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Q1 2018: Refining Margin Improvement Dominated by West Coast Refiners

Special Topic: IMO 2020 – Part 1 – Y2K for U.S. Refiners?

Houston, May 8, 2018

Baker & O'Brien, Inc.'s 18Q1 release to *PRISM*[1] subscribers reflects modest changes in refining cash margins in most regions compared to the prior quarter. Three of five PADDS showed slight quarterly declines. West Coast (PADD 5) refiners, however, experienced a $3.40/Bbl. improvement from the prior quarter.

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

	18Q1 vs. 17Q4	18Q1 vs. 17Q1
PADD 1	-0.04	1.74
PADD 2	-0.20	5.33
PADD 3	0.26	0.29
PADD 4	-0.74	4.33
PADD 5	3.40	5.00
U.S. Overall	**0.62**	**2.36**

Comparing Q1 results with a year ago, higher margins were prevalent throughout the U.S., with significant improvements in PADDs 2, 4, and 5.

Looking at the major indicators of refinery profitability in the table below, the USGC LLS 321 crack spread was essentially unchanged (up $0.17/Bbl.) from the previous quarter. Conversely, the Chicago WTI 321 crack spread decreased by over $7/Bbl. in 2018Q1. The major drivers for this decline were the narrowing of the WTI and LLS differential and weakening in Chicago product prices relative to the USGC. The WTI price discount to LLS decreased by almost $3/Bbl. from 2017Q4 to 2018Q1. For coking refineries, the heavy/light crude oil price differential remained essentially unchanged during 2018Q1 despite increasing LLS prices. Comparing 2017 to 2016, the USGC and Chicago crack spreads as well as crude oil prices increased across the board, although the heavy/light differential shrunk.

Key Refining Margin Metrics, $/Bbl.

	2018 March	2018 Q1	2017 Q4	2017 Annual	2016 Annual
WTI	62.77	**62.89**	55.32	50.87	43.24
LLS	65.14	**65.83**	61.03	54.11	44.92
Brent	65.89	**66.80**	61.37	54.26	43.72
LLS – Maya	8.28	**8.17**	8.34	7.01	8.50
USGC LLS 321*	12.27	**12.12**	11.95	13.34	10.66
USGC LLS 6321**	8.52	**8.46**	8.60	9.86	6.60
Chicago WTI 321***	13.02	**14.20**	21.44	17.71	14.26

** 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*

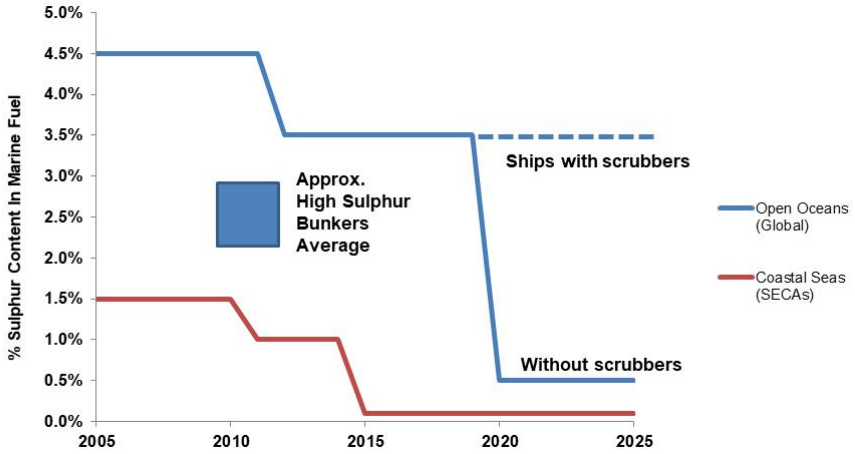
Special Topic: IMO 2020 – Part 1 – Y2K for U.S. Refiners

Have you noticed that International Maritime Organization (IMO) 2020, the impending clean fuels regulations to reduce the sulfur content in the "default" marine bunker fuels from 3.5wt% to 0.5wt% (see Figure 1), has become firmly embedded in the staple diet of the refining conference circuit?

[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.

