Terminal Decline Considerations in A&D Evaluations

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WHO...?

“Who’s on first?”
WHO...

• ...is the seller?

• ...performed the data room evaluation and terminal decline estimation?
WHAT...?

“What’s your damage?”
WHAT...

• ...are we potentially buying?

• ...type of reservoir(s) and drive mechanism?

• ...is the product mix now and expected over the life of the project?

• ...what’s its damage?
Unconventional
~93% of EUR prior to Boundary Dominated Flow
Conventional
~50% of EUR prior to Boundary Dominated Flow

*Same EUR for both forecasts
Product Mix in Midland Basin

From “Death by Bubble Point”, Dr. John Lee, SPE HEES 2018
WHERE...?

“Where we’re going, we don’t need roads.”
WHERE...

• ...are the future development and re-development opportunities located with respect to the existing wells and do we anticipate interference, i.e. infills, step outs?

www.fekete.com
WHY...?

“Atreyu, why do you look so sad?”
WHY...

• ...should we include/exclude certain wells when estimating terminal decline?

• ...should/could we use vertical wellbores as a proxy for horizontal terminal decline estimation?

• ...have existing wells become inactive in the past?
Estimated Terminal Decline

Active + Inactive Wells
"How far is Minas Tirith??"
HOW...

• ...did previous operators drill & complete these wells?

• ...are the wells being produced now and likely to be produced in the future?

• ...much opex/capex are associated with achieving the terminal decline expectations?
“When and where does this ‘real world’ occur?”
WHEN...

• ...in the field’s life cycle are we purchasing?

• ...will we produce the forecasted volumes and incur the costs?

[Graph: Monthly EIA Estimated U.S. Tight Oil Production By Resource Play, Jan 2000–Sep 2017]

Source: EIA

www.naturalgasintel.com
Hypothetical Unconventional Oil Opportunity

Project Rock Chalk
Key Stats
- 100% WI / 75% NRI
- 2000 bopd IP
- 120% nominal decline
- 0.7 b factor
- $7.5MM development capex
- $7500/well-mo fixed opex
- $10/bo variable opex

Sensitivities
- Terminal Decline
- WO capex
- Maturity
Terminal Decline Sensitivities

<table>
<thead>
<tr>
<th>Terminal Decline</th>
<th>Reserves MBOE</th>
<th>NPV10 M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>1,206</td>
<td>22,445</td>
</tr>
<tr>
<td>7%</td>
<td>1,175</td>
<td>22,422</td>
</tr>
<tr>
<td>10%</td>
<td>1,133</td>
<td>22,335</td>
</tr>
<tr>
<td>14%</td>
<td>1,082</td>
<td>22,119</td>
</tr>
<tr>
<td>Difference 14% to 5%</td>
<td>-10%</td>
<td>-1%</td>
</tr>
</tbody>
</table>
# Maintenance Capex Sensitivities

<table>
<thead>
<tr>
<th>WO Capex</th>
<th>Reserves MBOE</th>
<th>NPV10 M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (Base)</td>
<td>1,133</td>
<td>22,335</td>
</tr>
<tr>
<td>$150M / 4 years</td>
<td>1,127</td>
<td>22,020</td>
</tr>
<tr>
<td>$150M / 2 years</td>
<td>1,113</td>
<td>21,767</td>
</tr>
<tr>
<td>$300M / 2 years</td>
<td>1,093</td>
<td>21,228</td>
</tr>
<tr>
<td>Difference Max to Base</td>
<td>-4%</td>
<td>-5%</td>
</tr>
</tbody>
</table>
Maturity of Project at Acquisition Date

Monthly EIA Estimated U.S. Tight Oil Production By Resource Play, Jan 2000–Sep 2017

Source: EIA

www.naturalgasintel.com
# Maturity of Project at Acquisition Date

<table>
<thead>
<tr>
<th>Years from Initial Development</th>
<th>Reserves MBOE</th>
<th>NPV10 M$</th>
<th>Reserves MBOE</th>
<th>NPV10 M$</th>
<th>Reserves MBOE</th>
<th>NPV10 M$</th>
<th>Difference 10% to 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (Base)</td>
<td>1,206</td>
<td>22,445</td>
<td>1,133</td>
<td>22,335</td>
<td>-6%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>2.5 Years</td>
<td>620</td>
<td>12,299</td>
<td>548</td>
<td>12,152</td>
<td>-12%</td>
<td>-1%</td>
<td></td>
</tr>
<tr>
<td>5.5 Years</td>
<td>410</td>
<td>6,881</td>
<td>337</td>
<td>6,686</td>
<td>-18%</td>
<td>-3%</td>
<td></td>
</tr>
<tr>
<td>10.5 Years</td>
<td>255</td>
<td>3,599</td>
<td>183</td>
<td>3,285</td>
<td>-28%</td>
<td>-9%</td>
<td></td>
</tr>
</tbody>
</table>
Potential Implications of Terminal Decline Estimation Bust in A&D

• Over/under bid for acquisition

• Opex/capex KPI target misses

• Production volume/mix misses

• Reserves write downs and asset impairments

• DD&A implications
Conclusions

• Terminal decline is a larger driver in A&D evaluations when:

  – Reservoir achieves BDF sooner (i.e. conventional)

  – Reservoir is further along in its maturity

  – Interference from down spacing observed

  – Higher costs required to achieve the theoretically feasible terminal decline
DISCUSSION?

Question everything
BACKUP
BOOK VALUE AND DD&A

- Book value of PP&E represents (historical) costs incurred to acquire or develop assets, including successful exploration costs, ARO and capitalized interest, net of accumulated DD&A and impairment (pp. 68-69, 100)

- DD&A is based on historical costs going back many years, so will reflect necessary investment required to sustain reserves based on mixture of present and potentially very historic costs – poor benchmark for changes in real asset value

- DD&A using unit of production method

- Proved reserves and production volumes used as basis for recording DD&A
BOOK VALUE AND DD&A (Continued)

- \( \frac{\text{Unamortized Costs}}{\text{Proved Reserves}} \times \text{Production for Period} \)
DD&A COMPUTATION

<table>
<thead>
<tr>
<th>Illustration 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unamortized Costs</td>
</tr>
<tr>
<td>Estimated Reserves – beginning of period</td>
</tr>
<tr>
<td>Production during period</td>
</tr>
</tbody>
</table>

\[
\frac{750,000}{1,000,000 bbls} \times 40,000 bbls = 30,000
\]


## DD&A COMPUTATION

### Illustration 2  (significant reserves revision)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unamortized Costs</td>
<td>$750,000</td>
</tr>
<tr>
<td>Estimated reserves – beginning of period</td>
<td>$1,000,000 bbls</td>
</tr>
<tr>
<td>Production during period</td>
<td>40,000 bbls</td>
</tr>
<tr>
<td>Estimated reserves – end of period</td>
<td>560,000 bbls</td>
</tr>
</tbody>
</table>

\[
\frac{\$750,000}{560,000 \text{ bbls} + 40,000 \text{ bbls}} \times 40,000 \text{ bbls} = \$50,000
\]