
The Permian Triangle and U.S. Crude Dynamics

Cushing inventories drain into export market.

Morningstar Commodities Research
July 30, 2018

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Data Sources for This Publication
U.S. Energy Information Administration
CME Group
To discover more about the data sources used, [click here](#).

Midland-Cushing-Houston

The Permian triangle isn't a mythical sea in West Texas where ships disappear without explanation. It's a term we've devised as a metaphor for three trunk line crude routes through Texas and Oklahoma that between them have an outsized influence on today's U.S. crude prices. The three sides of the triangle connect Permian production gathered at Midland, Texas, with demand centers in Cushing, Oklahoma, feeding Midwest refineries, and Houston, Texas, feeding Gulf Coast refineries. Pipelines between Cushing and the Gulf Coast form the third side of the triangle. The direction of crude flow in these pipelines is always the same — from Midland to Cushing or Houston and from Cushing to Houston. The flows on each leg reflect oil market supply demand fundamentals that in turn influence prices at the three trading hubs anchoring the triangle as well as the interplay between U.S. crude sold domestically and exports. This note is the first in a series describing Permian triangle dynamics.

Midland to Cushing

Midland, Texas, is the gathering center for the West Texas Permian Basin. These days a lot of new drilling and production in the basin is farther west in New Mexico, but most crude is still picked up by gathering systems that deliver into or through Midland. Crude not consumed by local refiners is then shipped to market on long-haul pipelines.

Cushing, Oklahoma, is the largest crude storage and trading hub in the U.S., with multiple inbound and outbound pipelines. Crude activity at Cushing is centered on West Texas Intermediate — delivered from the Permian and traded for physical delivery throughout the Midwest and Gulf Coast refining regions. Cushing is also the delivery point for the dominant U.S. crude futures contract — CME Nymex WTI.

Since before the shale boom, three long-haul pipelines have carried Permian crude from Midland to the Midwest. The first two are the 100 thousand barrel/day Occidental Centurion and the 450 mb/d Plains All American Basin pipelines between Midland and Cushing. A third pipeline out of the Permian, the 300 mb/d Energy Transfer West Texas Gulf delivers crude to Longview, Texas, and from there to the Chicago area via the Mid-Valley pipeline (as well as, more recently, to the Gulf Coast). To keep things simple, we label this leg of the Permian triangle as Midland to Cushing because these are the trading hubs where WTI prices are set for crude in the Permian producing region and the Midwest refining region. Because production is increasing rapidly, Plains is expanding its Basin pipeline system to add 0.5 million barrels/day capacity to gathering systems in the Permian and 120 mb/d between Midland and Cushing, expected on line in 2019.

Permian to Gulf Coast

This pipeline network was developed during the shale era to ship growing Permian production to refining centers in and around Houston, Beaumont/Port Arthur, and Corpus Christi on the Texas Gulf Coast. Since 2013 five trunk lines have been developed, namely; the Magellan Longhorn, Magellan/Plains BridgeTex, Energy Transfer Permian Express, Plains Cactus, and Enterprise Midland-Sealy pipelines that between them can carry over 2 million barrels/day. These pipelines are currently running at capacity, causing congestion and price discounting at Midland that we'll get to in upcoming analysis. To relieve that congestion, midstream companies are developing projects to add at least another 2 mmb/d and (if all are permitted and built) as much as 3.6 mmb/d of additional capacity to this leg of the Permian triangle by the early 2020s. Most of these new pipelines are expected to ship Permian crude to export markets via the Port of Corpus Christi.

