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Argus White Paper:
WCS Houston: A new price signal for heavy crude at the US Gulf coast

Growing Canadian heavy crude output and new pipeline connections to the US Gulf coast have created the first active pipeline spot market for heavy sour crude at the US Gulf coast. Canadian heavy Western Canadian Select (WCS) now trades regularly on a spot basis at multiple terminals in the Houston area. The US Gulf market has searched for years for a representative and market-based price benchmark to reflect the value of heavy crude at the coast. But robust and transparent spot markets never developed around inbound cargoes of Mexican, Venezuelan, Colombian and other heavy sours. Now WCS Houston is ready to fill that gap.

The better benchmark

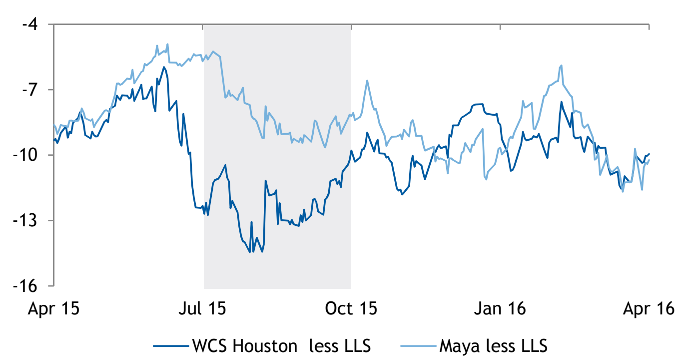
For years, the small volumes of Canadian heavy crude arriving at the US Gulf coast traded with reference to medium sour Mars, ASCI, or to Mexico's heavy Maya. In this way, the industry attempted to relate the price of heavy Canadian crude to prevailing market value. But Mars is much lighter and lower in sulphur content than Canadian heavy crude, making it an imperfect match (see graph at top right).

Maya, though similar in quality to WCS, is not a market but a price set by a government formula based 40pc on the price of West Texas Sour (WTS) crude at Midland, Texas, hundreds of miles from the Gulf coast. An additional 40pc of that formula is the illiquid 3pc sulphur fuel oil market at the Gulf coast which has now lost all relevance. A look at the recent moves in the Maya price in comparison to Argus' assessment of WCS Houston shows how dramatically Maya can diverge from Gulf coast heavy values (see graph at right).

Now, with stronger spot liquidity in WCS at Houston area terminals, market participants do not have to accept the basis risk associated with hedging against benchmarks that are poorly matched by quality or geography or that are subject to government control. As trade and transparency on

Array of Argus US Gulf coast markers

Maya and WCS Houston: Discounts to LLS, *$/bl*



July 2015 case study: Maya diverges from WCS Houston

- In July (see shaded area), Enbridge expands Line 67 of its Mainline system to 800,000 b/d. This raised the volume of Canadian heavy arriving at the Texas coast, and pushed the price of WCS at Houston lower.
- At the same time, Sunoco's Permian Express II pipeline began service, creating increased demand for WTS at Midland and raising the Midland price. Maya prices climbed along with WTS at Midland in spite of weaker prices for heavy crude at the coast.

WCS Houston grow, it will become the market-based heavy crude price signal that the industry has been seeking.

WCS market structure supports trading

The consistent quality of WCS and the growing ability to store it and trade it in the Houston area establish WCS at Houston as a valuable proxy for overall heavy crude value. WCS in the Houston area is largely delivered by pipeline on the same timing as other US Gulf pipeline grades, and it typically trades as a differential to the calendar month average of CME's light sweet crude contract. The wide area from Texas City to Port Arthur functions as a single market for WCS (see map p4). This is possible because of expanding pipeline connections among major terminals and multiple delivery points offered in the leading inbound pipeline tariffs. Argus employs the same volume-weighted average method in creating its daily WCS Houston assessment as for other US Gulf pipeline grades. All trades done during the trading day are considered. Argus publishes a methodology that describes the assessment process in detail.

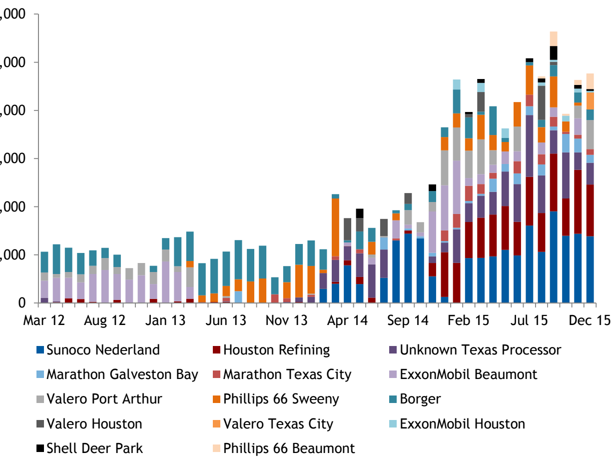
Rising trade flows underpin growth of WCS spot trade

WCS is backed by robust Canadian oil sands projects which continue to expand even in the face of lower crude oil prices. Analysts agree output from the oil sands is likely to rise by between 700,000 b/d and 900,000 b/d by 2020 under current oil price scenarios. Since most Padd 2 refinery capacity for heavy is already filled with Canadian crude, much of this incremental crude can be expected to make its way to the US Gulf coast – the world's largest heavy crude refining center. The greater Houston area alone is home to more than 3.7mn b/d of crude throughput capacity.

