Shale Gas Supply Issues
An Alternate Scenario to Consider

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Shale Gas and Multi-Stage Fracture Stimulation

Horizontal sections 4,000 ft to 10,000 ft in length
6-15 multi-stage fracture stimulations
2010-2035 Forecast

- For the period, the EIA forecasts a modest 10% increase in overall gas supply.
- This 10% increase relies heavily on growth of shale gas, growth of 150%.
- Success of a major policy change in usage of natural gas will be highly dependent on the viability of shale gas production.
Potential Gas Committee (2009 Report)

- **Upside Resource** = 1,836 Tcf Technically Recoverable (Proved + Probable + Possible + Speculative)
  - Shale Gas = 616 Tcf, In Effect ~27 Years of Supply.
  - **Proved + Probable Resource** = 441 Tcf or ~19 Years of Supply.
  - Probable Estimate is Shale Gas = 147 Tcf, ~6.5 Years at Current Consumption.
  - Substantially less than EIA forecasted production 2010-2035 (225 Tcf).

Forecasted Production By Area

Major U.S. Shale Gas Production and Projected Production

Million Cubic Feet Per Day (normalized pressure, 14.73)

- Projected Beyond February 2011

Source: George Lippman of LCI (2011)
Performance of Shale Gas Plays
Independent View

<table>
<thead>
<tr>
<th>Shale Play</th>
<th>Berman/Pittinger Studies</th>
<th>Operator Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnett</td>
<td>1.26 Bcf</td>
<td>2-2.5 Bcf</td>
</tr>
<tr>
<td>Fayetteville</td>
<td>1.2 Bcf</td>
<td>2-2.5 Bcf</td>
</tr>
<tr>
<td>Haynesville</td>
<td>2.5 Bcf</td>
<td>6-10 Bcf</td>
</tr>
<tr>
<td>Marcellus</td>
<td>No Public Monthly Data</td>
<td>4-4.5 Bcf</td>
</tr>
</tbody>
</table>

1) Our decline curve analysis yields 50% or lower estimates for ultimate recovery per well for each area.

2) Core areas perform better, but are limited in areal extent.

Barnett Production Decline Analysis

<table>
<thead>
<tr>
<th>Well</th>
<th>EUR, Mscf</th>
<th>b-exponent</th>
<th>Number of Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVN 2003</td>
<td>1,644,086</td>
<td>0.10</td>
<td>55</td>
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<tr>
<td>DVN 2004</td>
<td>1,415,194</td>
<td>0.25</td>
<td>91</td>
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<tr>
<td>DVN 2005</td>
<td>1,155,953</td>
<td>0.25</td>
<td>150</td>
</tr>
<tr>
<td>DVN 2006</td>
<td>1,279,064</td>
<td>0.25</td>
<td>285</td>
</tr>
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<td>DVN 2007</td>
<td>1,318,622</td>
<td>0.25</td>
<td>450</td>
</tr>
<tr>
<td>DVN 2008</td>
<td>1,340,084</td>
<td>0.25</td>
<td>573</td>
</tr>
<tr>
<td>DVN 2009</td>
<td>978,684</td>
<td>0.25</td>
<td>285</td>
</tr>
<tr>
<td>DVN 2010</td>
<td>1,320,071</td>
<td>0.25</td>
<td>398</td>
</tr>
<tr>
<td>WEIGHTED AVG EUR</td>
<td>1,226,817</td>
<td>TOTAL WELLS</td>
<td>2,206</td>
</tr>
</tbody>
</table>
Fayetteville Production Decline Analysis

Average Ultimate Recovery = 1.2 Bcf/well for ~ 2,000 wells

Haynesville Production Decline Analysis

* Mean Ultimate Recovery of 124 wells analyzed = 2.5 Bcf/well
* Core area has a higher mean of 4.6-4.8 Bcf/well
**Haynesville Core Area**

- Mean EUR = 4.6 Bcf
- Area ~ 160,000 acres
- At 120 acres/well, Ultimate Recovery in Core Area ~ 6.1 Tcf

**Non-Core Area**

- Mean EUR = 2.1 Bcf

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**Haynesville – Ultimate Recovery & Economics**

- Breakeven Gas Price, $/MMBtu @ Wellhead
  - (at 10% Discount Rate)
  - $8MM/well, $5,000/acre, 120 acre/well, ½ of land leased is fully developed

<table>
<thead>
<tr>
<th>EUR Scenario</th>
<th>EUR/Well, Bcf</th>
<th>Full Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Avg, Projected w/ b = 0</td>
<td>0.00</td>
<td>56.00</td>
</tr>
<tr>
<td>Group Avg, Projected w/ b = 0.5</td>
<td>0.00</td>
<td>37.00</td>
</tr>
<tr>
<td>Group Avg, Projected w/ b = 1.0</td>
<td>0.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Operator View, 14 MMcfd (P, b=1.0)</td>
<td>0.00</td>
<td>6.50</td>
</tr>
</tbody>
</table>
“Land Rush” Business Model

- Recent shale plays leased up in 2-3 years before plays are fully tested
- High volume of drilling, driven in part by need to hold acreage
  - 1 well per 640 acres to hold leases that would otherwise expire in 3-5 years
- Need to tell growth story to investors
  - Capital spending exceeds cash flow
  - Large write-downs
- Result: Excess gas supply, keeping prices very low
  - Natural gas sell for 75% discount on energy equivalent basis to oil
  - Probably not sustainable in the long term
- Awareness of actual well performance should increase
Summary – Uncertainty Abounds in Shale Gas Supply

• Shale gas development is not a “manufacturing” process that is consistently repeatable across the entire area of the play:
  – Quality and geology matters,
  – Sensitive to Price.

• Major policy discussions of expanding use of natural gas should consider a downside scenario for shale gas as compared to EIA forecast (12 Tcf/yr in 2035, 220 Tcf produced between 2010-2035)
  – Shale gas may disappoint by a factor of 2 to 4,
  – EIA forecast volumes are more likely with substantially higher natural gas prices.