
U.S. Refiners Disdain Abundant Light Crude

Quality and refining mismatch continues.

Morningstar Commodities Research

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Data Sources for This Publication

EIA
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Heavy Preferred

Between January 2015 and December 2018, U.S. domestic crude output increased by 2.5 million barrels a day. During that period, Energy Information Administration crude quality tracking data shows 92% of the increase was light crude with an API gravity above 35 degrees. During the same period, refiners continuously increased annual average throughput, but the average quality of the crude they processed lightened by less than one degree API. As a result, despite a growing abundance of domestic production, crude imports have increased and 90% of those imports are heavier grades, while exports of lighter shale have taken off. Seven years into the U.S. oil shale revolution, domestic crude output and refinery usage continue to be largely mismatched. This note asks whether and how that situation will change.

Slowdown

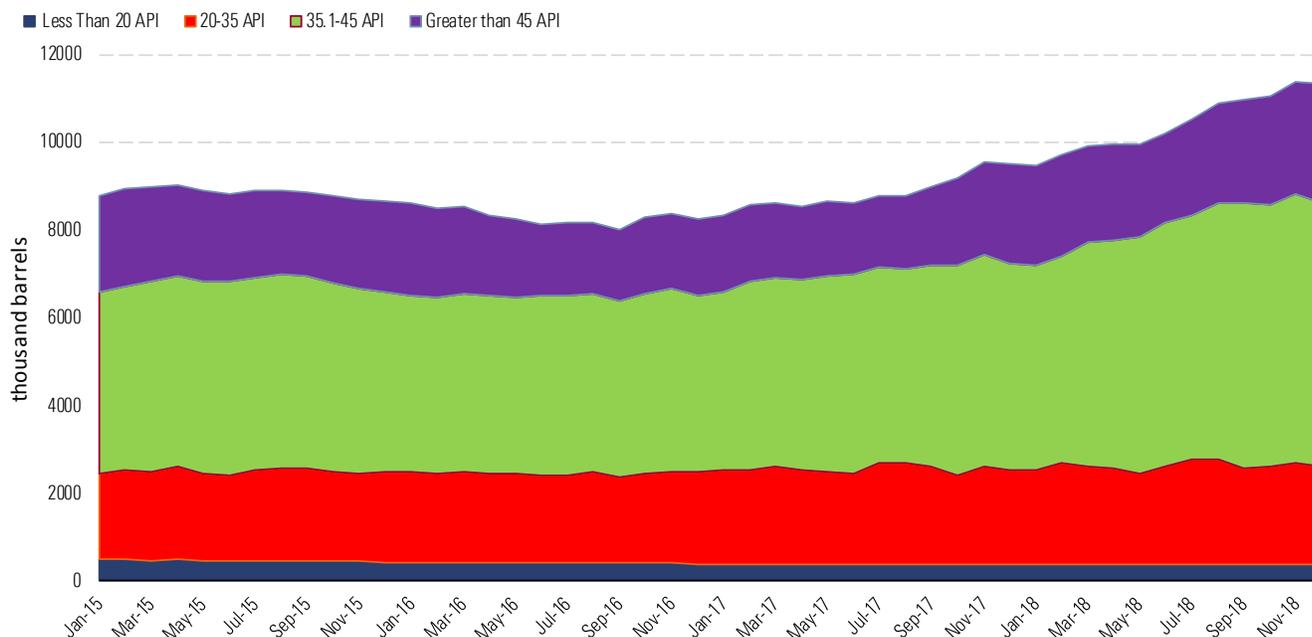
The collapse of oil prices late last year, along with pipeline takeaway constraints in the Permian (see our February note [Will New Permian Crude Capacity Overshoot?](#)) and congestion out of the Cushing, Oklahoma, Midwest hub (see [Cushing Builds as Gulf Coast Tanks Drain](#)), has threatened a slowdown in U.S. crude output this year. New EIA data released March 29 indicated a 90 thousand b/d decline between December and January. However, we expect production to take off again in the latter part of 2019 as new pipeline capacity opens and producers complete a large inventory of drilled but uncompleted wells. With prices for U.S. benchmark West Texas Intermediate delivered to Cushing trading above \$60/barrel and analyst consensus that the world crude market is tight, we do not expect producers to abandon shale basins anytime soon. Even if independent shale producers pay more attention to their bottom line and reduce drilling budgets, majors like ExxonMobil, Chevron, and BP have committing to scale up shale operations.

More Is Light

As new production from shale drives increased output, the overall quality of domestic crude is getting lighter. Exhibit 1 shows the API gravity of total U.S. crude on a monthly basis between January 2015 and December 2018. Over the four-year period, output of heavy crude with an API gravity below 20 degrees (blue shading) and heavy/medium crude with an API between 20.1 and 35.0 degrees (red shading) remained relatively flat. The major spurt in output came from lighter crude with an API between 35.1 and 45.0 degrees (green shading), which increased by 1.85 mmb/d, and ultra-light crude with an API above 45 degrees (purple shading), which increased by 0.53 mmb/d. On average during 2018, 75% of production was above 35 API and 25% was below. Although there has been recent investment in

medium sour crude output from Gulf of Mexico offshore production, the speed of this growth is slower than we see from shale and has a limited impact on the overall refining slate.

Exhibit 1 API Gravity of U.S. Crude Production



Source: EIA, Morningstar.