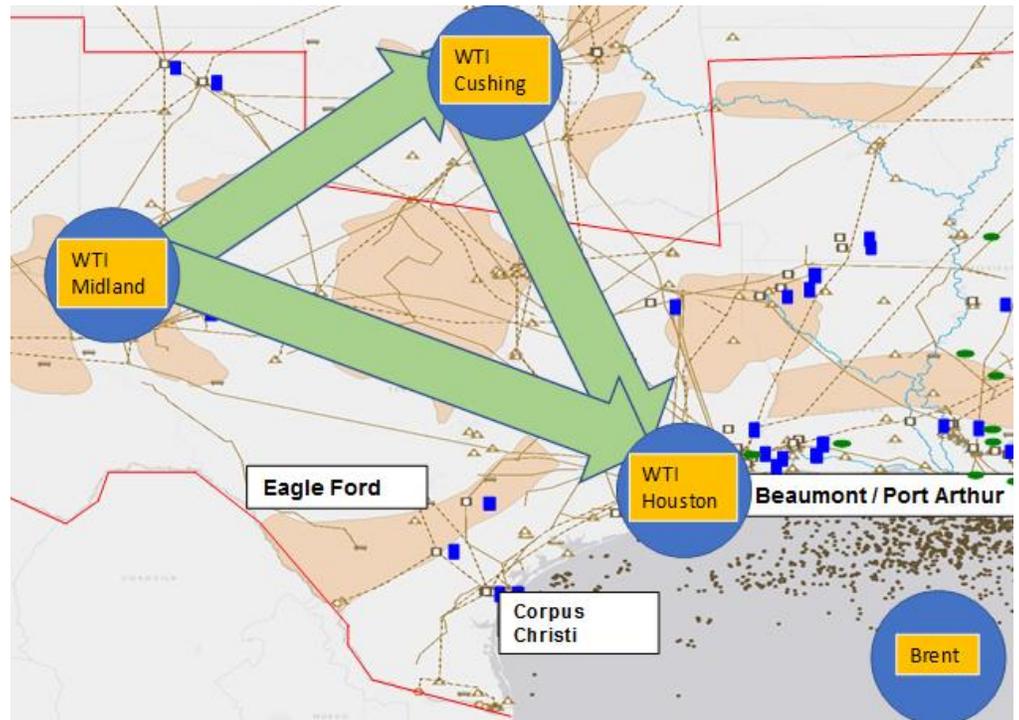
Cushing to Gulf Coast

All the crude in the first two legs of the Permian triangle is headed to destination refining markets on the Gulf Coast or in the Midwest. The third leg of the triangle delivers crude between these destination markets, representing a balancing mechanism of sorts, because crude can flow from Midland to Cushing and then to Houston. The third leg of the Permian triangle also ships multiple grades and blends of crude shipped into Cushing from surrounding production in the Anadarko Basin, or from farther afield in North Dakota, the Rockies, and Canada.

In the preshale era, pipelines on this third leg ran north from the Gulf Coast to Cushing, delivering imported or offshore Gulf of Mexico production crudes to Midwest refiners. After the shale boom, these lines were reversed, and new ones built to allow first shale and then Canadian crude to reach the Gulf Coast region that houses over 50% of the nation's refinery capacity. The trunk lines on this route are the 850 mb/d Seaway pipeline jointly owned by Enterprise and Enbridge and the 750 mb/d TransCanada Cushing Marketlink between Cushing and Nederland, Texas, that also has a lateral to Houston. These pipeline systems transport a mixture of light shale and heavy Canadian crude from Cushing to Gulf Coast destinations with most barrels ending up in the Houston region.

Triangulation

The three legs of the Permian triangle, including the direction of flows, are shown in Exhibit 1. Various price reporting agencies (Platts and Argus, for example) as well as futures exchanges (CME, ICE) provide pricing for WTI crude transactions at the Midland, Cushing, and Houston trading hubs. The relationship between these hubs is central to understanding U.S. domestic crude pricing. Further, the relationship between WTI Houston and the international market, represented by North Sea benchmark crude Brent, is key to understanding the dynamic between U.S. and international markets.



Source: EIA, Morningstar

Relationship Analysis

Price relationships between the three trading hubs in the Permian triangle are primarily based on crude supply demand fundamentals at Midland, Cushing, and Houston as well as the export market. Analysts lack publicly available, timely data regarding actual crude flows between these trading hubs. However, courtesy of mandatory reports to the U.S. Energy Information Administration, we do have a reasonably accurate weekly picture of crude inventories at Cushing and the Gulf Coast as well as production and refinery demand data.

