1987: Planes Trains and Automobiles

Steve Martin and John Candy
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2012: Trucks Trains Pipelines and Barges

US Petroleum and Railroad Industries
Major Crude Oil Flows -- 2011

- Pipeline crude oil flows from the Gulf Coast, Canada and West Texas into the Mid-Continent

- In 2011 Canadian, Bakken and Eagleford expanded rapidly creating a surplus of crude
  - Outpacing the capacity of the pipelines
  - Requiring expensive rail to ship oil to USGC

- Production growth continued in 2012. Permian Basin production also grew to exceed the existing pipeline capacity out of that region requiring expensive rail and truck movements to Gulf Coast markets

- Overall result was much lower prices for crude “trapped behind Cushing” (WTI, WTS, Bakken, Canada) than crude in those regions that rely on “World Crude Price” imported crude (Gulf Coast, East Coast, West Coast)
  - WTI was only $2.50 under LLS in 2004-2010
  - $17.40 under LLS in 2011/12

- Light product prices are still set by world prices resulting in a substantially higher refining margins for “WTI-based refiners”
Windfall for West Texas and Midcontinent Refiners

- Light product prices continue to track world crude prices – imports still needed

- Light product margins for running world crudes (Brent and other waterborne crudes) and crudes that are tightly linked to these foreign crudes (e.g. LLS, ANS) have seen little improvement (or even some declines)

- Margins for running WTI, however, greatly improved

  - Windfall for West Texas and midcontinent refiners – Like Alon at Big Spring, TX
  - Strong incentives to get West Texas/Midcontinent, shale crude and Canadian crude to coastal markets (USGC, USEC, USWC)

- Crude producers have very large incentives to commit to pipeline projects to raise wellhead netbacks in Bakken, Eagle Ford and Permian Basin
  - And at the same time to commit to new rail loading/unloading terminals to keep up with production growth and to open access to new markets that will not be served by pipelines (East Coast, West Coast)
Recent Market Developments

- Increase in Permian Basin production has resulted in unprecedented discounts for crude at Midland
  - Small imbalances between production and take-away capacity can result in large price swings
Recent Market Developments

- As deliveries of domestic, light crude to the USGC increase, expect a growing disconnect between LLS crude and Brent as foreign crude requirements are backed out of the USGC
  - Sweet Crude imports into PADD-II and PADD-III already at record low – little left to displace
  - Forward markets anticipate a discount of about $3.50/B for LLS from Brent

- Additional potential for structural improvement in refining margins for Midcontinent refiners and Gulf Coast refiners who process light crudes
  - Product prices more closely tied to Brent
  - Oil Producers with rail access should look towards East Coast and West Coast markets
Oil Production History and Projections

- Permian Basin production should attain levels last seen in the 70’s
- Production will also grow in Canada, Bakken, and Eagle Ford (as well as other shale areas)
- Logistic constraints have restrained production to some extent, but rail has become mainstream and numerous pipeline projects are underway
  - Pipelines should catch up in Permian Basin and Eagle Ford
  - Bakken, Niobrara and Canada all likely to require rail for foreseeable future
- Dislocations likely to advantage refiners in Permian, PADD IV and upper mid-west
  - and others that can access rail crudes cost effectively
- Likely to over-supply the demand for light crude in the USGC → lower LLS prices
Pipeline Conversions -- Looking Forward

- As Canadian and Shale production increases, pipeline projects are intended to ease the amount of crude that is “trapped behind Cushing”
  - Sunoco AMDEL reversal (2011/12)
  - Sunoco West Texas Gulf Expansion (2012)
  - Seaway Reversal/Expansion – 100-400 MBD (2012/13)
  - Shell HOHO reversal– 200 MBD (2013)
  - Sunoco Permian Express I – 90/150 MBD (2013)
  - Sunoco Permian Express II – 200 MBD (2014)
  - Magellan/OXY Bridge-Tex – 278 MBD (2014)
  - Seaway Twin Loop – 450 MBD (2014)

  - Over-supply of light crude to the USGC will require marine shipping to East Coast and Canadian refiners