Refining

While average new production gets lighter, the typical barrel that U.S. refiners process remains heavier than 35 degrees API. The average barrel processed in 2015 had an API of 31.46 degrees, getting lighter by 2.3% to 32.20 degrees during 2018. That's during a period when annual average refinery throughput increased by 5.5%, from 16.4 mmb/d in 2015 to 17.3 mmb/d in 2018. The need to balance a heavier refining slate with growing light domestic production required increased imports of heavier crude. Annual average crude imports increased from 7.36 mmb/d in 2015 to 7.76 mmb/d in 2018 despite domestic output jumping by 2.5 mmb/d over the same period. Crude import quality remained strongly biased toward heavier grades with 90% having an API below 35 degrees in 2018 (Exhibit 2).

Exhibit 2 API Gravity of U.S. Crude Imports (%)

	Below 35 API	35-45 API	Above 45 API
2015	92	7	0
2016	89	9	2
2017	89	8	2
2018	90	7	3

Source: U.S. EIA., Morningstar.

Light Brigade

The U.S. refinery bias toward heavier crudes was born of expedience in the early 2000s, when light sweet grades like WTI were expected to run out as producers scoured far and wide for new sources. The prevailing belief was that easier-to-find heavy crude grades would be the cheapest feedstock and refiners invested in expensive secondary processing to convert more heavy oil into transport fuels. Fast forward to 2019 and there is more than enough light crude to go around, but most refineries still aren't configured to process it. Refinery owners are understandably reluctant to abandon expensive upgrade technology or rebuild plants to process light crude today. In the two years before the crude export ban was lifted at the end of 2015, several refineries added light processing capacity, including Valero at its Houston and Corpus Christi plants and Marathon at its Midwestern plants. At the same time, several condensate splitters were built to process very light crude in Houston and Corpus Christi. As we discussed in a July 2016 note ([Gulf Coast Refiners Penalized for Running the Lights](#)), these investments soured when the export ban was lifted and the value of lighter crudes increased to international levels. Nevertheless, the growing deluge of shale crude has had an impact on refining tastes, as Exxon's and Chevron's recent plans to increase shale throughput in their Gulf Coast refineries demonstrate (see our February note [Permian Majors Expand Downstream Processing](#)).

Heavy Addiction

But U.S. refiners' addiction to heavy crude has proved tough to crack, in particular because of the windfall returns that cheap imports from close neighbor Canada have brought to Midwestern refiners. Landlocked discounted Canadian heavy barrels have been delivered to refiners at big discounts to WTI, handily justifying investment in upgrading capacity. At the same time, Gulf Coast refiners have enjoyed access to competitive heavy crude imports from the Middle East as well as close by Venezuela and Mexico. That situation changed in the past three months as a result of a shortage of heavy crude caused by OPEC production cuts and sanctions on Iran and Venezuela, narrowing discounts to WTI (see our March note [Heavy Sour Crude Shortage Disrupts IMO 2020 Response](#)). Although there's a good chance that the IMO 2020 regulations to lower sulfur levels in marine fuel oil will devalue heavy sour crude again, the recent narrowing of discounts could serve as a wakeup call to refiners. The bunker fuel regulations should also attract significant volumes of straight-run fuel oil to the U.S. Gulf Coast that can be run directly through upgrade units in lieu of primary distillation of heavy crude. That could make room for more light crude processing by refineries built to run heavy barrels.

Nevertheless, we expect U.S. refiners to continue their love affair with heavy crude so long as price discounts make it cheaper than light alternatives. New refinery capacity is likely to favor light crudes over heavy, but construction will be incremental add-ons rather than wholesale replacement in today's tough permitting environment.

Export Agenda

In these circumstances, limited conversion of U.S. refineries to processing light crude leaves producers and traders with a growing export supply of shale from new production (see our March note [Gulf Coast Crude Exports to Europe and Asia Drive 2018 Growth](#)). So far this year (Jan. 1 through March 29), U.S. crude traders and marketers have found a home for an average 2.7 mmb/d of crude exports, according

to weekly EIA data, with Europe and Asia being the favored destinations. This growing export market has been won at the expense of international rivals from West Africa, the North Sea, and the Middle East. Production cuts by OPEC and its allies have created space for U.S. exports, as have sanctions on Iran. However, shale crude is not an obvious replacement match for heavier OPEC Middle East output or barrels displaced by U.S. sanctions on Iran or Venezuela. Political disruption to crude logistics in West Africa has created demand for equivalent light grades in Europe, as has the decline in some North Sea output. As we discussed in a note last September, the impact of sanctions on Iranian condensate supply creates an opportunity to export very light crude above 45 API (see [U.S. Condensate to Replace Sanctioned Iranian Barrels?](#)). And several refiners have tested shale crude to "buy and try" grades that have been discounted to clear in international markets.

One issue that has hampered U.S. exports is the quality of U.S. crude. Recent reports of poor-quality Eagle Ford condensate cargoes rejected by South Korean refiners are a public case in point. Pipeline operators in the Permian and at Cushing are dealing with export crude quality issues by segregating barrels and tightening specifications (see [Quality and Location Count for WTI Contracts](#)).

International Influence

Our expectation is that the future of U.S. crude export sales lies in Asia, where new capacity is coming on line and many less sophisticated refineries are able to process light sweet grades. This market will be helped by the IMO regulations that require Asian refiners to reduce the production of high-sulfur fuel oil they traditionally sell into the Singapore bunker market. Many such refiners will look to process low-sulfur light sweet grades instead of medium-sulfur Middle East crude, creating an opportunity for U.S. sellers.

As the growing U.S. crude market evolves, production and exports will expand while heavy crude imports will continue to be a key feedstock for refiners. The United States remains the largest consumer of crude oil as well as a significant producer, exporter, and importer. The resultant increased interaction with world crude supply and demand will increase U.S. influence in international markets over the next few years to the point where the Gulf Coast sets the marginal price of crude. ■■

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