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Q3 2019: U.S. Refining Margins Move Downward

Special Topic: Renewable Diesel: The wave of the future?

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Baker & O'Brien, Inc.'s 19Q3 *PRISM*[1] update showed a substantial decrease in U.S. refining cash margins compared to the prior quarter. With the exception of PADD 1, all PADDs showed decreases versus the second quarter, with the biggest decreases coming in PADDs 4 and 5. PADD 1 showed a slight increase in refining margins from the prior quarter, which was buoyed by the closing of the Philadelphia Energy Solutions refinery in August as a result of an alkylation unit fire.

Much of the quarterly decline in margins can be attributed to a sharp decrease in gasoline prices in August relative to crude oil prices. Gasoline prices were down over 7% in the third quarter compared to the second quarter while crude prices declined just over 5% during this time period. Compared to a year ago, refining margins were also lower in all PADDs with the exception of PADD 5.

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

	19Q3 vs. 19Q2	19Q3 vs. 18Q3
PADD 1	0.57	-0.55
PADD 2	-2.23	-4.70
PADD 3	-1.27	-3.80
PADD 4	-2.44	-6.80
PADD 5	-5.41	0.48
U.S. Overall	**-1.96**	**-3.21**

Weekly EIA consumption data indicate a 0.1% increase in gasoline consumption compared to the prior quarter and a 0.1% increase compared to 18Q3. Conversely, distillate product demand on a quarterly basis actually declined 0.7%. The relatively flat gasoline demand coupled with slightly declining distillate product demand has resulted in much lower 321 crack spreads for the Midcontinent refiners compared to the previous quarter. The LLS – Maya price differential continued its decline and remains significantly lower than in 2018, which continues to be a challenge for U.S. Gulf Coast coking refineries.[2]

[1] *PRISM*™ is Baker & O'Brien's refinery modeling and database system that includes operational and economic performance details for refineries in the U.S., Canada, Europe, and Asia.
[2] Note that PEMEX recently adjusted the formula for Maya crude pricing effective in December 2019.

Key Refining Margin Metrics, $/Bbl.

	2019 Sept.	2019 Q3	2019 Q2	2018 Annual	2017 Annual
WTI	56.94	**56.46**	59.81	64.92	50.87
LLS	60.59	**60.67**	66.94	69.96	54.11
Brent	62.76	**62.00**	68.85	71.06	54.26
LLS – Maya	1.68	**2.22**	5.07	7.49	7.01
USGC LLS 321*	12.44	**13.66**	12.19	11.29	13.34
USGC LLS 6321**	9.11	**10.25**	9.34	8.27	9.86
Chicago WTI 321***	15.28	**18.86**	24.70	17.40	17.71

** LLS deemed conversion to 67% conventional 87R gasoline and 33% ULSD*

*** LLS deemed conversion to 50% conventional 87R gasoline, 33% ULSD and 17% Fuel Oil*

**** WTI deemed conversion to 33% conventional 87R gasoline, 33% RBOB and 33% ULSD*

Special Topic: Renewable Diesel: The wave of the future?

Alternative energy production continues to be a key area of interest around the globe as policy makers and the consumers they support push towards renewable fuel requirements. In the U.S., the Renewable Fuel Standard (RFS) was implemented as part of the Energy Policy Act of 2005 and expanded by the Energy Independence and Security Act of 2007. The RFS requires increasing amounts of renewable fuels to be part of the transportation fuel pool to meet these goals. These renewable fuels have historically included ethanol and biodiesel, but the latest commodity that is piquing the interest of the fuel supply industry is renewable diesel.

Like biodiesel, renewable diesel can be sourced from lipids (typically vegetable oil, waste cooking oil, animal fats, etc.) and has a lower carbon intensity (CI)[3] versus petroleum-based diesel; however, the manufacturing processes, thus the chemical structure, for the two fuels are different. Renewable diesel is produced by a few different processes. The most common is with hydrogen addition (hydrotreating), which transforms the renewable feedstock to be chemically similar to petroleum-based diesel; therefore, it can be used as a direct "drop-in" substitute that does not typically have a blending limit. In contrast, the manufacture of biodiesel involves a process called transesterification that transforms the lipids into fatty acid methyl esters (FAME), which are not chemically similar to petroleum-based diesel and are typically subjected to blending limits of 5%-20% (less in colder climates) due to poor cold-flow properties (e.g., pour point, CFPP) that can lead to plugging in fuel systems.