Over recent months, you may also have noted that refinery commentators discussing IMO 2020 have suggested "chaos" is just around the corner for an industry that is usually the becalmed epitome of conservatism and restraint. Or perhaps, you have encountered technology providers declaring that refiners are being complacent in reducing their MARPOL[2] exposure, as they let the cut-off date sail by for serious heavy oil upgrading and sulfur removal investments that would eliminate high sulfur residual fuel production.

FIGURE 1
RESIDUAL FUEL OIL SULFUR SPECIFICATION HISTORY



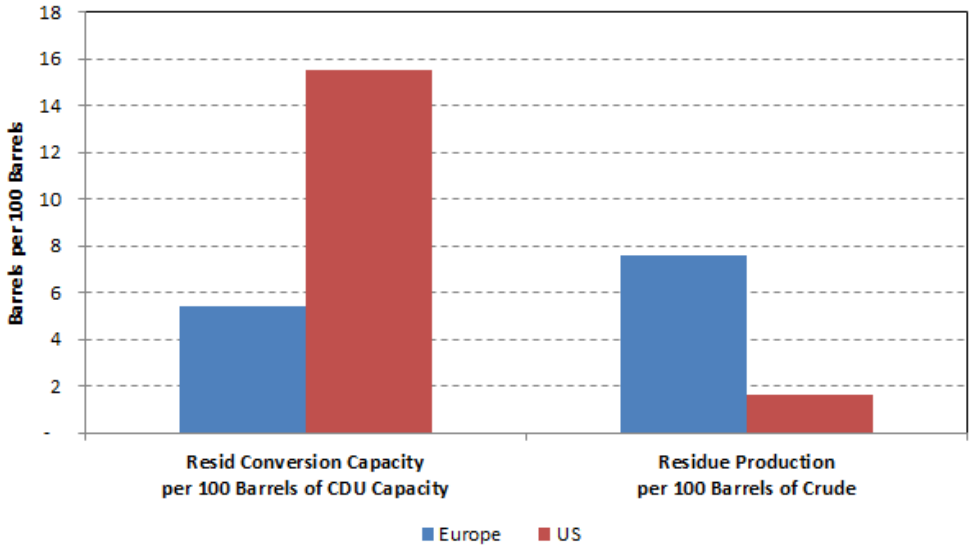
Sources: International Maritime Organization; *PRISM*

Granted, MARPOL is different than the prior automotive ultra clean diesel and gasoline transportation regulations, where only refiners were mandated to provide the solution. Arguably, the shippers and refiners are playing out a high stakes poker game to see who will blink first and invest. However, you may recall the "Y2K" fears in 1999 and how this mostly turned out to be a non-event for businesses. So, could MARPOL 2020 be another Y2K event for U.S. refiners?

We thought we would take a closer look by comparing various features of the U.S. and European refiners. Figure 2 shows that U.S. refineries have three times the installed base of heavy oil upgrading capacity relative to the crude unit capacity and produce approximately four times less heavy residual fuel oil per barrel of crude processed.

[2] The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.

