The Role of Unconventional Gas in the Future World Energy Supply
Workshop on Golden Rules for Unconventional Gas Prospects

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THE US SHALE EXTRACTION REVOLUTION

Source: EIA, Annual Energy Outlook 2012 Early Release
What does it really mean; intensity of activity (2011)

- Rigs 1,800+
- Wells 30,000+
- Horizontal Wells 17,000+
- Frac Stages 250,000+
- Jobs 100,000+
What is really takes to produce 5 BCF (.14 BCM) of Natural Gas per day
GLOBAL UNCONVENTIONAL GAS RESOURCES

Rock music

Estimated unconventional natural-gas resources
Trn cubic metres

- Shale gas
- Tight gas
- Coal-bed methane

Asia-Pacific
North America
Former Soviet Union
Latin America
Middle East and North Africa
Europe
Sub-Saharan Africa

Source: IEA
GLOBAL NATURAL GAS RESOURCES IN SHALE FORMATIONS
## Technically Recoverable Natural Gas from Shale Formations

188,000 TCM

<table>
<thead>
<tr>
<th>Continent</th>
<th>Technically Recoverable (Tcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America (non U.S.)</td>
<td></td>
</tr>
<tr>
<td>Coolada, Mexico</td>
<td>1,069</td>
</tr>
<tr>
<td>U.S.</td>
<td>862</td>
</tr>
<tr>
<td>Total North America</td>
<td>1,931</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
</tr>
<tr>
<td>Morocco, Algeria, Tunisia, Libya, Mauritania, Western Sahara, South Africa</td>
<td>1,042</td>
</tr>
<tr>
<td>Asia</td>
<td></td>
</tr>
<tr>
<td>China, India, Pakistan</td>
<td>1,404</td>
</tr>
<tr>
<td>Australia</td>
<td>396</td>
</tr>
<tr>
<td>Europe</td>
<td></td>
</tr>
<tr>
<td>France, Germany, Netherlands, Sweden, Norway, Denmark, U.K., Poland, Lithuania, Ukraine, Turkey</td>
<td>624</td>
</tr>
<tr>
<td>South America</td>
<td></td>
</tr>
<tr>
<td>Colombia, Venezuela, Argentina, Bolivia, Brazil, Chile, Uruguay, Paraguay</td>
<td>1,225</td>
</tr>
<tr>
<td>Total</td>
<td>6,622</td>
</tr>
<tr>
<td>Total without U.S.</td>
<td>5,760</td>
</tr>
</tbody>
</table>
**Major Factors Influencing Natural Gas Extraction from Shale Formations**

- **Geological**
  - Formations are not homogeneous, formations differ
  - Potential is difficult to estimate
  - Extracting from formation “sweet spot” extremely important

- **Economics**
  - Technology has driven cost investment low but productivity depletes quickly
  - Prices demand focus on well productivity and operational efficiency, cash flow critical
  - Price controls may impact development
  - “Wet” vs. “Dry” development
  - Proximity of pipeline network
MAJOR FACTORS INFLUENCING NATURAL GAS EXTRACTION FROM SHALE FORMATIONS (CON’T)

- **Operational and Environmental**
  - Availability of services industry and resources
  - Preparation and movement of equipment to the site
  - Availability of water
  - Flow back water handling and treatment
  - Drilling intensity
  - Emission mitigation

- **Social and Political**
  - Ownership of subsurface rights
  - Government commitment
  - Public engagement and acceptance
  - Patchwork or regulatory frameworks
THANK YOU