40 days.



However, despite recovery in demand for gasoline and diesel fuel, refinery margins and utilization rates remain stubbornly low. What is happening?

The main issue is jet fuel supply (Figure 3). With air travel still severely limited, jet fuel demand remains at about half of pre-COVID levels and is not showing any signs of further recovery.

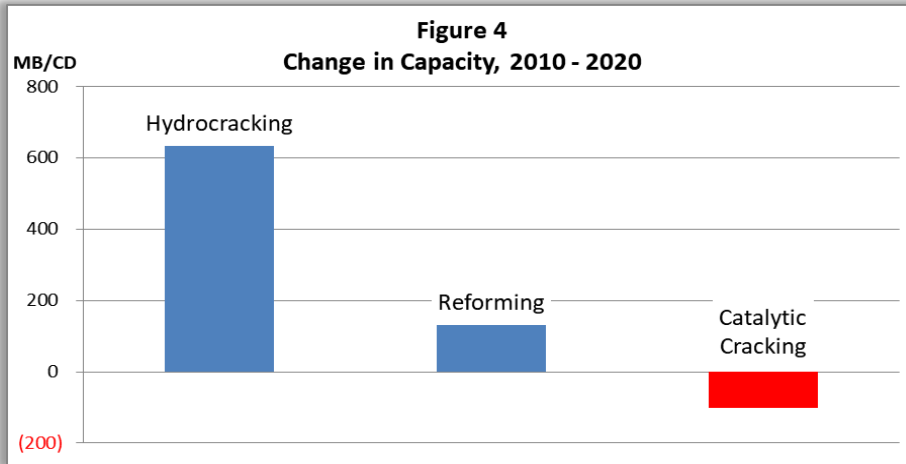


Since there has been little improvement in the market for jet fuel, refiners must blend it into diesel fuel. Our PRISM analysis indicates that about 50% of the jet fuel can be blended into diesel. The primary constraint is the sulfur specification for ULS diesel fuel, which limits the amount of untreated

jet that can be blended. Unfortunately, the increased yield of diesel fuel continues to suppress refinery utilization rates, as refiners work to keep jet and diesel inventories in balance.

For refiners, this change in demand for jet fuel inconveniently comes after nearly a decade of investment to increase distillate production. Based on the outlook for better margins, attractive export markets, and increasing demand for jet fuel and diesel fuel, U.S. refiners have increased

hydrocracking capacity by more than 630 MB/CD since 2010 (**Figure 4**). By comparison, increases in catalytic reforming and catalytic cracking capacity to produce gasoline have amounted to only a net 28 MB/CD. The COVID market has essentially flipped the demand trends for gasoline and



distillates of the past 10 years, with refiners now needing to minimize distillate production while meeting the recovering demand for gasoline.

Most refiners have a limited number of "dials" they can turn to optimize their product slates between gasoline

and distillate production. Operators can adjust the throughput and operating severity of major conversion units. They can select feedstocks that yield more or less distillate. They can adjust distillation "cuts" within limits to favor gasoline or distillate production. They can also supply non-traditional markets, such as blending distillate into marine fuels. However, the combined impact of all of these changes is ultimately limited by each refinery's fixed equipment and configuration. Our analysis indicates that the typical refinery can "swing" gasoline and distillate yields by only 5%–7% of total crude oil throughput.

All of this leaves U.S. refiners with limited options until demand for gasoline and jet fuel return to historical trends. It does not appear that export markets, the traditional path to "clear" excess distillate, have absorbed the additional volume. Alternative markets for diesel (heating oil, marine fuel oil, and power production) are relatively limited. Fall may have arrived, but U.S. refineries are likely to remain stuck in "summer mode" to produce maximum gasoline and minimum distillates, possibly through the coming winter. A cold winter and a strong heating oil season could provide some relief. However, a further wave of COVID lock-downs and low refining margins could result in continuing low refinery capacity utilization. With one of the largest markets in the global refining industry, the response of U.S. refiners will have knock-on effects in crude oil and refined product markets around the world.

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About Baker & O'Brien

Baker & O'Brien is an independent professional consulting firm specializing in technology, economics, and management practice for the international oil, gas, chemical, and related industries. With offices in Dallas, Houston, and London, the firm assists clients with strategic studies, mergers and acquisitions, and technology evaluations. The firm also provides expert services to support insurance claims, investigate operating incidents, and support a wide range of commercial and construction disputes in the energy industry.

About *PRISM*

Baker & O'Brien's *PRISM* software is used to perform detailed analysis of individual refineries and the refining value chain from crude oil load port to products truck rack. The system combines a large historical database with a robust refinery simulator to provide analytical support to competitive assessments, strategic planning, crude oil valuation, and delivered cost of supply. The *PRISM* database currently includes operational and economic performance details for all refineries in the U.S. and Canada, most refineries in Europe, and over 50 refineries in the Asia Pacific region. The *PRISM* system is available for license and is used in consulting assignments for Baker & O'Brien clients.

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