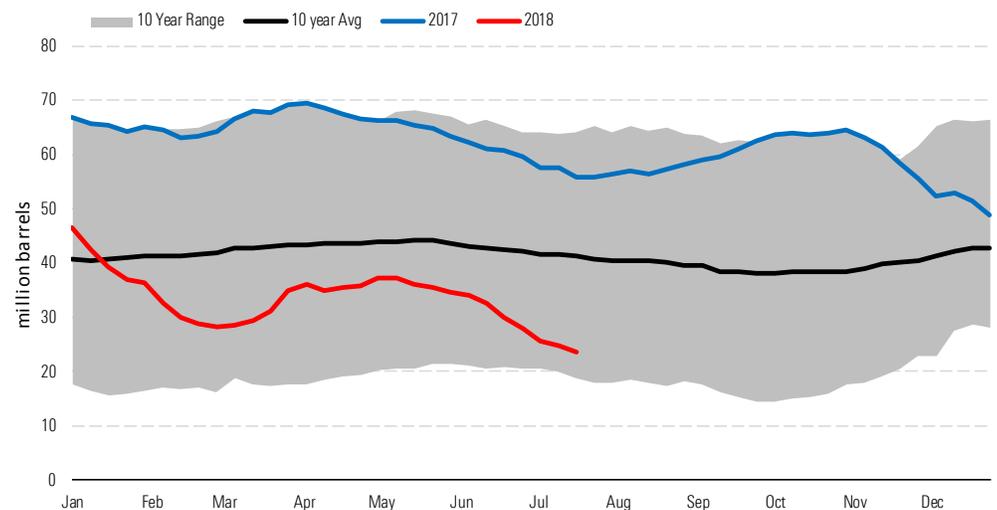
In the remainder of this note, we look at how weekly crude inventory at Cushing and the Gulf Coast as well as crude exports explain flows and pricing on the third leg of the Permian triangle, between Cushing and Houston. In upcoming analyses, we'll look at additional fundamental factors affecting the triangle, such as current pipeline congestion in Midland and incoming flows into the Cushing trading hub from outside the Permian.

Cushing Inventories

According to EIA weekly data, current Cushing crude inventories were 23.7 million barrels as of July 20, 2018, just 4.9 million barrels above their 10-year low point at this time of year (Exhibit 2). Crude inventories at Cushing have fallen more or less continually since they peaked at 69 million barrels just 15 months ago in April 2017. When Cushing inventory is falling, we can assume one or more of three fundamental factors are at work. The first, rather obviously, is that inbound flows into Cushing are lower than outbound flows, suggesting a regional supply imbalance. The second related fundamental is that refineries supplied by Cushing could be processing more crude than usual and drawing on inventory.

The third is that Cushing crude is in demand at Gulf Coast refineries or the export market, pulling it out of storage to ship south. We should also note that the consistent fall in Cushing inventories over 15 months is consistent with an absence of price incentive to store crude—a market structure known as backwardation, where forward delivery prices are lower than today. If you can find a buyer, there's no reason to store crude in Cushing.

Exhibit 2 Seasonal Cushing Crude Inventory



Source: EIA, Morningstar

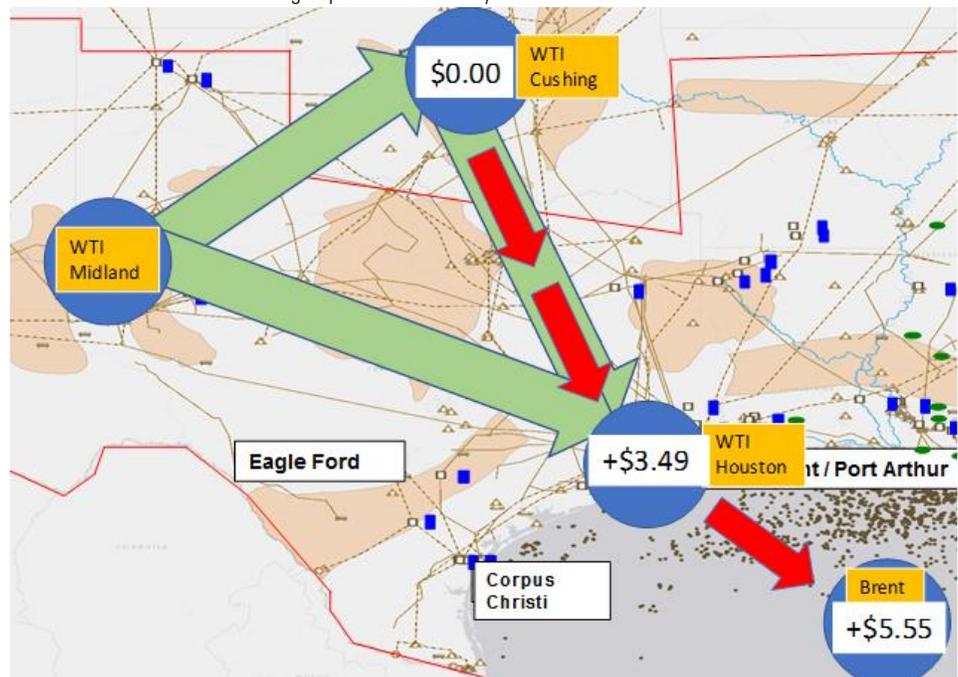
To decipher what's behind the Cushing draw, we looked first at EIA refinery input data in the surrounding PADD 2 Midwest region. PADD 2 crude inputs to refineries have increased steadily for years, up by an average 2% a year since 2010, according to EIA. Inputs ramped up this year after spring refinery maintenance to reach a record 4.1 mmb/d in June before falling back in the past seven weeks to 3.9 mmb/d. These numbers are high, but not enough to explain the continued decline in Cushing stocks during the past 15 months, since crude inputs were growing just as fast in 2015 and 2016 when Cushing inventory was increasing. Next, we looked at inventory levels at the Gulf Coast (PADD 3), where, in stark contrast to Cushing draws, inventories, as of July 20 were level with the start of 2018 and have increased in recent weeks. At the same time, relative crude inputs to Gulf Coast refineries have been just as high as the Midwest this year.

