Geopolitics of Unconventional Oil & Gas
New Markets, New Risks, New Policies

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Outline of Presentation

- Context: O&G’s role in the economy and foreign affairs
- What is different about Unconventional O&G?
- The North American Experience
- Implications for Major producers and consumers
- Some cases: Russia, Iran, China, Saudi Arabia, ....
- Uncertainties
Old View

- O&G global resources concentrated in Middle East and a few major resource holders.
- Large economies hopelessly dependent on oil and increasingly gas imports.
- The real price of O&G will inevitably increase.
- Natural Gas Markets inevitably regional – Europe, Asia, North America.

New View

- Unconventional O&G (shales, tight sands, coal bed CH₄) widely available around the world.
- Previously dependent economies will stop being import dependent, e.g. U.S.
- Increased supply may lead to lower real prices for several decades.
- Global Natural Gas market possible, but not soon.
Implications of the changes

- Energy, especially O&G, will continue to be key to economic performance and geopolitical affairs.

- Consumers will benefit from lower prices, e.g. lower cost for home heating with natural gas.

- There will greater demand for O&G due to lower prices.

- The shift in relative prices (O&G, coal, nuclear, renewables) will cause shift in energy use, e.g natural gas for electric power generation.

- Winner & Loser among traditional major resource holders.
What is different about Unconventional O&G?
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Keep scale of production in mind.
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Enormous surface operations
Initial Environmental Concern - Hydraulic fracturing fluid contaminating drinking water – not the major environmental issue

**Exhibit 35: Volumetric Composition of a Fracture Fluid**

- **Water and Sand**: 99.51%
- **KCl**: 0.06%
- **Surfactant**: 0.085%
- **Other**: 0.49%
- **Friction Reducer**: 0.088%
- **Biocide**: 0.001%
- **Acid**: 0.123%
- **Corrosion Inhibitor**: 0.004%
- **Iron Control**: 0.007%
- **Crosslinker**: 0.007%
- **Breaker**: 0.01%
- **pH Adjusting Agent**: 0.011%
- **Gelling Agent**: 0.056%
- **Scale Inhibitor**: 0.043%

Full disclosure of all additives – type and quantity
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**Principal Environmental impacts:**

1. Water quality
2. Air quality
3. Community impacts
4. Land-use impacts
5. Induced Seismicity

**Key points:**

- Not just hydraulic fracturing
- All environmental impacts of production should be included
- Different than conventional production
- Expect great diversity
Global Markets
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Rapid growth of Unconventional O&G production in US

Figure 11. U.S. energy production by fuel, 1980-2040
Explosion of Shale gas resource is world-wide
# Geopolitics of Unconventional Oil & Gas
## New Markets, New Risks, New Policies

**Table 2. Top 10 countries with technically recoverable shale oil resources**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Shale oil (billion barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Russia</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>U.S.¹</td>
<td>58 (48)</td>
</tr>
<tr>
<td>3</td>
<td>China</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Argentina</td>
<td>27</td>
</tr>
<tr>
<td>5</td>
<td>Libya</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>Venezuela</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>Mexico</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>Pakistan</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Canada</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Indonesia</td>
<td>8</td>
</tr>
</tbody>
</table>

**World Total**: 345 (335)

¹ EIA estimates used for ranking order. ARI estimates in parentheses.

**Table 3. Top 10 countries with technically recoverable shale gas resources**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Shale gas (trillion cubic feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>1,115</td>
</tr>
<tr>
<td>2</td>
<td>Argentina</td>
<td>802</td>
</tr>
<tr>
<td>3</td>
<td>Algeria</td>
<td>707</td>
</tr>
<tr>
<td>4</td>
<td>U.S.¹</td>
<td>665 (1,161)</td>
</tr>
<tr>
<td>5</td>
<td>Canada</td>
<td>573</td>
</tr>
<tr>
<td>6</td>
<td>Mexico</td>
<td>545</td>
</tr>
<tr>
<td>7</td>
<td>Australia</td>
<td>437</td>
</tr>
<tr>
<td>8</td>
<td>South Africa</td>
<td>390</td>
</tr>
<tr>
<td>9</td>
<td>Russia</td>
<td>285</td>
</tr>
<tr>
<td>10</td>
<td>Brazil</td>
<td>245</td>
</tr>
</tbody>
</table>

**World Total**: 7,299 (7,795)

¹ EIA estimates used for ranking order. ARI estimates in parentheses.

EIA June 2013 estimates
• **Global Resource Base Potential Huge**
  
• **Uncertainties Large**
  
  • Large variation within resource play – Oil/Gas/Water.
  
  • Environmental impacts and production cost.
  
  • Oil/Gas price uncertain both in local economy and globally.
  
  • Economics of global LNG trade uncertain.
  
  • O&G infrastructure is huge and expensive so pace of commercial development will be slow.
  