[3] Each renewable diesel fuel source has a unique CI based on carbon life-cycle analysis and certification including the feedstocks and manufacturing process.
California Resource Board LCFS Pathway Certified Carbon Intensities
Carbon Intensity Records under the Renewable and Low Carbon Fuel Requirements Regulation

Renewable Diesel Demand

Renewable diesel demand is expected to grow significantly over the next few years due to legislative changes, such as the RFS, Low Carbon Fuel Standards (LCFS), and the newly proposed Canadian Clean Fuels Standard (CCFS).

Renewable volume obligations (RVO) under the RFS are steadily increasing with biomass-based diesel (majority of renewable diesel is included in this category) predicted to have the largest increase over the past four years, 330 million gallons per year (mmgpy), from 2019 to 2020. To meet the increasing RVO, a refiner can either blend higher amounts of biofuels to generate the renewable identification numbers (RINs) or purchase the RINs. Renewable diesel allows refiners/blenders to generate RINs at a higher rate since renewable diesel has a higher RIN equivalent value (1.6-1.7) versus biodiesel (1.5) or ethanol (1.0) and can also be blended in higher percentages due to its chemical structure.

Final Volume Requirements for 2017 - 2020[a]

	2017	2018	2019	2020
Cellulosic biofuel (million gallons)	311	288	418	n/a
Biomass-based diesel (billion gallons)	2.0	2.1	2.1[b]	2.43
Advanced biofuel (billion gallons)	4.28	4.29	4.92	n/a
Renewable fuel (billion gallons)	19.28	19.29	19.92	n/a

[a] All values are ethanol-equivalent on an energy content basis, except for BBD which is biodiesel-equivalent.
[b] The 2019 BBD volume requirement was established in the 2018 final rule.

Source: EPA

LCFS in California (2011), British Columbia (2010), Oregon (2016), and pending legislation in Washington State, command increasing volumes of low CI fuels to meet the CI targets on the West Coast. Renewable diesel generates LCFS credits, which are attractive to producers and blenders on the West Coast, as they participate in the LCFS program.

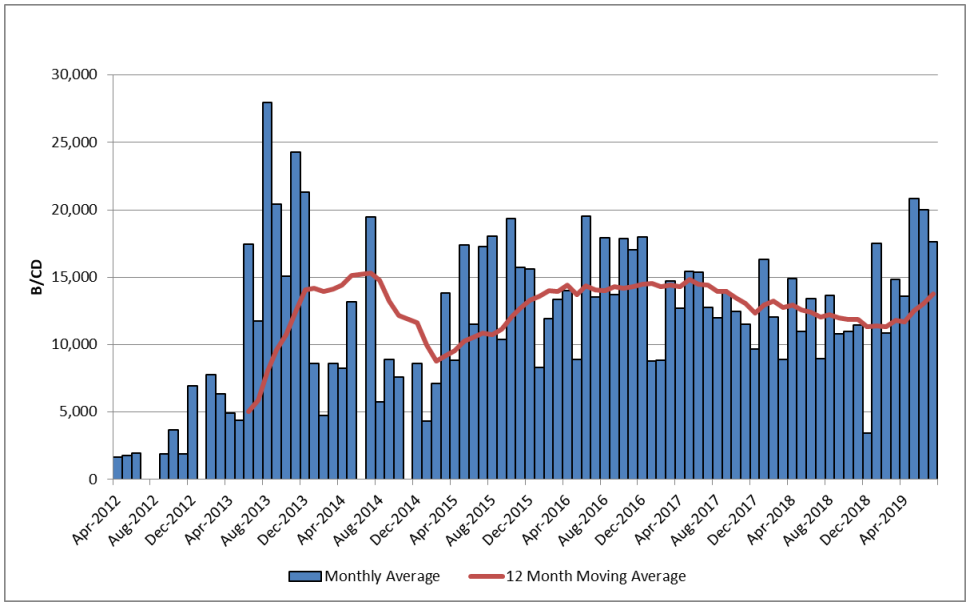
The proposed national CCFS [4] is much like the LCFS programs on the West Coast. It mandates a reduction in the CI of fuels produced in refineries by 10%-12% by 2030 starting in 2022.[5] As with the LCFS and RFS, compliance options are limited and most likely will result in blending a higher proportion of renewable diesel.