A big differentiator between these two regions that helps explain why Cushing stocks are drawing while the Gulf Coast is building, is crude production. Although production has been growing in PADD 2 over the past 15 months, it hasn't grown nearly as fast as PADD 3, where Permian output has been on a tear (see our recent note [Can U.S. Production Help Trump Shore Up World Crude Supply?](#)). Moreover, the fact that higher production is keeping PADD 3 inventories topped up even as Cushing stocks fall suggests that increasing U.S. onshore production is flowing to the Gulf Coast rather than to Cushing or that it flows right through Cushing and continues to the Gulf Coast.

Export Drive

In fact, as we have emphasized over the past year, the principal Gulf Coast crude market driver since the start of 2017 has been exports, (see our May outlook [U.S. Crude Exports Take Off](#)). Total U.S. crude exports doubled in 2017 to 1.1 mmb/d and have grown year to date in 2018 on a weekly average basis to 1.8 mmb/d, according to EIA. We believe this rising demand for exports, especially after Hurricane Harvey hit the Gulf Coast at the end of August 2017, is responsible for pulling crude south from Cushing to the Gulf Coast and nearly emptying tanks at the Midwest hub in the process. The growth in exports has been encouraged by a widening Brent price premium over WTI Houston, making U.S. shale crude competitive overseas. Higher WTI prices in Houston compared with Cushing have in turn encouraged increased flows from Cushing to the Gulf Coast. The red arrows in Exhibit 3 show the direction of these flows as well as average WTI Houston premiums over Cushing (\$3.49/barrel) and Brent premiums over Cushing (\$5.55/barrel) between September 2017 and the end of May 2018.

Exhibit 3 Crude Flows and Pricing September 2017-May 2018



Source: EIA, Morningstar, CME Group

Cushing Shortage

However, since June, the Cushing crude storage drawdown has worsened to the point that refiners in the Midwest bid up Cushing prices relative to Houston, narrowing the spread between Cushing and Houston WTI from over \$8/barrel at the end of May to less than \$2/barrel last week (July 25, 2018), according to CME. This narrowing spread has removed the price incentive to ship crude south from Cushing to Houston for export. Cushing inventory draws may continue in the short term, with the recent Canadian Syncrude shortage we discussed earlier this month being the most likely cause (see [Canadian Syncrude Outage Offset by Alternate Supply](#)). But pricing signals now encourage Permian crude flowing between Midland and Cushing to stay in Cushing. Higher prices should also be bringing incremental

barrels into Cushing from North Dakota and the Rockies. We expect the WTI Houston premium over Cushing to remain narrow until the Midwest supply equilibrium is restored and for Cushing demand to slow the pace of Gulf Coast exports in coming months.

In upcoming analyses we'll continue this discussion with a look at the implications on Permian triangle flows of congestion pricing in Midland. ■■

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