  • Drilling and stimulation technology mostly in North America.
  
  • Hard to predict relative economic value of oil/gas for domestic use compared to export.
Implications for global oil & gas markets

- The North American Supply shock has not and will not, by itself, result in a cratering of the world oil price.

- The relatively high levels of global spare production capacity, NA production growth, and slower global demand growth points to potential oil price drop to the range of $70 - $90 per barrel.

- Global spare capacity has dampened “minor” supply disruptions: Syria, Nigeria, Libya, Yemen.

- MRHs such as Iran, Venezuela, Russia have suffered negative wealth effect – the value of their conventional O&G resources have gone down.

- Expensive conventional O&G projects are now underwater: Australian CBM, Gulf of Mexico deep off shore, and Artic oil.
Major economic questions

• Will natural gas prices maintain regional difference?
  NA $4/MCF  Europe $10/MCF  Asia $16/MCF

• Will the energy equivalent difference between oil and gas continue?
  Oil $100/b = $15/MMBTU  NA natural gas $4/MMTU

• Tremendous economic incentive for technology change that will increase natural gas demand:
  – Natural gas in power generation (displacing nuclear, renewables, coal)
  – Natural gas in transportation sector: CNGVs or bi-fuel vehicles?
  – Gas to Liquids (GTL) transform CH$_4$ to CH$_3$OH.
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Geopolitical Implications
How quickly will new Unconventional Oil & Gas production come on line?

- In U.S. resource belongs to land owner – not the government. Tremendous financial incentive to exploit resource.

- North American has much greater intensity of drill rigs and pumping equipment and stimulation technology.

- National oil companies do not have technical know-how of investor owned E&P companies.

- Large overhang of conventional O&G production capacity.
Changes in U.S. Energy Policy

• U.S. (and N.A.) will have the potential to export oil, gas (and coal) so U.S. will be more influential in balancing world markets.

• North America will become “effectively independent of oil imports” but this does not mean “energy independent.”

• The change in the U.S. energy posture significantly increases foreign policy leverage and will advance its interests.

• Changes best understood by considering country examples
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### Six country examples

- Iran
- Russia
- Saudi Arabia
- China
- Venezuela
- Mozambique

### Points to remember

- Energy is always an important part of foreign policy
- First priority – avoid conflict
- Oil & Gas is only one aspect of energy
- Increased supply favors consumers.
- Bilateral & Multilateral action
Iran

- **FP Issues:** Nuclear weapons program, terrorism, Iraq, Israel/Palestine

- **Oil production:** 3 million b/d export reduced by sanctions. Burden for importing countries such as Japan, Germany, China.

- Increase in global supply imposes tremendous “wealth loss” of Iran’s gas resource base (due to anticipated fall in natural gas and oil prices).

- Increase in global supply encourages greater firmness by international community on Iran to reverse course on their nuclear program.
Russia

- Russian economy highly dependent on O&G exports.
- Eastern Europe, especially Germany, dependent on Russian natural gas exports with pricing indexed to oil. This dependence influences the foreign policy position of Germany and other countries.
- Diversity of supply leverages Europe’s bargaining position.
- Lower prices means: lower revenue, lower investment in O&G sector. Major economic risk for Russia and contributes to political instability.
Saudi Arabia

- Great risk from lower oil and gas prices.
- Fiscal breakeven for Kingdom said to be $90 per barrel (IMF estimate).
- Prolonged drop in oil price will make it difficult to maintain social safety next at a time when expectations rising among the younger generation. (Saudi citizen unemployment rate is about 10%).
- Some risk this will destabilize monarchy – with successor government less inclined to stabilize the global oil market.
- However any successor regime will continue to be oil exporter.
- Other MRH have similar risk: Algeria, Iraq, Libya, and Yemen.
China

- China’s economic growth requires increasing consumption of O&G. (+40% O&G imports 2012 to 2035).

- New opportunities for needed O&G supply:
  - Unconventional O&G production (but water is a constraint).
  - Greater imports from Russia and Central Asia.

- Natural Gas import prices linkage to oil weakened – Index to oil reduced. Future supplies from Australia cheaper.

- Eases Chinese interest in “going out” for oil and gas reserves.
Venezuela

- Venezuela has been a thorn in the U.S. side for a long time.
- Venezuela has provided oil to Caribbean and Central American countries gaining influence in the region.
- Prospects that VZ exports to region will be decline in next several years.
Mozambique

- Interesting example ENI and Anadarko considering large LNG projects.
- Planned on assumption that LNG price indexed to oil. No longer true.
- Major increase in regional supply impacts regional market, in this case Iran.
Fig. 2—Barnett shale measured fracture heights sorted by depth and compared to aquifers.

SPE 145949

Hydraulic Fracture-Height Growth: Real Data
Kevin Fisher and Norm Warpinski, SPE, Pinnacle—A Halliburton Service