The Globalization of Gas: Issues for China and India

David G. Victor
January 28, 2005
Stanford, CA

http://pesd.stanford.edu/
Primary Energy Supply in China: 1971-2030
Primary Energy Supply in India: 1971-2030
Gas Resources and Potential Demand

White: where the lights are on, satellite imagery
Blue → Red: Gas resources, with increasing size (USGS)
The Baker/Stanford Approach:

• Historical Case Studies
  – Key “first of a kind” projects
  – Compare built projects with alternatives

• Model of Gas Futures
  – “World Gas Trade Model” (WGTM”)
  – All major resources and supply curves
  – All major demand centers
  – All major gas transmission technologies
# Seven Historical Case Studies

<table>
<thead>
<tr>
<th>Built Projects</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indonesia LNG to Japan</td>
<td>Lewis &amp; von der Mehden</td>
</tr>
<tr>
<td>2. Algeria to Italy</td>
<td>Hayes</td>
</tr>
<tr>
<td>3. Russia to Poland and Germany</td>
<td>Victor &amp; Victor</td>
</tr>
<tr>
<td>4. Turkmenistan (to Iran, to Russia, to Pakistan &amp; India)</td>
<td>Olcott</td>
</tr>
<tr>
<td>5. Qatar to Japan</td>
<td>Hashimoto</td>
</tr>
<tr>
<td>6. Trinidad LNG to U.S.</td>
<td>Shepherd &amp; Ball</td>
</tr>
<tr>
<td>7. Southern Cone (Bolivia to Argentina; Argentina to Chile; Bolivia to Brazil)</td>
<td>Mares</td>
</tr>
</tbody>
</table>
Program on Energy and Sustainable Development - http://pesd.stanford.edu/

Atlantic LNG
Qatargas LNG
Arun LNG
TransMed
YABOG
GasBol
GasAndes
The Belarus Connector
Bluestream
Turkmenistan Export Routes

Existing
Proposed

0 1,500 3,000 6,000 Kilometers
The “Economics Only” View: Projected Gas Trade Between Regions
Four Implications

1. New Market Structures
   • Regional to Global; rising role of LNG

2. Changing Roles for Governments
   • From Builder to Facilitator

3. Supply Security
   • A Scramble for Gas Resources?

4. Dangers Ahead?
   • Four Pitfalls
2. Changing Role for the State

• “Old World”
  • State-owned enterprises
  • Tightly regulated, monopoly markets
  • Oil-indexed gas prices

• “New World”
  • Private operators and financing
  • Contestable, multiple markets
  • Gas-on-gas competition

➢ The New World: Faster or Slower Shift to Gas?
The Changing Role of the State

Role of state in gas projects

- **Private**
  - Transmed (Algeria → Italy) 1983

- **Hybrid**
  - Arun (Indonesia LNG → Japan) 1972
  - Yabog (Bolivia → Argentina) 1972

- **State**
  - Qatargas LNG → Japan 1996
  - Belarus Connector 1996
  - Turkmenistan → Iran 1997
  - GasAndes 1997
  - GasBol 1998
  - Bluestream (Russia → Turkey) 2002

Year

Old World: State “creates” demand
3. Security of Supply and Cartels

• To date, very few political interruptions
  – Ukraine (middle 1990s) and Belarus (2004)
  – Algeria (early 1980s)
  – Indonesia (~2002)
  – Argentina (2004)

• Is Gas Cartel Feasible?
  – Gas Exporting Countries Forum (GECF)
  – Large Competitive Fringe
  – Policy responses
Gas Trade Interruptions

<table>
<thead>
<tr>
<th>Initiating Party</th>
<th>Examples from 7 Case Studies</th>
</tr>
</thead>
</table>
| **Supplier**     | 1. Algeria (1981 to 1983). “Gas Battle” with Italy, the United States and others.  
                          2. Ukraine (mid-1990s) disputes with Gazprom over volumes and payments for gas shipments.  
                   2. YABOG (1987). Argentina refuses to take or pay for full Bolivian shipments.  
                   3. GasBol (2001). Brazil refuses full volumes contracted from Bolivia  
Prospects for a Gas Cartel

• Reserves and Exports highly concentrated
  – Exports
    • Russia has 28%
    • Top 7 have 79% of exports
• But
  – Not all are likely Cartel members (e.g., Canada, Norway, Netherlands—30% of exports)
  – Export concentration reflects underdevelopment of many major deposits
    • Qatar (2.6% of world exports) is only significant Middle East player
  – High supply elasticity → many “competitive fringe” suppliers
Chinese Gas Infrastructure
Chinese Gas Infrastructure (2)
STAGES IN CREATION OF OIL AND GAS PIPELINE NETWORK IN THE EAST OF RUSSIA

Source: Energy Systems Institute of SB RAS, Irkutsk
4. Challenges to Gas Future

A. Investor confidence

- $3.1 trillion capital needed for next 30 years
- Mainly upstream (E&D, liquefaction)
- In hospitable investment environments
### Top 10 Exporters

<table>
<thead>
<tr>
<th>Rank</th>
<th>Exports (bcm)</th>
<th>Production (bcm)</th>
<th>Reserves (tcm)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Russia</td>
<td>128.22</td>
<td>554.9</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Canada</td>
<td>108.80</td>
<td>183.5</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Norway</td>
<td>61.19</td>
<td>65.4</td>
<td>7</td>
</tr>
<tr>
<td>4.</td>
<td>Algeria</td>
<td>57.76</td>
<td>80.4</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Netherlands</td>
<td>42.70</td>
<td>59.9</td>
<td>9</td>
</tr>
<tr>
<td>6.</td>
<td>Indonesia</td>
<td>35.83</td>
<td>70.6</td>
<td>6</td>
</tr>
<tr>
<td>7.</td>
<td>Malaysia</td>
<td>20.52</td>
<td>50.3</td>
<td>12</td>
</tr>
<tr>
<td>8.</td>
<td>Qatar</td>
<td>18.59</td>
<td>29.3</td>
<td>19</td>
</tr>
<tr>
<td>9.</td>
<td>United States</td>
<td>15.12</td>
<td>547.7</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>United Kingdom</td>
<td>14.16</td>
<td>103.1</td>
<td>4</td>
</tr>
</tbody>
</table>
More Challenges

B. "Resource Curse"
   • Arun, Algeria, Russia: all affected
   • Does the resource curse apply to gas?

C. Siting and terrorism
   • Regasification facilities

D. Electricity
   • 2/3 of expected incremental demand
   • Will markets be restructured?
     – Caution of Brazil
   • Will coal fight back? Large scale renewables? Nuclear?
     – Coal in Poland