Agenda:

» Oil and Gas Production Produces a Range of Hydrocarbons
» The Value of Different Hydrocarbons Varies Based on Quality
» US Liquids Production is Booming
» The Quality of US Crude is Getting Lighter
» Reserves Are Measured Using Very Generic Definitions – Volumes Not Value
» Lighter Crudes or Condensates Have Lower Value
» Accounting & Other Regulations Do Not Distinguish Between Liquids – Leading to Potential Overvaluation
» Improvements Are Desirable but Rather Impractical
» Shale Drilling Economics Change Time Horizon
Oil & Gas Production Basics

Oil and Gas Production

Field Separation

Crude Oil Pipeline/ Rail

Refinery

Motor Fuels

Petro-chemicals

Electricity

Oil

NGL Pipeline/ Rail

Gas Processing

Gas Pipeline and Distribution

Gas

NGL

Oil
Value: Oil versus Gas

- Natural Gas $/MMBtu
- Crude Oil $/Bbl

Source: CME-NYMEX – 15 May 2014
Crude Oil Quality

API Gravity (Heavy vs. Light)  Sulfur (Sweet vs. Sour)
## Crude Oil Quality

<table>
<thead>
<tr>
<th>Condensate</th>
<th>Gravity</th>
<th>Sulfur</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°API</td>
<td>Wt. %</td>
</tr>
<tr>
<td>Condensate</td>
<td>≥ 55.0</td>
<td>All</td>
</tr>
<tr>
<td>Super Light</td>
<td>42.0 – 55.0</td>
<td>All</td>
</tr>
<tr>
<td>Light Sweet</td>
<td>31.0 – 41.9</td>
<td>≤ 0.99</td>
</tr>
<tr>
<td>Light Sour</td>
<td>31.0 – 41.9</td>
<td>≥ 1.00</td>
</tr>
<tr>
<td>Medium</td>
<td>24.1 – 30.9</td>
<td>All</td>
</tr>
<tr>
<td>Heavy</td>
<td>≤ 24.0</td>
<td>All</td>
</tr>
</tbody>
</table>

Source: Turner, Mason & Company, *2013 NORTH AMERICAN CRUDE & CONDENSATE OUTLOOK*
Yields – Typical Crude Oil

- Heavy Naphthas
- Light Naphthas
- NGLs
- Distillates
- Gas Oils
- Resids

Amount

Boiling Range

Lighter Boiling

Heavier Boiling

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Crude Quality Challenges

» Not an Homogenous Commodity
» Every Well is Different
» Mixture of Hydrocarbons
» Varies Over Life of Well
» Makes Transportation Difficult As Well As Accounting
U.S. Oil Production 11.0 MMb/d in 2019

Source: Bentek – 5 May 2014
Crude Oil Production Forecast

Permian

Production (Mb/d)

Jan-05  Jan-06  Jan-07  Jan-08  Jan-09  Jan-10  Jan-11  Jan-12  Jan-13  Jan-14  Jan-15  Jan-16  Jan-17  Jan-18  Jan-19

Source: Bentek/RBN
“Condensate is a mixture of hydrocarbons that exists in the gaseous phase at original reservoir temperature and pressure, but that, when produced, is in the liquid phase at surface pressure and temperature.”

- Treated Same as Crude
- Including Federal Definition (DOE, BIS)
Increasing U.S. Average API Gravity
Significant Increase in Condensate Material

US Field Condensate Production

- Everything Else
- Williston
- Denver-Julesburg
- Powder River
- Permian
- Eagle Ford

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Condensate Price Disadvantage

Crude and Condensate Pricing

- LLS
- Eagle Ford Condensate Posting 55 API

Jan-13 | Apr-13 | Jul-13 | Oct-13 | Jan-14 | Apr-14

$Bbl

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Disclose separately material reserves of the following product types:

- (i) Oil;
- (ii) Natural gas;
- (iii) Synthetic oil;
- (iv) Synthetic gas; and
- (v) Sales products of other non-renewable natural resources that are intended to be upgraded into synthetic oil and gas.

### Upstream reserves

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated net proved reserves</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(net of royalties)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Liquids</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>4,349</td>
<td>4,672</td>
<td>5,331</td>
</tr>
<tr>
<td>Equity-accounted entities</td>
<td>745</td>
<td>838</td>
<td>929</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,094</td>
<td>5,510</td>
<td>6,260</td>
</tr>
<tr>
<td><strong>Natural gas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>34,187</td>
<td>33,264</td>
<td>36,381</td>
</tr>
<tr>
<td>Equity-accounted entities</td>
<td>2,517</td>
<td>2,549</td>
<td>2,397</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>36,704</td>
<td>35,813</td>
<td>38,778</td>
</tr>
<tr>
<td><strong>Total hydrocarbons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>10,243</td>
<td>10,408</td>
<td>11,604</td>
</tr>
<tr>
<td>Equity-accounted entities</td>
<td>1,179</td>
<td>1,277</td>
<td>1,342</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11,422</td>
<td>11,685</td>
<td>12,946</td>
</tr>
</tbody>
</table>
Possible Improvements

» Improved Definition of Condensate?
  - > 55 Degrees API
  - Segregated Stream

» Crude Classification?
  - API Heavy/Medium/Light
  - Sulfur Sweet/Sour
Improved Resource Assessment: Constraints

» Impractical to Implement
  ▪ Varies Over Life of Well
  ▪ Subject to Blending
  ▪ Measured at the Surface – Reserves Are Below
  ▪ No Incentive to Under Report Crude by Calling it Condensate

» Better to Understand and Account for Quality Risk
Additional Shale Considerations

» Hydrocarbon Value Determines the Focus of Drilling

» Most Shale Wells Produce Majority of Output in First Year (80% Decline)

» Initial Production (IP) Very High but Estimated Ultimate Recoverable (EUR) is Uncertain

» Impact of Regulation on Value
Summary

» Oil and Gas Production Produces a Range of Hydrocarbons
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» Reserves Are Measured Using Very Generic Definitions – Volumes not Value
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» Improvements Are Desirable but Rather Impractical
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The Marcellus Changes Everything

Yesterday the highest and lowest natural gas prices in the country were only 100 mbtu apart - on the same pipeline. Tomorrow Train 4 averaged $1.85/MMBtu while Zone 6 came in at $1.56/MMBtu. Weird stuff like this happens in the middle of winter, but not in late spring. In today's world of tiny natural gas hour differentials, this is an incredible shoulder season differential of more than $0.30/MMBtu. What could cause such a rupture in this price time continuum? How long will the situation continue? Why does this development portend dramatic, long-term changes in natural gas flows across North America.

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