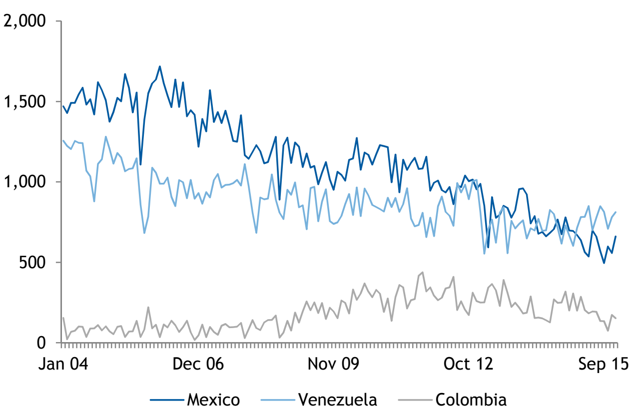
Beginning in late 2014 with the completion of the key Flanagan South, Seaway and Marketlink pipelines, volumes of heavy Canadian crude arriving on the Texas coast surpassed 200,000 b/d, and this wave of inbound heavy crude is likely to grow.

At the same time, US Gulf coast refiners are receiving less heavy crude from Venezuela, Mexico, and Colombia. This is a function of stagnant or falling production in Venezuela and Mexico as well as increased shipments of heavy crude from Latin America to China and other Asian destinations (see graph at middle right). As Canadian heavy crude of all types come to comprise a greater share of the Gulf coast market, the benchmark WCS takes on greater significance as a pricing reference.

Major Texas recipients of Canadian heavy crude from Flanagan South and Marketlink, *b/d*



US Gulf coast imports from Mexico, Venezuela and Colombia have fallen, *'000 b/d*



Average physical volume	b/d last 3 trade months
Argus Sour Crude Index (ASCI)	449,588
Argus WTI Midland	500,039
Argus Mars	342,126
North Sea Forwards	351,648
BFOE physical cargoes	408,791
Argus LLS	195,656
Argus WTI Houston	125,434
Maya formula	79,551

WCS Houston completes the array of US Gulf pricing tools

With the addition of a WCS Houston assessment, Argus now offers a full array of crude price assessments for hedging, contracting and analysis at the US Gulf coast. WTI Houston and LLS reflect light sweet values, Mars and ASCI reflect medium sours and WCS Houston reflects heavy sour crude. All are based on actual spot trade and all are based on the same timing that applies to US pipeline delivery. This array of benchmarks now allows for identifying price spreads among these various qualities of crude at the same geographic area at the same time. Now that the US has the ability to export crude, the US Gulf coast has a benchmark structure that can price those exports across the entire quality spectrum from light shale to heavy Canadian.

Financial contracts settling on Argus Chicago Mercantile Exchange (CME) Futures:

WTI Houston (6 contracts)
LLS (11 contracts)
Mars (4 contracts)
Argus Sour Crude Index (ASCI) (4 contracts)
WTI Midland (4 contracts)
WTS (4 contracts)
Argus WTI Formula Basis Calendar Month Futures
Argus WTI Trade Month Futures

Financial contracts settling on Argus Intercontinental Exchange (ICE) Futures:

Argus WTI Houston (2 contracts)
LLS Contracts (8 contracts)
Mars (4 contracts)
Argus Sour Crude Index (ASCI) (4 contracts)
WTI Midland (2 contracts)
WTS (2 contracts)
Argus WCS (Cushing) Crude Oil Future
Argus Bakken (Clearbrook) Crude Oil Future
Argus WTI CMA Trade Month Future

Born as a benchmark

WCS was created in December 2004 by founding producers Petro-Canada (now Suncor), EnCana (now Cenovus), Talisman (now owned by Spain's Repsol) and Canadian Natural Resources. In March 2015, Husky Energy joined the ranks of WCS producers. The goal in creating WCS was to establish a heavy crude stream of consistent quality that would be embraced by US refiners, principally in the Chicago area.

The founders blended multiple streams of crude and condensate in tanks at the Hardisty market center and allowed the resulting WCS blend to trade on a spot basis. It soon became a price benchmark for most other heavy crude streams in western Canada. Large streams such as Cold Lake, CDB, AWB and others are typically valued at differentials to WCS. Production of WCS is estimated at 300,000-400,000 b/d and increasing volumes of it are now being sold to US Gulf coast refiners.