[4] Clean Fuel Standard-Proposed Regulatory Approach, Environment and Climate Change Canada, June 2019.
[5] 10 grams of CO2 equivalent per metric tonne (gCO2e/MT) decrease between 2022 and 2030 starting with a 3.6 gCO2e/MT reduction in 2022.

Capacity Build-out

The current demand for renewable diesel in the U.S. is met from production in the U.S. Gulf Coast, the Midwest, and by imports. Through 2019, all imports of renewable diesel into the U.S. have been destined for the West Coast. Canadian imports of renewable diesel have been imported into both the East Coast (from Europe) and West Coast (from Singapore).[6]

Figure 1
Renewable Diesel Imports

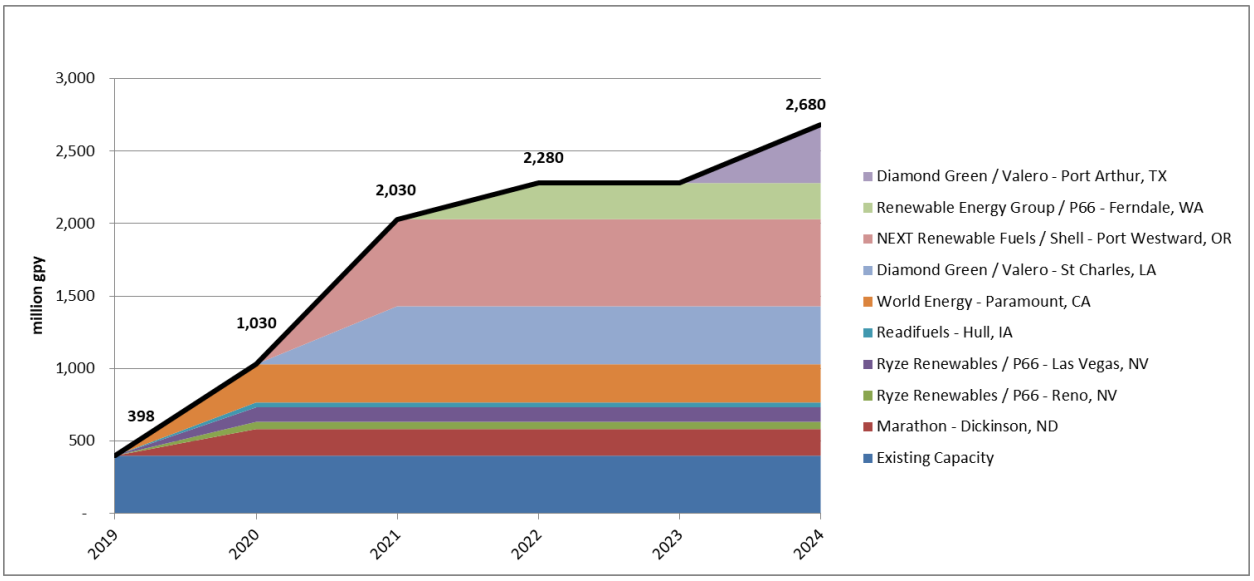


Source: EIA

With demand projected to grow, renewable diesel capacity in the U.S. is set to expand over the next few years. By Baker & O'Brien's estimation, proposed or under construction renewable diesel and jet fuel capacity scheduled to go online in the U.S. by 2024 is more than 2,200 mmgpy from the current 398 mmgpy stand-alone capacity.[7] The new total renewable diesel capacity of 2,680 mmgpy (175 thousand barrels per day) represents approximately 4% of the U.S. diesel supplied,[8] with the majority of the new capacity being built through partnerships with refining companies. Canada does not currently produce renewable diesel,[9] but several projects are in the early stages of development and will be required to meet the proposed CCFS.

[6] Advanced Biofuels Canada, Written Submission for the Pre-Budget Consultations in Advance of the 2019 Budget, August 2018.
[7] EIA capacity – Includes 42 mmgpy of jet fuel.
[8] Based on average 4.1 million barrels per day January-August 2019, EIA U.S. Product Supplied of Distillate Fuel Oil.
[9] Canada Biofuels Annual 2019, USDA Foreign Agricultural Service, July 7, 2019.

Figure 2
Projected U.S. Renewable Distillate Production



Sources: News Articles, Press Releases, and Baker & O'Brien estimates

In short, renewable diesel is a "dead-ringer" for petroleum-based diesel but sourced from agricultural and food waste – doesn't that sound like something that is here to stay?

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 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.

Contact: Kevin Milburn
(832) 358-1453
kevin.milburn@bakerobrien.com