Perspectives on US Energy Outlook, Cocktail Party Issues and Impacts on E&C Players

October 4, 2011

Wood Mackenzie
downstream consulting
1. World Oil Outlook
2. US Refining and Gasoline Outlook
3. US Natural Gas Outlook
4. US NGL Outlook
Oil supply, outside OPEC increases markedly

Total Non-OPEC Supply *
2010: 50.48 m b/d
2020: 56.06 m b/d
+5.58 m b/d

* including unconventionals and Indonesia

Unconventionals

Note: Countries included where change is greater than 100,000 b/d
OPEC spare crude oil capacity ensures demand can be met

Forecast of OPEC Crude oil Capacity Minus Call on OPEC Crude oil

% of global oil demand

Source: Wood Mackenzie

Call on OPEC crude oil is world oil demand forecast compared with our forecasts for non-OPEC production, OPEC and non-OPEC natural gas liquids, world refining processing gains, and our definition of unconventionals (consisting of biofuels, CTL, GTL, and shale oil).

Source: Wood Mackenzie
World oil demand forecast shows strong growth

Demand by Region

Demand by Major Sectors

Source: History-IEA, EIA; Forecast-Wood Mackenzie
Brent price forecast to 2020 shows increase from about $100

**Price volatility risk**
- Financial investors shifting stance
- Inflation and weak US dollar hedges

**Upward price risk**
- Political turmoil in key producing nations
- Attack on Iran nuclear facilities
- Inadequate upstream investment

**Downward price risk**
- Recovery from financial crisis lags expectations
- Slower than expected GDP growth
- Iraq supply wildcard

Source: History - Thomson Datastream, Forecast - Wood Mackenzie
COCKTAIL PARTY ISSUE #1: What’s up with WTI?
Cushing constraints dislocate WTI from global oil markets

› Brent – WTI spread has multiple drivers
  • Rising North America light crude production (WTI ↓)
  • US refineries re-positioning (WTI ↓)
  • Strong Asian oil demand growth (Brent ↑)
  • Libya production off-line (Brent ↑)

› Widening spread helps inland refiners
  • Buy crude on a WTI basis
  • Product import competition (from USGC) indexed off Brent

Source: Platts, Wood Mackenzie
USGC connectivity is primarily inbound to Cushing impacting the WTI - Brent differential

Legend:
- Inbound
- Outbound
- Outbound planned

Source: Wood Mackenzie – April 2011
Cushing storage utilizations influence the price dynamics of Brent – WTI differentials

Recent differentials suggest other factors are governing the dynamics of WTI.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>World Oil Outlook</td>
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Global capacity additions are concentrated in emerging Asia and the Middle East, with closures in the developed world.

Refinery Capacity Additions

Source: Wood Mackenzie Product Markets Service
On a cumulative basis demand just outpaces capacity growth

Excludes capacity creep and utilisation rate changes

Source: Wood Mackenzie Product Markets Service
## North American Oil Product Demand shows decreased Gasoline and Naphtha Demand

<table>
<thead>
<tr>
<th>Million barrels per day</th>
<th>2005</th>
<th>2010</th>
<th>2011</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td><strong>United States</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>LPG (excl C2)</td>
<td>1.37</td>
<td>1.26</td>
<td>1.25</td>
<td>1.21</td>
<td>1.16</td>
<td>1.16</td>
<td>1.15</td>
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<tr>
<td>Naphtha</td>
<td>0.40</td>
<td>0.27</td>
<td>0.26</td>
<td>0.22</td>
<td>0.19</td>
<td>0.19</td>
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<tr>
<td>Gasoline</td>
<td>9.16</td>
<td>9.03</td>
<td>9.03</td>
<td>9.11</td>
<td>8.79</td>
<td>8.27</td>
<td>7.75</td>
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<tr>
<td>Jet/Other Kero</td>
<td>1.75</td>
<td>1.44</td>
<td>1.44</td>
<td>1.50</td>
<td>1.56</td>
<td>1.60</td>
<td>1.63</td>
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<tr>
<td>Gas/Diesel Oil</td>
<td>4.12</td>
<td>3.79</td>
<td>3.90</td>
<td>4.16</td>
<td>4.20</td>
<td>4.23</td>
<td>4.22</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>0.92</td>
<td>0.55</td>
<td>0.53</td>
<td>0.39</td>
<td>0.37</td>
<td>0.35</td>
<td>0.33</td>
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<tr>
<td>Other</td>
<td>3.09</td>
<td>2.80</td>
<td>2.92</td>
<td>3.14</td>
<td>3.23</td>
<td>3.23</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>US-50 Total</strong></td>
<td>20.80</td>
<td>19.15</td>
<td>19.32</td>
<td>19.73</td>
<td>19.51</td>
<td>19.03</td>
<td>18.46</td>
</tr>
</tbody>
</table>

