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THIRD QUARTER (13Q3) U.S. REFINING MARGINS DECLINE AS INLAND CRUDE OIL PRICE DISCOUNTS SHRINK AND GASOLINE CRACK SPREADS WEAKEN

Special Topic: Gearing Up for the Light Oil Boom – PADD 3 Refinery Retrofits Underway

Houston, November 5, 2013

Baker & O'Brien, Inc.'s 13Q3 release to PRISM¹ subscribers reflects a hefty quarter-to-quarter decrease of more than \$4.50/Bbl. in average U.S. refining margins. Although all PADDs exhibited some margin decline, the effect was more pronounced in those with the heaviest exposure to discounted inland crudes—PADDs 2 and 4. The observed margin declines were largely due to continued shrinkage in the discounts for land-locked inland crude oils and a PADD-wide demand-driven weakening in gasoline crack spreads.

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

	13Q3 vs. 13Q2	13Q3 vs. 12Q3
PADD 1	-3.13	-8.35
PADD 2	-12.77	-20.16
PADD 3	-1.23	-6.62
PADD 4	-10.96	-19.00
PADD 5	-4.62	-7.30
U.S. Overall	-4.55	-8.17

As discussed in our 12Q2 release, the WTI-to-Brent discount had already begun to narrow considerably in June and July. That trend accelerated in Q3 and fell to “only” \$4.57/Bbl.—much lower than in the first half of 2013. However, compared to longer-term averages prior to January 2011, that discount still provides a significant advantage to U.S. refiners over their Brent-based European counterparts. Thus,

although U.S. refiner margins are lower this quarter, refiners in Europe appear to be in even worse shape. The continuing surge in U.S. product exports reflects this fact.

Key Refining Margin Metrics, \$/Bbl.

	2013 Sept.	2013 Q3	2013 Q2	2012 Annual	2011 Annual
WTI	106.19	105.80	94.12	94.16	95.05
LLS	108.17	109.89	104.63	111.72	112.28
Brent	111.89	110.37	102.44	111.58	111.28
LLS – Maya	9.24	10.12	6.85	12.14	13.62
USGC LLS 321*	6.82	11.23	13.03	9.81	7.12
USGC LLS 6321**	4.27	6.89	8.67	6.58	3.52
Chicago WTI 321***	14.81	17.90	33.14	29.24	25.35

*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

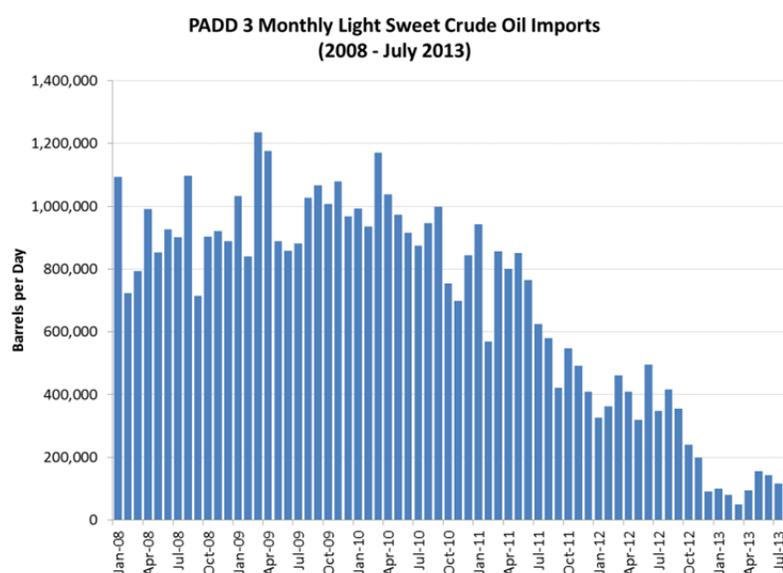
Gasoline price spreads vs. Brent declined by \$8/Bbl. quarter-to-quarter, while diesel spreads—this year's key profit-maker for most refineries—held at about the same level. Coking economics showed some modest improvement in 13Q3, driven largely by an increase in the light-heavy crude oil spread (as measured by the LLS-Maya differential) of more than \$3/Bbl.

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.

Gearing Up for the Light Oil Boom – PADD 3 Refinery Retrofits Underway

The U.S. is currently experiencing a “renaissance” in domestic light sweet crude oil production. This has created logistical challenges for producers—as well as refiners—as they seek the most cost-effective ways to move production from the wellhead to the refining centers. As these challenges have gradually been addressed through new and/or expanded pipeline or rail capacity, traditional imports of North Sea and African light sweet crude oils have declined precipitously. The chart below shows imports of light sweet crude oils into PADD 3 from Jan 2008 to Jul 2013.

With light sweet crude imports now almost totally displaced, and with expectations for expanded domestic light crude production and delivery capacity to the U.S Gulf Coast, the question becomes: In the absence of a lifting of U.S. government restrictions on crude oil exports, how will PADD 3 refiners cope with this virtual “tidal wave” of new light crude oil production?



Sources: EIA, Baker & O'Brien analysis

degrees, to be “stranded.” New investments now appear focused on how to process additional light crude oil in refineries equipped for medium or heavy grades.

Several refiners have initiated projects and are making significant investments to switch to a lighter overall crude slate. As highlighted in the table below, notable “early movers” seem to be Valero and Flint Hills. Both are making sizeable investments that will position them to make step-changes in light oil processing volumes by 2015.

It is likely that other refiners—both large and small—are considering similar changes to deal with the rising availability of economically advantaged domestic light crude oils. Since the investment costs to accommodate additional light crude oil in a heavy oil refinery are relatively much less than the converse, it seems likely almost all of the 30 or so PADD 3 coastal refineries, whatever their size, may see strong incentives for such investments. By expanding their ability to process light crude oil, refiners can export excess refined products to other markets, provided the advantages due to comparatively low crude oil and natural gas prices persist.

For more than two decades, conventional wisdom has favored refining investments to enable the additional processing of heavy, high-sulfur oils—in anticipation that a widening future light-heavy spread would justify such investments. In the past 5-7 years alone, more than \$30 billion was invested in U.S. refineries to expand capacity to process heavy crude oils from Canada and the Middle East. Now, as light oil production balloons—and heavy Mexican and Venezuelan imports are in decline—many of these investments appear, in varying

Company-Location	Investment	Timing	Notes
Flint Hills-Corpus Christi	\$250 MM	2015	Sat gas plant; new and modified tankage; only modest increase to existing capacity
Valero-Corpus Christi	\$240 MM	Late 2015	70 MB/D topping unit
Valero-Houston	\$290 MM	Late 2015	90 MB/D topping unit
Valero-McKee		Mid 2015	25 MB/D expansion
Valero-Meraux, Port Arthur			Evaluating low-cost projects to unlock light crude oil capacity
Lyondell-Houston			Minor modifications during 13Q1 turnaround to increase light crude capacity
Marathon-Texas City			Will discuss modifications at investor day meeting in December
Phillips 66-Lake Charles, Sweeny			Making modifications to enable processing of more advantaged crude oil

Source: Company Press Releases and Earnings Conference Calls. Not a comprehensive evaluation.

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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