Light-Heavy Crude Oil Outlook: Implications for Coker Margins

Argus U.S./Canada Asphalt 2009
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1. LLS-Maya Benchmark: Overview

2. Delayed Coker Feedstock Supply Factors
   a) U.S. Crude Production
   b) Heavy Crude Regional Production
   c) Vacuum Resid Imports
   d) U.S. Refining Capacity Rationalization

3. Delayed Coker Feedstock Demand Factors
   a) New Delayed Coker Projects
   b) Fuel Oil Switching in Power Generation
   c) Asphalt Demand

4. Outlook and Sensitivities
ρ Light Louisiana Sweet (LLS) and Maya represent opposite ends of crude oil quality spectrum.

ρ Each grade is a key pricing benchmark.

ρ Not without imperfections:

    LLS – USGC (St. James delivery), declining volumes, increased importance due to WTI price breakdown, however, a hedging mechanism is not currently available.

    Maya – declining volumes; price link to fuel oil can lead to short-term anomalies.

ρ LLS-Maya still useful indicator: relative crude pricing, coking margins.

<table>
<thead>
<tr>
<th>Crude Oil Gravity (degrees API)</th>
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<tbody>
<tr>
<td>45</td>
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<table>
<thead>
<tr>
<th>Sweet</th>
<th>Sour</th>
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<tbody>
<tr>
<td>Condensates</td>
<td>WTS</td>
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<tr>
<td>Ultra-Light</td>
<td>Mars</td>
</tr>
<tr>
<td>LLS Brent WTI</td>
<td>Maya WCS</td>
</tr>
<tr>
<td>Marlim</td>
<td>Ultra-Heavy Mexican and Brazilian</td>
</tr>
</tbody>
</table>

SOURCE: Baker & O’Brien Analysis
Historical Context: Lower and Upper Boundaries

**Upper Limit**
- Driven by coker additions over longer term
- Function of absolute oil price and new coker capital costs

**Lower Limit**
- Refining indifference point between heavy sour and lighter grades
- Fuel price competition with natural gas

*New coker requires LLS-Maya = $15-19/B*  
*For LLS of $60 to $120/B*

**LLS-Maya Price Differential**

**Coker economics of the past**

Approx floor = $4-6/B

Historical Data through 2008

SOURCE: Platts, Baker & O’Brien Analysis
Today’s Coker Projects Require Higher LLS-Maya: Three USGC Projects Reviewed

Comparison of Expansion Project Economics

Project 1
Returns of 12%-21% at LLS-Maya = $15-$19

Project 2

Project 3

Overview

LLS - Maya Differential, $/Bbl.

Assumptions:
LLS = $60/B
USGC 321Crack Spread = $4.00/B

SOURCE: Baker & O’Brien Analysis
Supply-Demand Forces for Coker Feedstock

U.S. Vacuum Residuum Balance (recent)

**Supply**

- U.S. Crude Production: 850 MB/D
- Heavy Crude Imports: 1,050 MB/D
- Other Crude Oil Imports: 870 MB/D
- Resid Imports: 250 MB/D

**Demand**

- Vacuum Resid Upgraded at Refineries: 2,050 MB/D
- RFO and Bunker Fuel: 470 MB/D
- Asphalt: 500 MB/D

**SOURCE:** EIA, Baker & O'Brien Analysis
Supply Factors – U.S. Production

Modest, Negative Impacts From U.S. Production

- Production declines of **Heavy Crudes** over past five years driven by California.
- Growth prospects of **Light Crudes** include Gulf of Mexico and Williston Basin/Bakken (U.S. Upper Midwest).
- Short-term Outlook: According to the EIA, domestic production is projected to increase approximately 400,000 Bbl./day in 2009 (first increase in U.S. production since 1991).
- Longer-term Outlook: By 2012, however, any gains of Vacuum Resid supply would be wiped out by expected production declines.
Brazil Outlook: Waiting for New Production Volume to Show on Market

Supply Factors – Heavy Imports

Total Brazil Crude Oil Production, MB/D

- Heavy Grades
- Light Grades
- Total IEA 2008
- Total EIA 2009 AEO [Preliminary]
- Announced Projects

SOURCE: EIA, IEA, Petrobras, Baker & O’Brien Analysis
Canadian Bitumen Production Growth Curve Likely to Shift Downward a Bit

Announced Projects

SOURCE: CAPP, Baker & O'Brien Analysis
Mexican Heavy Decline Tempered Over Short Term by KMZ Development

