

Heavy Bets Pay Off for Midwestern Refineries

Why PADD 2 refineries passed up shale bounty on their doorstep.

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Data Used in this Publication

- ▶ CME Group
- ▶ EIA

To discover more about the data sources used, [Click Here](#)

Canadian Crude Imports Preferred

According to U.S. Energy Information Administration data, the 26 refineries in the Midwest PADD 2 region processed an average 3.6 million barrels/day, or mmb/d, of crude oil in 2016—up 300 thousand barrels/day, or mb/d, from 3.3 mmb/d in 2010. Over the same six-year period, local light shale production in the region shot up by over 1 mmb/d—mostly from the prolific Bakken formation in North Dakota. Yet Midwest refiners did little to take advantage of the sudden abundance of local production. Instead, increasing their appetite for imported heavy crude from Canada by nearly 1 mmb/d from 0.8 mmb/d in 2010 to 1.8 mmb/d in 2016.

This note is based on analysis from our newly published deep-dive outlook that reviews crude supply and demand, refinery operations, refined product supply and demand as well as refining margins in the Midwest. If you would like to receive a copy of the larger report, please contact commodity-research@morningstar.com.

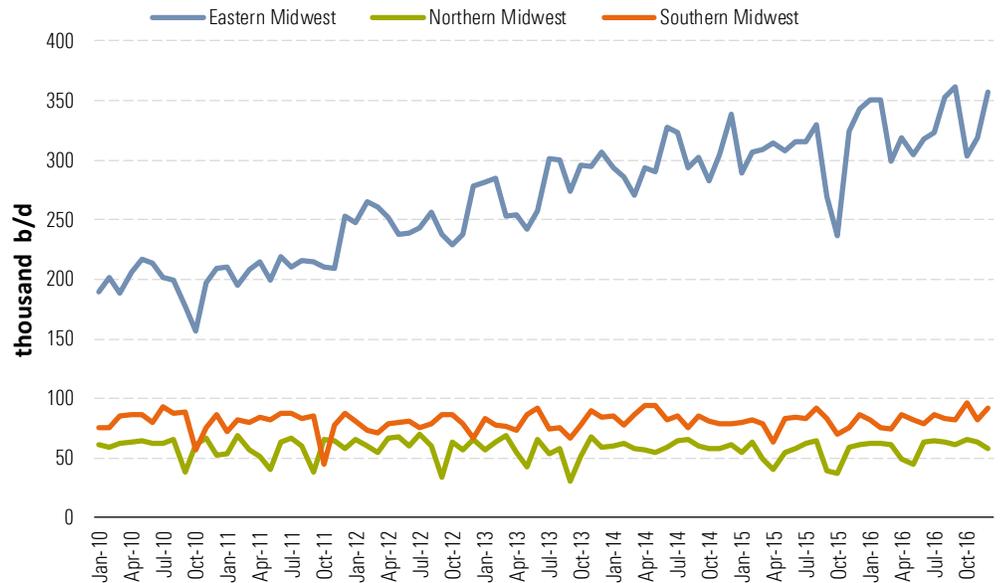
Bad Timing

Much of the reason why PADD 2 refiners focused on heavy crude when shale supplies arrived on their doorstep was timing. Just before domestic production took off in 2011, several large refineries in PADD 2, including the largest—the 414 mb/d BP Whiting plant in Indiana—underwent upgrades to increase their coking capacity to process heavy crude (see our August 2016 note [Processing Heavy Crude](#) for more on this topic). These expensive investments (BP spent \$4.2 Billion) were made in a world before shale, when the prevailing opinion was that lighter crudes that are easier to process were running out and likely to get more expensive. Heavy crude requires more complex and expensive equipment to refine, but is (the theory went) more abundant and expected to be cheaper to buy than light crude. Around the same time, heavy bitumen crude producers in western Canada were bringing several new projects online (see our recent note [Lower for Longer](#) for more on Canadian production). These projects targeted the same Midwest refinery upgrades - in some cases through joint ventures. Which is why, having made significant investments, the largest refineries in the Midwest increased their consumption of imported heavy Canadian crude at the expense of abundant shale.

