

**BAKER & O'BRIEN**  
INCORPORATED

**Q2 2018: Refining Margins Continue Steady Move Upward**

**Special Topic: IMO 2020 – Part 2, Can European Refiners Navigate the Marine Fuel Oil Storm?**

Houston, August 1, 2018

Baker & O'Brien, Inc.'s second quarter 2018 *PRISM*<sup>1</sup> update shows continued improvement in United States (U.S.) refining cash margins compared to the prior quarter and 2017. All PADDs showed quarterly increases versus the first quarter, with the biggest increase coming in PADD 4. EIA data indicates a 2.8% increase in

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

	<b>18Q2 vs. 18Q1</b>	<b>18Q2 vs. 17Q2</b>
<b>PADD 1</b>	1.77	0.56
<b>PADD 2</b>	2.52	6.43
<b>PADD 3</b>	3.37	2.66
<b>PADD 4</b>	9.13	9.27
<b>PADD 5</b>	2.00	-0.42
<b>U.S. Overall</b>	<b>3.07</b>	<b>3.12</b>

gasoline and diesel consumption compared to the prior quarter. Continued robust U.S. product demand coupled with discounted domestic crude oil prices relative to other world crude oils contributed positively to refiner's 2018Q2 earnings.

The major crack spread indicators show the same trends. The USGC LLS 321 crack was up almost a \$1/Bbl. from the previous quarter. The Chicago WTI 321 showed even greater improvement increasing by over \$6/Bbl. The major driver for this improvement was the widening of the WTI and LLS differential by over \$2/Bbl. compared to the prior quarter. The

**Key Refining Margin Metrics, \$/Bbl.**

	<b>2018</b>	<b>2018</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>
	<b>June</b>	<b>Q2</b>	<b>Q1</b>	<b>Annual</b>	<b>Annual</b>
WTI	67.65	<b>67.98</b>	62.89	50.87	43.24
LLS	74.57	<b>73.09</b>	65.83	54.11	44.92
Brent	74.32	<b>74.34</b>	66.80	54.26	43.72
LLS – Maya	10.29	<b>11.28</b>	8.17	7.01	8.50
USGC LLS 321*	11.85	<b>13.04</b>	12.12	13.34	10.66
USGC LLS 6321**	8.21	<b>9.07</b>	8.46	9.86	6.60
Chicago WTI 321***	22.64	<b>20.47</b>	14.20	17.71	14.26

heavy/light crude oil price differential increased by \$3/Bbl. leading to improved refining margins for coking refineries.

\* 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

<sup>1</sup> *PRISM*<sup>TM</sup> 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.

## Special Topic: IMO 2020 - Part 2

### Can European Refiners Navigate the Marine Fuel Oil Storm?

In our last *PRISM* Special Topic, we concluded that European refiners are distinctly disadvantaged by the 2020 MARPOL regulations (IMO 2020). Compared to U.S. refiners (per barrel of crude oil capacity), European refineries have only one third of the installed heavy oil upgrading capacity and produce approximately four times more residual fuel oil. Despite this “Achilles Heel,” a significant number of European refiners have not taken action to reduce their fuel oil yield.

#### European Heavy Oil Project Status

	Number
Total European refineries in <i>PRISM</i> database	83
Number with suitable heavy oil upgrade capacity installed*	40
Number with announced suitable heavy oil upgrade projects in progress**	10
Refineries with limited/no ability to upgrade heavy oil	33

\* Refineries producing less than 10% HFO not compliant with IMO 2020.

\*\* Heavy oil conversion projects outside of refineries are not included.

Thirty-three of the European refineries modeled in *PRISM* European data set cannot meet IMO 2020 regulations and are out of time to implement heavy oil upgrading projects by 2020. These refiners may be betting on a relaxation of the IMO requirements. Although IMO currently insists that the regulation will go into effect on schedule, there could be a backlash from farmers and truckers worldwide if diesel prices increase dramatically. That would create an interesting political situation. If IMO 2020 does proceed on schedule, the 33 refineries will face difficult choices.

So why haven't we seen more heavy oil upgrading projects? We decided to take a closer look at one proposed project, the installation of a new delayed coker at Gunvor's 88,000 barrel per day Rotterdam refinery. The table below summarizes our *PRISM* view of actual refinery performance in 2017 and, hypothetically, how it would have looked with a delayed coker.

#### Gunvor's Rotterdam Estimated Refinery Margins Current Operation versus Coker Addition

\$/B Refinery Input	2017 Performance	2017 Performance with Coker	Margin Improvement with Coker
Gross Margin	5.62	7.32	1.70
Operating Cost*	7.47	8.33	(0.86)
Cash Margin	(1.85)	(1.01)	0.84

\* Includes variable and fixed costs

The project improves the cash margin by \$0.84/B. The post 2020 improvement could be in the range of \$1.50 – \$3.00/B. For an estimated \$500 million investment, the cash margin improvement based on 2017 performance would result in an internal rate of return (IRR) of much less than 10%. Even if there was a substantially higher future margin in the range previously mentioned, the IRR could still be under 15%.

In recent years, the European refining sector has been challenged with lackluster petroleum product demand, more stringent regulatory issues, increased Russian, U.S., and Middle Eastern refining competition, and higher operating fuel costs. And now, MARPOL looms on the horizon. Only time will tell which European refiners will weather through this latest storm.

#### 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.

Contact: Gary N. Devenish  
(832) 358-1453  
[gary.devenish@bakerobrien.com](mailto:gary.devenish@bakerobrien.com)