

REFINING INDUSTRY IN FOCUS

Baker & O'Brien, Inc.

www.bakerobrien.com

Q1 2021

Q1 2021: U.S. Refining Margins Show Signs of Improvement

Houston, June 8, 2021

Baker & O'Brien, Inc.'s Q1 2021 *PRISM*™ update showed that the United States (U.S.) refining margins improved substantially from the prior quarter. Average U.S. oil refining cash margins for the quarter were \$2/Bbl. to \$5/Bbl., above breakeven levels for all of the U.S. PADDs and providing some needed improvement for those refiners that were spared from the widespread disruption caused by Winter Storm Uri.

Total demand for gasoline, jet fuel, and diesel fuel remained below pre-COVID-19 levels and fell 1.2% from the prior quarter. Diesel demand recovery was once again a bright spot, improving by 1.1% over the prior quarter, but there was little improvement in demand for gasoline and jet fuel. As the economy reverts to normal activity with the COVID-19 vaccine rollout, there is optimism in the market that gasoline and jet fuel demand will recover, resulting in continued improvement in refining margins.

When comparing the Q1 2021 oil refinery cash margins to the same quarter a year ago, the margins are lower, with the exception of PADD 1. However, margins appear to have stabilized, and this year-on-year decline is generally less than trends reported since the start of the COVID-19 pandemic.

Most of the Key Refining Margin Metrics showed a marked improvement from the prior quarter. Crack spreads showed substantial improvement despite the crude oil prices being higher during the quarter. The LLS - Maya light-heavy spread showed little change from the prior quarter, which continues to be a disadvantage for coking refineries.

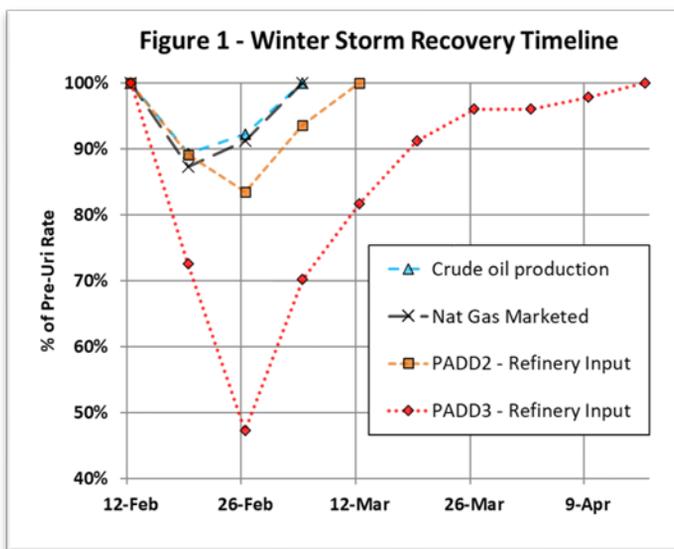
	Q1 2021 vs. Q4 2020	Q1 2021 vs. Q1 2020
PADD 1	5.24	2.45
PADD 2	5.48	-1.25
PADD 3	3.98	-2.56
PADD 4	4.74	-4.66
PADD 5	2.65	-3.74
U.S. Overall	4.27	-2.23

	Apr 2021	Q1 2021	Q4 2020	2020	2019
WTI	61.85	57.78	42.56	39.30	57.02
LLS	63.87	59.91	44.06	41.20	62.67
Brent	64.69	60.82	44.09	41.50	64.29
LLS - Maya	4.65	3.57	3.50	4.88	4.67
USGC LLS 321	16.63	12.06	6.61	7.09	10.82
USGC LLS 6321	12.03	8.69	5.01	5.45	7.91
Chicago WTI 321	21.61	13.08	7.23	8.38	17.54

Special Topic: Winter Storm Uri—A Storm As Big As Texas

Winter Storm Uri brought much of the U.S., Canada, and Northern Mexico to a standstill between February 13 and 17, 2021. The arctic blast swept in from the Pacific Northwest and progressed through the mid-continent and ultimately exited the East Coast, bringing record snowfall and cold temperatures that interrupted electrical power, heat, and water supplies for millions of people. Texas was hit particularly hard, resulting in one of the largest blackout events in modern U.S. history.

The refining industry was not spared from the impacts of Winter Storm Uri. Across the U.S., facilities were forced to shut down due to mechanical failures, lack of natural gas for fuel, lack of crude oil supply, and electrical grid issues.