Supply Factors – Heavy Imports

Note: Assumes 14% decline rate in Maya production

SOURCE: PEMEX, Baker & O’Brien Analysis
Potential Regional Coker Feedstock From Major Imported Heavy Oil Sources

Supply Factors – Heavy Imports

Key Assumptions:
- Maya decline at 14%/Yr.
- Brazil based on EIA AEO 2009 [Preliminary]
- Adjusted CAPP bitumen production
- Flat Venezuelan Growth

Volumes shown represent incremental volumes versus preceding year

SOURCE: Company Reported Information, Baker & O’Brien Analysis
Resid Imports Supply only a Small Share of Total Demand

Importing Vacuum Resid: 250 MB/D

- **Russia**: 55%
- **Angola**: 3%
- **Nigeria**: 5%
- **UK**: 9%
- **Libya**: 5%

*Other*: 23%

SOURCE: EIA (2008)
Over two-thirds of the announced cokers are “integrated” with a Canadian or Middle East crude supplier, suggesting less likelihood of being cancelled (although with a possibility of being delayed).
Potential U.S. Refinery Rationalization Would Affect Crude and Resid Balances

Cumulative barrels of clean product yield\(^1\) (MMB/D)

\[\text{Capacity Removed: } 1,000 \text{ MBB/D} \]
\[\text{Light Sweet Grades: } 880 \text{ MBB/D} \]
\[\text{Light Sour Grades: } 120 \text{ MBB/D} \]
\[\text{Vacuum Resid: } 80 \text{ MBB/D} \]

\[\text{Capacity Removed: } 500 \text{ MBB/D} \]
\[\text{Light Sweet Crude: } 470 \text{ MBB/D} \]
\[\text{Light Sour Crude: } 30 \text{ MBB/D} \]
\[\text{Vacuum Resid: } 40 \text{ MBB/D} \]

\(^1\) Not included within the evaluation group were those specialty refineries primarily operating to produce petrochemicals, lubricants, or asphalt.

SOURCE: PRISM\(^\text{TM}\)  PRISM is a trademark of Baker & O’Brien, Inc. All rights reserved.
Demand Factors – Fuel Oil Conversion

Volumes of Residual Fuel Oil to Power Generation Can Swing 200 MB/D

RFO volumes to power generation increases when price is favorable

RFO volumes decrease when nat gas price is more favorable

SOURCE: EIA, Baker & O'Brien Analysis
• U.S. Asphalt demand falls in a fairly narrow range (500-550 MB/D).
• Asphalt Demand Outlook: Demand is expected to increase in the future due to U.S. Government-financed economic stimulus projects.

SOURCE:EIA
### Summary

**Indicators expected to tighten coker feedstock balance, increase relative pricing for fuel oil & asphalt and degrade coker economics.**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Impact on Coker Feedstock Availability</th>
<th>Relative Asphalt Price</th>
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</thead>
<tbody>
<tr>
<td>Regional Heavy Crude Supply</td>
<td>Increased supply 3%-6%</td>
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</tr>
<tr>
<td>U.S. Refinery Rationalization</td>
<td>Reduced supply 2%-4%</td>
<td></td>
</tr>
<tr>
<td>New Coker Projects</td>
<td>Increased demand 5%-10%</td>
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<tr>
<td>Increased RFO to Power Plants</td>
<td>Reduced supply 5-10%</td>
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<tr>
<td>Declining U.S. Crude Production</td>
<td>Reduced supply 1%-2%</td>
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<tr>
<td>Reduced Resid Imports</td>
<td>Reduced supply 2%-5%</td>
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<td>Asphalt Stimulus Projects</td>
<td>Increased demand 2%-4%</td>
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Limited volumes of heavy crude oils, along with new cokers coming on-stream in 2011 and 2012 will likely erode coker margins and lead to relative price strengthening for asphalt and residual fuel oil.

- Case can be made for continued wide differentials and relatively depressed asphalt prices for the next two years.
  - Production growth in Brazil and Canada are key factors to watch.
- After two years - when/if significant coker capacity comes on line – key supply and demand factors suggest strengthening asphalt prices.
- Other “wildcards” also seem to favor higher asphalt prices:
  - Global recession leading to curtailed production of less valuable, but more costly to produce heavy grades of crude oil.
  - Integrated cokers will be run at full capacity to monetize heavy crude oils, regardless of low coker margins.
- Analysis is complex and dynamic.