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Do You Believe???

• Reserves estimation is “science + art”
• Usefulness of reserves is contingent on confidence
  – Reliability, quality of reporting
  – Due diligence is equal opportunity, but costly
• Frontier, unconventional plays raise new challenges
• FD cost, commodity price variability
“Art”: A Proposed Definition

The ability to visualize, build and execute a concept for optimal commercialization of upstream assets based on valuations using thorough analysis of, and reasonable and sound scientific interpretation of, G&G and engineering data and information.

Project Based

**SPE Description of Uncertainty**

The system accommodates multiple approaches to assessing uncertainty.

<table>
<thead>
<tr>
<th>Deterministic Methods</th>
<th>Probabilistic Methods</th>
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</thead>
<tbody>
<tr>
<td>Can Fail, Proved, Possible</td>
<td>EUR</td>
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<tr>
<td>Reasonably Certain</td>
<td>EUR</td>
</tr>
<tr>
<td>1P scenario - high degree of confidence</td>
<td>1P scenario - more likely than not</td>
</tr>
<tr>
<td>Less likely than Proved</td>
<td>Less likely than Possible</td>
</tr>
<tr>
<td>More Likely than Possible</td>
<td></td>
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<tr>
<td>2P scenario - more likely than not</td>
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<tr>
<td>3P scenario - unlikely</td>
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</tbody>
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Lenders, investors seek “commerciality”:
- Independently audited reserves figures
- Proved reserves as collateral
- Development plan (reasonable timetable)
- Access to market (infrastructure is/can be available)
- Risk assessment
- Overall, positive financial metrics
Reserves Definitions Matter

- IOCs investing globally have to comply with regulations and market expectations
  - Fiscal regimes have to be conducive to reporting and revenues to shareholders
- Governments and NOCs
  - Petrobras pays Brazilian government about 50% of value it generates
  - Pemex pays Mexican government about 80% of value it generates

U.S. Annual Breakeven Cost, $/BOE After 10% Return

Implied Oil Price (3 X Annual FD $/Bbl)

U.S. Crude Oil First Purchase Price, $/Bbl

**U.S. breakeven cost** is finding and development (FD) expense plus all production cash costs (production operating expense, general and administrative, net interest) plus income and non-income taxes. It is an average for the group of companies included in the U.S. EIA Financial Reporting System. **Implied oil price** is the price needed by producers based on a formula of 3X FD expense (excluding cash costs; i.e., “drillbit” cost only). When breakeven cost and/or implied price are above U.S. crude oil first purchase price (average price paid for production at the wellhead or lease), companies adjust capital expenditures downward.

Correlations between annual breakeven, implied oil price and crude oil first purchase price are close to 0.9. Standard deviation is roughly 19.

CEE analysis based on U.S. EIA FRS
### U.S. Nat Gas Cost Structure, 2010

- **10% Return**
- **U.S. 10 Cash Exploration Costs $/MCFE**
- **U.S. 10 Cash Operating Costs $/MCFE**
- **U.S. All Source FD Costs 07-10 $/MCFE**
- **Henry Hub Spot Price $4/MCF**

*Not all companies report current cash exploration costs*

### Average Change, 2009-2010

- **10% Return**
- **U.S. Cash Exploration Costs $/MCFE**
- **U.S. Cash Operating Costs $/MCFE**
- **U.S. All Source FD Costs $/MCFE**
- **Henry Hub Spot Price $4/MCF**

*Not all companies report current cash exploration costs*
Average Change, By Company

Challenges:
- High variability in geology (matrix porosity)
- High variability in cost structure
- Allocating high overhead

The Myth of “Big Oil” (As a Percent of Proven Reserves)
National Oil Companies (NOCs) Increasingly Control the World’s Oil Reserves

Source: PFC Energy.
### 2009 Largest Oil and Gas Companies (percent of worldwide reserves)

- Saudi Aramco Oil Co: 10.19%
- National Iranian Oil Co: 8.49%
- Kuwait Petroleum Corp: 7.50%
- Petroleos de Venezuela SA: 7.34%
- Abu Dhabi National Oil Co: 6.54%
- Nigerian National Petroleum Corp: 5.27%
- Qatar Petroleum Corp: 2.75%
- QNG Resnatt: 1.88%
- OAO Lukoil: 1.33%
- Petrobras: 1.03%
- PetroChina Co Ltd: 0.83%
- Petroleos Mexicanos: 0.79%
- Petroleo Brasileiro SA: 0.70%
- Sonangol: 0.68%
- ExxonMobil: 0.53%
- Chevron: 0.41%
- Total SA: 0.42%
- BP PLC: 0.42%

Source: Calculated from World Reserves of 1.34 trillion barrels as of January 1, 2010 according to Oil & Gas Journal, December 6, 2009 and leading companies according to Oil & Gas Journal, September 6, 2010.

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### Fiscal Agreements Decisions

1. **May oil and gas companies own hydrocarbons?**
   - Yes (Y)
   - No (N)

2. **How are oil and gas companies paid?**
   - In Kind
   - In Cash

3. **Production-Sharing Contract/Agreement**
   - Yes (Y)
   - No (N)

4. **Is there sufficient risk for oil and gas companies to book reserves?**
   - Yes (Y)
   - No (N)

5. **Risk-Service Contract**
   - Yes (Y)
   - No (N)

6. **Fee-for-Service Contract**
   - Yes (Y)
   - No (N)
Upstream Regimes

Note: Investor (oil company) perspective

Quality of Commercial Frameworks

Relative Risk, Reserve Position (Prospectivity)

Recent fiscal regime changes (up is more favorable)


Reserves Replacement Rate (%) 2004-2009 Average Each NOC

Rosneft and Gazprom exclude Yukos acquisition.
Challenges:
• High variability in cost structure
• Maturity and regime

Conclusions
• It’s not a perfect world
  – Transparency is critical
• Technical challenges need to be addressed
  – Everyone loses if envelope pushed too far
• Substitutes to reserves are not attractive