- WTI/LLS discounts should decline as pipeline capacity is added, but oversupply of light crude in USGC likely to support refinery margins in Midcontinent and USGC
  - LLS likely to trade under Brent
  - Remote shale and Canadian crude priced on rail netbacks
Estimated Rail-Based Transportation Costs to Refining Market Areas

Puget Sound
- Western Canada
  - Bakken
    - Niobrara
      - Permian
        - TX GC
          - LA GC
  - $7-8
  - $10
  - $14-18
  - $13-15
  - $9-11
  - $8-11
  - $10-13
  - $14-16
  - $11-14
  - $5-8

ANS/PG Sour
- N CA, S CA, Bkfl’d
  - PHl/NJ
  - $19-20
  - $16-18

PG Sour
- North Sea / West Africa
  - $7-8

* Est. Rail + Car + Unload Fee + Barge/PL (if needed) to Refinery Market Area, $/B
Factors Driving Refiner’s Decision to Use Rail/Shale Crude

Delivered Price  Quality  Reliability

- Shale crudes have predominantly gained share by competing on price.
  - Significant advantages based on refinery location or advantaged ownership/control of logistic assets
- Quality is comparable to other light sweet crudes (WTI, North Sea, LLS, West Africa)
- Refining value discounts for extreme lightness of some crudes -- particularly when > 40 API. (Eagle Ford, Niobrara, Bakken, Permian shales)
  - Low value C3’s and C4’s are typically higher than other light sweet crudes
  - Significant variability even within the same field

<table>
<thead>
<tr>
<th>Cline Shale WTI -- Crude Variability</th>
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<tbody>
<tr>
<td>API</td>
</tr>
<tr>
<td>Sulfur Wt %</td>
</tr>
<tr>
<td>C3/C4 Vol%</td>
</tr>
<tr>
<td>C5’s Vol%</td>
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<tr>
<td>VTB (1040+) Vol%</td>
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<tr>
<td>Yield Discount $/Barrel</td>
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</tbody>
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- Observed contaminants prevalent in crudes from certain regions – fracking chemicals?
  - Organic Iron and Calcium compounds – catalyst deactivation
  - H2S scavenger chemicals – jet fuel treater issues
Outlook for Shale and Rail Crude Markets -- Likely Trends

• Shale crude has been a good substitute for other imported light sweet crudes
  • Midcontinent, Gulf Coast and East Coast
  • Quality discounts needed to reflect higher content of C3’s an C4’s

• Refiners equipped to process light and medium gravity sour crudes will convert only when the premium for the light shale crude vs light sour crude is very small
  • Midcontinent, Gulf Coast, and West Coast
  • Light-ends processing can be a limitation in refineries

• Refinery crude unit expansions in regions that are closest to shale production

• As pipelines are directed toward the Gulf Coast, expect more of the rail/shale crude to shift towards East and West Coasts
  • Puget Sound refiners are best-positioned for Bakken and Canadian
  • Bakken Crudes relatively competitive into California and East Coast
  • California best positioned for Permian Basin and Niobrara rail

• Heavier Canadian crudes will continue to be pulled both to the Gulf Coast by rail and pipeline and to the West Coast by rail as infrastructure is developed
Puget Sound
• Well-suited to Bakken and Canadian Rail imports
• Blend of crudes can substitute for declining ANS
• Mostly being developed by individual refineries; industry terminals possible

California
• Well-suited for Western Shale and Canadian Rail imports
  • Rail system needs to be debottlenecked to support numerous, full scale unit trains
  • Industry is generally equipped to refine heavier, higher sulfur crudes
• Substitute for medium sour crude imports
  • Substitute for light crudes, in niche refineries
• Potential for receipt terminals to serve refining industry
  • San Joaquin Valley terminals could serve local market and connect by pipeline to San Francisco and Los Angeles
  • Easier to permit, less expensive to build than in SF/LA
Alon Bakersfield Project

- Alon USA in permitting phase for Bakersfield refinery modification and rail crude receipt terminal

- Refinery modifications to optimize processing of light crudes
  - Bakken, Niobrara, Permian Basin and Monterey shale
  - New demand for 60 MBD light crude

- Rail terminal design to unload two unit trains per day
  - Shale fields
  - Canadian crudes

  - On BNSF mainline track
  - Utilizes existing infrastructure

- Access to pipelines that can serve local market, Los Angeles and San Francisco