The storm affected upstream and downstream operations across the Midwest (PADD 2) and the Gulf Coast (PADD 3) regions of the U.S. Figure 1 charts the weekly impact on refinery crude runs in these regions, as well as on the total U.S. oil and gas production in the Lower 48.

Although Winter Storm Uri came and went in just a few days, oil industry recovery efforts took weeks. Two weeks after the storm hit, refinery input had fallen by approximately 17% in PADD 2 and by 53% in PADD 3, with most of the refinery outages

occurring in Texas. By some estimates, as much as 5 million barrels per day of refining capacity in the Gulf Coast was forced offline at the peak of the disruption.

Figure 1 also shows that oil refining took a longer time to recover than oil and gas production, due to repairs that had to be made to facilities and the length of time required to safely re-start units. PADD 2 refineries did not achieve pre-storm inputs for four weeks after the storm, while PADD 3 refineries required a further five weeks to fully recover. The total lost refinery production in PADD 3 over the 9-week period beginning February 12 was approximately 89 million barrels, which equates to about 10 days of lost PADD 3 refining capacity.

An interesting aspect of the refinery outages from Winter Storm Uri is that the impact on oil refining was comparable to outages following major hurricanes, as shown in the figures below.

Figure 2 ranks the impacts of major storms on PADD 3 refineries by comparing the difference between peak inputs preceding the storm to the lowest inputs following the storm. On this basis, Winter Storm Uri was the worst storm to hit PADD 3 in the past 20 years, with refinery runs falling over 4.5 million barrels per day. Its impact was so large because the storm affected a vast area, shutting down refineries across the entire Gulf Coast and the Midwest. Conversely, hurricanes are generally more disruptive to specific geographical areas.

Figure 3 ranks the impacts of major storms by comparing the total lost refinery runs in PADD 2 and PADD 3 following each of them. Refinery inputs were reduced by just under 100 million barrels before returning to pre-storm levels in the aftermath of Winter Storm Uri. The only two hurricanes in the past 20 years that ranked higher were Katrina and Rita in 2005. While it took nine weeks for refineries to return to pre-storm rates after Winter Storm Uri, Hurricanes Katrina and Rita caused much longer outages due to flooding and extensive repairs to Gulf Coast refineries.

Winter Storm Uri wreaked havoc on the lives of many people and the U.S. refining industry at a scale that is comparable to some of the worst hurricanes in the past 20 years. The lost production resulting from the storm highlighted the extent to which oil refineries are reliant on the external supply of gas and electricity. Despite the hardships placed by Winter Storm Uri on the facilities and the people that operate them in the midst of the COVID-19 pandemic, refining operations were able to recover relatively quickly and safely to pre-storm levels once utilities were restored and start-up sequences were completed.

As a reminder, hurricane season opened June 1 and is predicted to be an active season this year, producing three to five major hurricanes.

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Figure 2 - Pre-Storm High to Post-Storm Low Gross Inputs in PADD 3

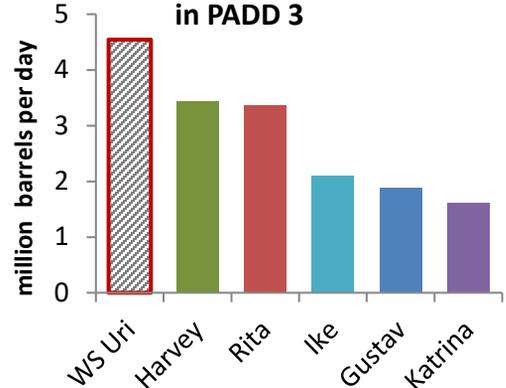
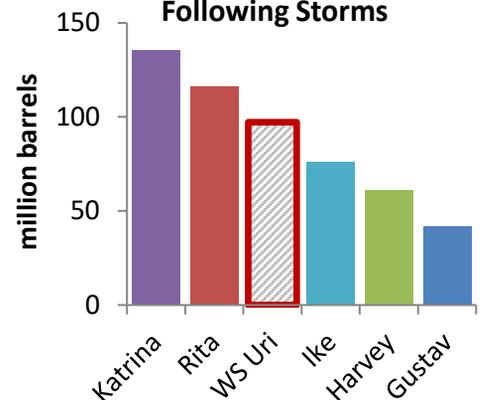


Figure 3 - Lost Production Capacity in PADDs 2 and 3 Following Storms



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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