Sources: EIA & IEA (history), WM (forecast)
Global capacity utilization equalizes, but margins improve in Asia, where oil demand is growing.
CP ISSUE #2: What is happening on USEC refining? USEC continues to suffer from global competition

Gasoline flows from Europe to North America are forecast to continue

Europe continues to export to Africa and the Middle East

Growing surplus of gasoline in FSU as refiners invest in improving octane levels

Asian exports to the Middle East decline

Source: Wood Mackenzie Analysis
Opportunity may be for USEC players to play a larger role in supplying diesel/gasoil to Europe

Diesel/Gasoil Trade

US exports of diesel to Europe should increase
Europe from Middle East should increase
Russia continues to export diesel/gasoil to Europe
Middle East diesel/gasoil exports to Asia fall later in the forecast period

US exports of diesel to Latin America should decline

Source: Wood Mackenzie Analysis
Run cut losers are in the Atlantic Basin

**USGC utilisations manage to stay fairly constant**

Source: Wood Mackenzie Product Markets Service
CP ISSUE #3: Why are these utilizations so low?
Improved vehicle efficiency is a restraint on gasoline demand

Average light vehicle efficiency is below CAFÉ standards which measure vehicles in optimum driving conditions not typical driving conditions.

Existing vehicle stock means the average fleet efficiency takes longer to improve.

By 2025 CAFÉ standards are proposed to move towards 54 mpg.
Compliance with RFS and LCFS regulation substitutes with Ethanol

Forecast Compliance With the US RFS

The Californian LCFS Carbon Intensity Requirements vs Two Gasoline Ethanol Blends

CARBOB + 10% Brazilian Ethanol
CARBOB + 20% Brazilian Ethanol

CARBOB - California Reformulated Gasoline Blendstock for Oxygenate Blending
Natural gas supply anticipated to grow

\textit{(Bcfd, dry)}

- Supply overall increases by 27 Bcfd in the US 2010-2030.
- The largest increases are in the Gulf Coast and the Northeast.
Shale gas reserves are key to growth

Source: Wood Mackenzie
CP ISSUE #4: Will we be allowed to get to it?
The supply mix depends on shales, and hydraulic fracturing

- Close to 50% of supply longer term will be affected by regulations on hydraulic fracturing.
- Still, strong growth potential - 28.5 Bcf/d in the known shale plays by 2025!
Power is still the largest and a growing use of natural gas in the US. Initially, rapid growth, but a longer term slowing.

- Coal retirements, a resumption of economic growth drive 1.5 Bcfd growth annually through 2020.
- Post 2020, efficiencies and renewables reduce growth to < 1 Bcfd yearly.
New-drill cost curves indicate higher long-term Henry Hub price requirement, but well below recent years

*Assumes development breakeven economics (not including land lease costs) at a 10% real IRR adjusted to a Henry Hub-equivalent price

Source: Wood Mackenzie (North America Gas Service)
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Middle East continues to dominate the LPG production – while the US supply remains steady
Given the infrastructure of regional demand, the USGC is the hub for Propane and Butane for Chemical use.
LPG petchem demand expected to increase in the Middle East while other regions’ demand profile remains nearly unchanged.
CP ISSUE #5: Why is everybody’s talking about Ethane?
With all these shales NGL content ("richness") is a key driver

- High oil-gas price differential has increased the attractiveness of liquids-rich shale gas plays…
  - Increased focus on “wetter” shale plays in 2010/11
  - Shifting upstream strategies and capital allocation across independents

![US Shale Gas Production by Play](image)

Source: Wood Mackenzie Unconventional Gas Service
North America’s “Liquids Fairway” unveils an “ethane supply” story


Source: Wood Mackenzie
USGC petchems may focus on maximizing Ethane feedstock

Feedstock demand to produce 1 ton of Ethylene

Ethane Price Projection ($/MMBtu) 2010-2025
In summary, how do the broader trends in the energy industry impact the E&C business?

### Macro-Fundamentals

- Oil supply is stable and more from non-OPEC sources
- Gasoline demand declining
  - Overall demand
  - CAFÉ
  - RFS/LCFS
- Natural gas volumes increased with (wet) shale plays
- NGL supply stable, but ethane will grow significantly

### E&C Impact

- Mega projects in the upstream remain in the mix (Brazil deepwater and Canada)
- Infrastructure plays become the more important in future
- Refining projects to be smaller more geared to regulatory compliance vs. profitability
- Gas fired power plants win the day
- Ethylene units may already have too many announced
THANKS

Any Questions?
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