This decision was not just about investment. There are also technical constraints that prevent refiners from easily switching from heavy Canadian imports to processing domestic shale crude. Once refineries are configured or upgraded to process heavy barrels they are less efficient at processing crudes like shale since they produce too many light components that can overwhelm downstream units.

Geographically, most of the new coking capacity was added to the 14 refineries in the part of PADD 2 that the EIA calls the Eastern District (Indiana, Illinois, Kentucky, Tennessee, Michigan and Ohio) where the majority of the population lives. Exhibit 1 shows the increase in coking capacity in the east (blue line) between 2010 and 2016. Over the same period, coking capacity in the Southern District (Oklahoma, Kansas, Nebraska, Missouri and Iowa) and the Northern District (Minnesota, Wisconsin, North Dakota, and South Dakota) remained flat (green and orange lines). Refiners in the Northern and Southern districts of PADD 2 that had more capacity configured to process light crude, did change their feedstock to shale in time, but the process was delayed by pipeline constraints out of the Bakken that caused producers there to instead ship their crude to coastal refineries by rail (more on the congestion in a minute).

Exhibit 1 PADD 2 Refinery Coker Capacity by District



Source: EIA, Morningstar

Windfall Margins

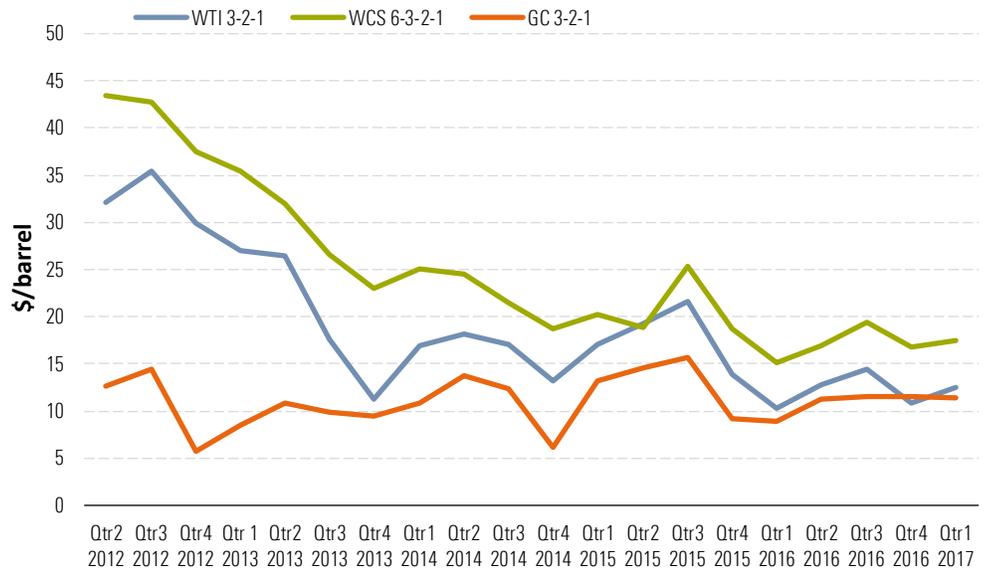
As it turns out, all Midwest refiners, whether configured to process heavy or light crude, ended up benefiting from the booming shale production between 2012 and 2014, even if they weren't actually processing it. That was because all the new Canadian and Bakken shale crude coming into the Midwest flooded the distribution system, causing pipeline congestion and a build-up of inventory at Cushing. The congestion meant that North Dakota and Canadian producers had to swallow discounted crude prices to secure space on crowded pipelines (or to pay higher freight rates to ship crude out by rail). The result was that Midwest refiners enjoyed windfall margins compared with their competitors on the Gulf Coast, because their crude cost was so cheap. Light sweet crudes like domestic benchmark West Texas Intermediate sold for an average \$18/barrel less than equivalent crude at the Gulf Coast in 2012. Discounts for Canadian heavy crude were even higher (as much as \$40/barrel) because not only were

pipelines congested in the Midwest, but pipelines crossing the border into the U.S. were over-subscribed.

