The evolution of US export markets

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Argus - global scale, global coverage

- Founded in 1970 — nearly 50 years experience
- Over 160 publications and services
- 900 employees, 400 reporters
- Customers in more than 140 countries
- London HQ, 21 offices around the globe
Quick intro to pricing and benchmarking
How US pipeline markets work

- Spot price is determined at a specific location or pricing hub prior to delivery to specific refineries, terminals or storage locations in other regions.
- Spot trades commonly done for small volumes.
- Trade cycles are determined by the pipeline schedule:
  - Different to the Nymex futures.
- Physical trades are done as:
  - An exchange of barrels for WTI plus a cash differential (buy/sell).
  - A cash transaction using the Calendar Month Average (CMA) and the Argus Diff to CMA.
Why pipeline markets allow for effective price discovery

• Abundance of transactions allow Argus to generate Volume Weighted Average (VWA) differential prices
  ◦ Usual spot trade is 1,000 b/d

• VWAs are transparent

• Ample participation in larger markets means there is no one company setting the price
North American benchmarking just 5 years ago
New markets begin to emerge
2010 – focus still on getting coastal crude inland
2012 – System beginning to deliver to the coasts
2014 – Piping the Permian begins in earnest
2016 – Building focused on Canada and Texas
2018 – Bakken and WTI get new pipelines to the coast
After that, US crude goes global
Exports by destination
And exports shift domestic trade patterns

Louisiana crude exports v. physical Mars trade volume

First LOOP export

Approximate Louisiana crude exports
Reported Mars trade month volume
So where are we now
US primary and secondary benchmarks

- The Nymex light sweet crude futures contract at Cushing is still the primary benchmark for US pipeline grades.

- Physical grade differentials are then used as complimentary secondary benchmarks in physical exchanges:
  - WTI Houston
  - WTI Midland
  - LLS
  - Mars
  - ASCI
  - WCS Cushing/WCS Houston
In the US, secondary benchmarks play a key role

- Secondary benchmarks are useful to market participants because they:
  - Negate some of the basis volatility
  - Allow for benchmarking against grades that are more similar in quality
  - Better reflect regional economics
  - Enable hedging using swap futures
Why secondary benchmarks matter

Secondary benchmarks minimize volatility

WTI diff to Ice Brent
LLS Diff to WTI
Mars Diff to WTI

illuminating the markets
Gulf of Mexico crude qualities

![Graph showing API gravity and percent sulfur for different crude oils. The graph highlights LLS, WTI Houston, Mars, ASCI, Maya, and WCS. The x-axis represents API gravity, ranging from 15 to 45, and the y-axis represents percent sulfur, ranging from 0 to 4. The graph indicates that LLS and WTI Houston are sweeter and lighter compared to the others.]
Bottlenecks, access to water, refinery and export demand all can have a marked effect on prices at different locations – even when quality is the same.
How are secondary US benchmarks performing?
Secondary benchmarks are liquid with high participation.
US benchmarks stack well against global markers

**Average daily trade volume underlying benchmark in 4Q 2018**

- Argus ESPO
- Argus WTI Midland
- North Sea Forwards
- Dubai Partials
- ASCI
- Argus WTI Houston
- Dubai Physical
- Argus Mars
- BFOET Physical
- Argus LLS
- Urals NW Europe

**Average monthly deal count underlying benchmark in 4Q 2018**

- Argus WTI Midland
- Dubai Partials
- ASCI
- Argus WTI Houston
- Argus Mars
- North Sea Forwards
- Argus LLS
- Argus ESPO
- Dubai Physical
- BFOET Physical
- Urals NW Europe

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So are players willing to use secondary markers?

• In short, YES!
• WTI Houston used to:
  ◦ Price crude delivered to Texas refineries
  ◦ Price Texas production - Eagle Ford crude and condensate
  ◦ Value grades at Corpus Christi
  ◦ Value exports
  ◦ Price first ever Bakken exports to Mexico
• LLS is used in many light sweet crude supply contracts
• Mars is used to value attractiveness of sour imports
• WCS Houston used in supply contracts for heavy sours
WTI Houston clearly leads the pack

Out of the secondary benchmarks, WTI Houston has become the fastest growing and most commonly used one because:

- It is backed by growing Permian production
- Quality is guaranteed and highly consistent
- Participation and transaction iteration is high
- Houston is close to the water so crude can go to regional refineries or be exported
Looking at WTI Houston participation stats...

• No one participant has a dominant share of the WTI Houston spot market.

• WTI sourced from Houston competes globally with west African and European light grades.

• Argus also has a WTI Houston fob price.
And on the paper side, the growth is clear.
Waterborne assessments
FOB diffs to Nymex, WTI Houston and Ice Brent

- Argus publishes WTI fob and Bakken fob as:
  1. A differential to Nymex CMA
  2. A differential to Argus WTI Houston pipeline price assessment at the MEH terminal
  3. More recently a diff to Ice Brent
- Doesn’t replace pipeline assessments – these are still the most liquid/transparent

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<th>US Gulf coast waterborne</th>
<th>Basis</th>
<th>Diff low/high</th>
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<td>Timing</td>
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<td>WTI fob Houston</td>
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<td>Apr CMA Nymex</td>
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Looking to the future
Expanded method for WCS Cushing and Houston

• Argus expanded its VWA methodology for WCS to allow for the inclusion of Cold Lake transactions in the calculation

• Since the grades are similar quality, the VWA prices are little affected but this allows for:
  ◦ Increased volume to underpin the price at each location
  ◦ More participants to be included
  ◦ A more robust indication of Canadian prices at both locations

• WCS has the potential to become a reliable secondary benchmark for heavy sour values at the US Gulf coast
West Texas Light (WTL) market emerging

- New production lighter than 44° API is now trading as WTL at Midland
- And at a differential to WTI Midland prices
- Volumes are small still but there is a high level of interest in this price
- Further ahead trade for WTL might also emerge at Houston and Cushing
- Argus is currently including reported WTL trades in its deals done tables and will look to launch assessments as appropriate

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In conclusion
New markets have led to new benchmarks

- US incremental production is light sweet and needs to be exported
- WTI Houston has many advantages over other physical markets
  - Volumes of trade/production/iteration/participation/proximity to export facilities
- Global buyers are becoming acquainted and comfortable with WTI Houston
- Looking forward:
  - WCS Houston has potential to become an important secondary benchmark
  - WTL assessments could be coming