FIGURE 2
COMPARISON OF U.S. AND EUROPEAN HEAVY OIL CONVERSION CAPACITY AND PRODUCTION

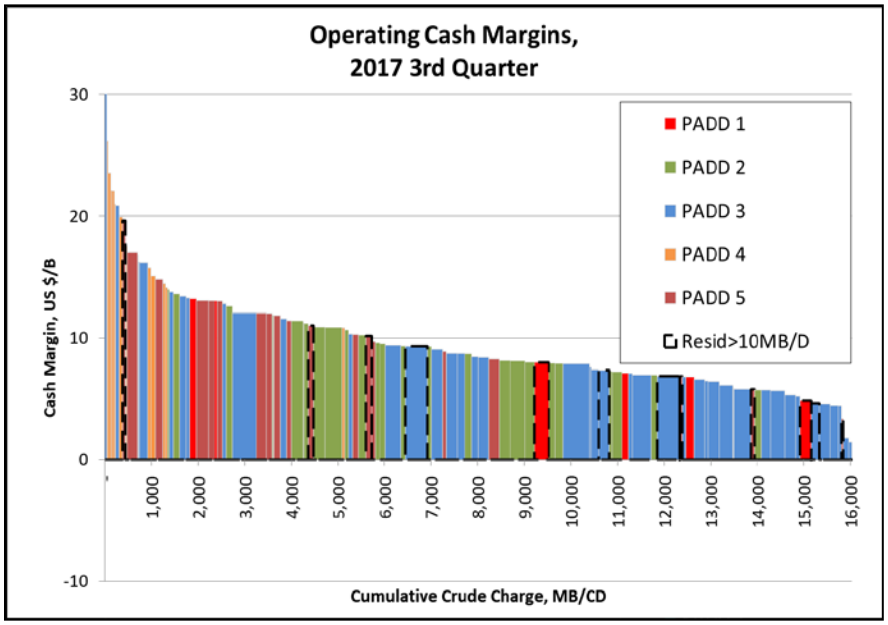


Source: *PRISM*

We then looked at the number of refineries producing more than a threshold level of 10,000 barrels per day (B/D) of high sulfur residual fuel oil. Refineries producing more than this threshold are shown below in the cash margin "piano" charts for refineries in the U.S. (Figure 3, black dashed outline) and Europe (Figure 4, green columns). The contrast between the U.S. and Europe is visually stark: in the U.S., only a small minority of refiners exceeds the 10,000 B/D residual fuel oil production threshold, whereas in Europe, the vast majority exceeds it.

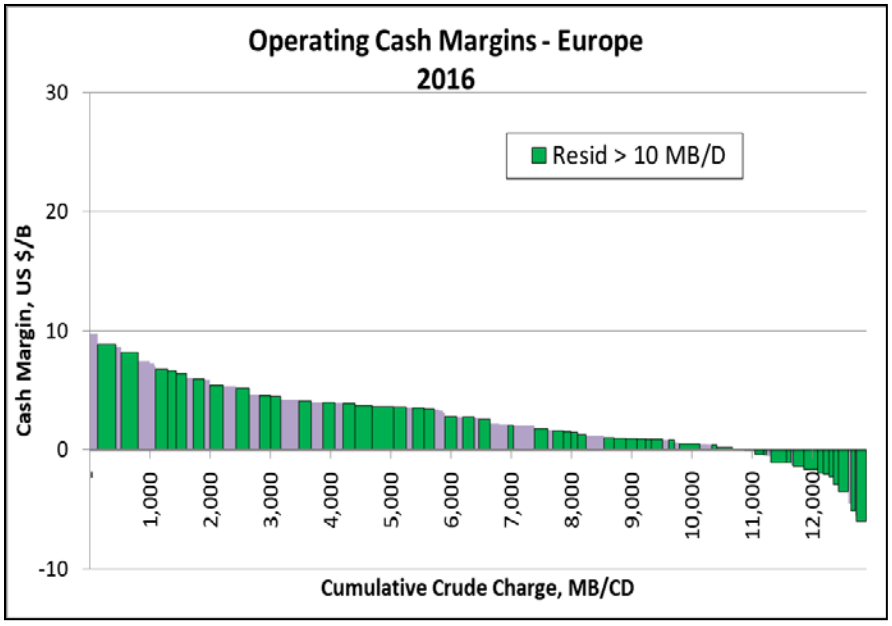
As refiners also have a number of operational levers at their disposal to soften the impact, in our view, MARPOL 2020 is likely to be another Y2K for the U.S. refining sector. However, across the Atlantic, European refiners look distinctly exposed. Although we have noted that a number of heavy oil upgrading unit projects in Europe have recently been announced, overall the response looks muted. So, are European refiners being complacent? Is heavy oil upgrading investment in Europe really a strategic necessity or is it a debt liability in a declining transportation fuels market? We will take a closer look when our European update is released in July.

FIGURE 3
U.S. REFINING MARGIN COMPARISON



Source: *PRISM*

FIGURE 4
EUROPEAN REFINING MARGIN COMPARISON



Source: *PRISM*

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 focuses primarily on the downstream industry and 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.

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