Taken together, these constraints meant that all refiners in the Midwest enjoyed strong margins – until the pipeline congestion began to unwind in 2013 and 2014. After then, our analysis shows that Midwest refining margins narrowed from windfall levels, but while light crude refiners lost nearly all their advantage by 2016, heavy crude refiners continue to enjoy higher returns even today.

We reached these conclusions through a comparison of three crack spreads – rule of thumb benchmarks of refinery performance. These were chosen to reflect margins for processing light and heavy crude in the Chicago area, home to the most coking capacity in PADD 2, and for light crude at the Gulf Coast. Our heavy crude coking crack spread calculation is based on a 6-3-2-1 ratio using benchmark Western Canadian Select crude priced at Cushing. The crack assumes 6 barrels of WCS produce 3 barrels of gasoline (Chicago price), 2 barrels of diesel (Chicago) and 1 barrel of fuel oil (New York). Our light crude Chicago 3-2-1 crack assumes 3 barrels of WTI Cushing as a feedstock, producing 2 barrels of gasoline and 1 barrel of diesel sold in Chicago. The Gulf Coast comparison is a 3-2-1 crack assuming 3 barrels of Light Louisiana Sweet crude priced at St. James, Louisiana, processed to produce 2 barrels of gasoline and 1 barrel of diesel sold at Gulf Coast prices. The results were aggregated up to quarterly averages over the period from second-quarter 2012 to first-quarter 2017 (Exhibit 2).

Exhibit 2 PADD 2 Crack Spread Analysis



Source: CME Group, Morningstar

Heavy Refiners Retain Advantage

The 6-3-2-1 crack for heavy Canadian crude averaged an impressive \$41.3/barrel in 2012 (second quarter to fourth quarter) at the height of the Midwest congestion — a whopping \$30.0/barrel higher than the \$10.9/barrel Gulf Coast 3-2-1 crack and \$8.5/barrel higher than the \$32.5/barrel Midwest WTI 3-2-1 during the same year. As the chart shows, all three margins declined after 2012 as capacity opened up to ease the pipeline congestion, but the impact was more dramatic on WTI than it was on Canadian heavy crude. By 2016, with plenty of pipeline capacity open between Cushing and the Gulf Coast and with U.S. crude export regulations lifted, the Midwest WTI crack averaged only \$1.3/barrel above the Gulf Coast 3-2-1 margin. The story was somewhat different for heavy crude refiners. In 2016 the Midwest 6-3-2-1 coking crack averaged \$4.9/barrel higher than WTI 3-2-1 and over \$6/barrel higher than the Gulf Coast 3-2-1 crack. And that advantage continued into first-quarter 2017. This ongoing advantage for heavy crude refiners reflects continued pipeline congestion getting Canadian crude across the border into the U.S. as a result of delays in permits including the 2015 refusal of the Obama Administration to approve the Keystone XL crossing permit.

For the moment, our crack spread analysis shows that Midwest refiners that upgraded their capacity to process heavy crude retain their advantage over competitors configured to process light crude, despite the surge in domestic shale production. Yet those Midwest refiners now wedded to Canadian heavy crude are vulnerable to declining new investment in expensive oil sands projects in western Canada. If Canadian oil sands output drops over the next decade, then that could push heavy crude prices higher in the Midwest — pushing margins below refineries processing shale crude. If new pipeline capacity across the U.S. border is built - such as the Keystone XL pipeline approved by the Trump Administration, that would also increase Canadian crude prices.

Full Midwest Refinery Outlook

Our comprehensive Outlook report on Midwest refining provides detailed analysis of crude supply for PADD 2 refineries. We detail refinery capacity and operating levels as well as geographic distribution. The report describes refined product supply and demand in the Midwest — highlighting the lack of opportunities for market expansion. There are also sections on refinery margins across the region including comparison with the Gulf Coast and the importance of the Cushing trading hub to the region. The report details of 26 refineries and a newbuild project in North Dakota and concludes with our outlook on winners and losers in the region. If you would like to receive a copy of the Outlook, please contact commodity-research@morningstar.com. 

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