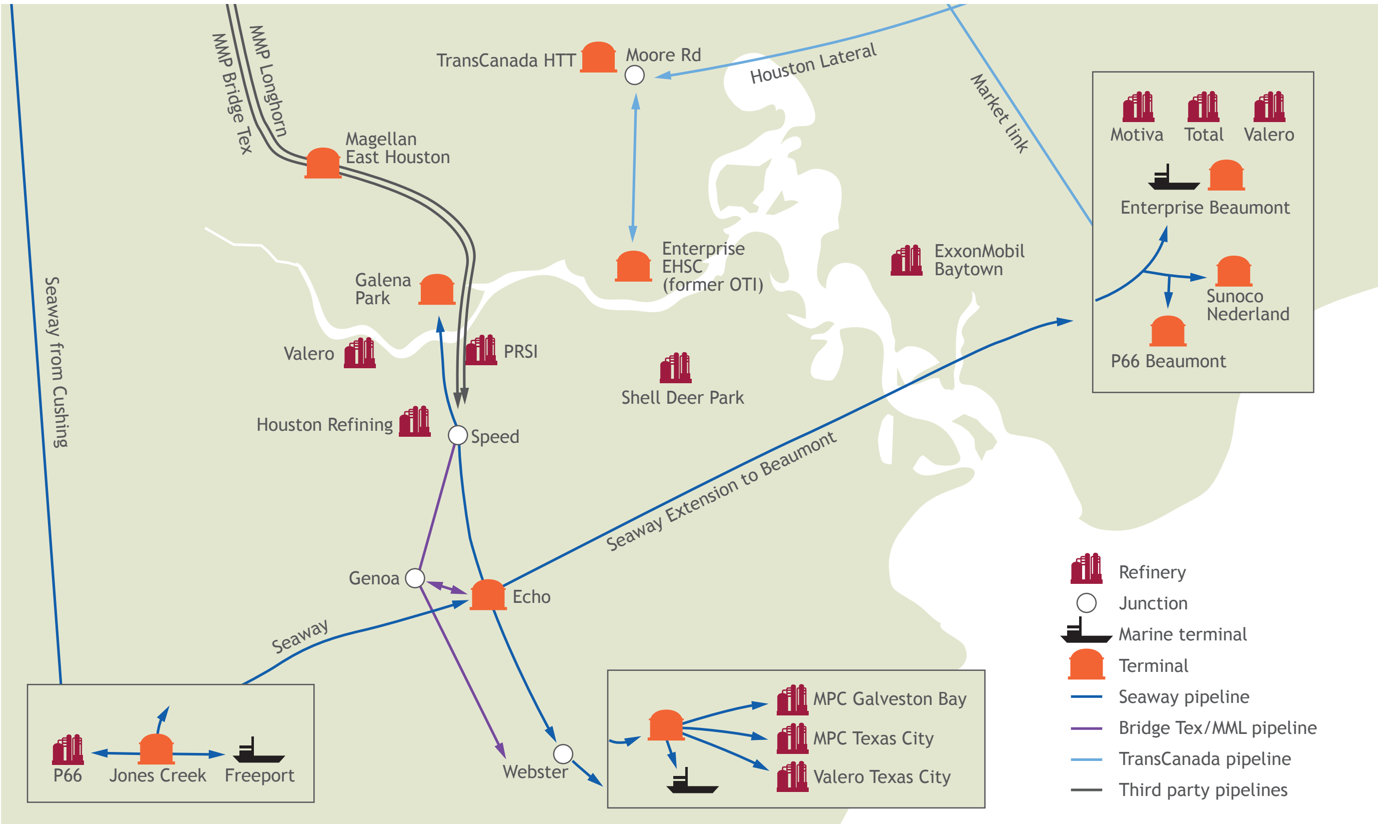
WTI Houston demonstrates potential of new benchmark

At the beginning of the April 2015 pipeline trade month, Argus responded to growing spot trade of light crude arriving at Magellan's East Houston terminal on the Longhorn and BridgeTex pipelines by launching a WTI Houston spot market assessment.

The segregation of a defined quality of Permian sweet crude in a facility that allowed in-tank transfers attracted rapidly growing spot trade and came to be the strongest signal of sweet crude value on the Texas coast. CME and ICE have launched financial contracts settling on the Argus WTI Houston assessment, making it possible to hedge sweet crude sales, lock in values relative to LLS or Mars, and to accurately project and analyze revenue.

The strong spot physical market and related financial markets emerged within a year of the Argus WTI Houston launch – underscoring how quickly industry support through spot trading and reporting trades can create new market tools.

The integrated Houston-area market for WCS



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