Geopolitics of Natural Gas

A joint study:

Energy Forum of the Baker Institute
Rice University

Program on Energy and Sustainable Development
Stanford University

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Supply and 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 Future Gas Market
  – “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>
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<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>
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<tr>
<td>6. Trinidad LNG to U.S.</td>
<td>Shepherd &amp; Ball</td>
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<tr>
<td>7. Southern Cone (Bolivia to Argentina; Argentina to Chile; Bolivia to Brazil)</td>
<td>Mares</td>
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</tbody>
</table>
A Vision for 2030

2002 Production Share

- Russia, 22.0%
- EU (L48 and Alaska), 18.8%
- North Sea Region, 9.5%
- Australasia, 7.3%
- Africa (majors), 4.6%
- South America (majors), 4.2%
- Turkmenistan, 1.3%
- Kazakhstam, 1.1%
- Saudi Arabia, 2.1%
- Qatar, 1.4%
- Iraq, 0.1%
- Iran, 2.5%
- Canada, 6.4%
- ROW, 17.2%

2030 Production Share

- Russia, 23.2%
- US (L48 and Alaska), 9.4%
- South America (majors), 8.5%
- Africa (majors), 6.4%
- North Sea Region, 6.2%
- Australasia, 8.1%
- Mexico, 0.7%
- Canada, 2.0%
- Turkmenistan, 2.2%
- Kazakhstam, 1.4%
- Saudi Arabia, 4.9%
- Qatar, 2.3%
- Iraq, 2.1%
- Iran, 7.6%
Geopolitical Implications:

four points

1. New Market Structures
   - Regional to Global

2. Changing Roles for Governments
   - From Builder to Facilitator

3. Supply Security
   - A Viable Cartel?

4. Challenges to Gas Future
   - Four Possible Pitfalls
1. New Market Structures

Global Market Supply by Source

LNG Share of World Supply by Region
More countries import more gas

Net import share in own demand

-20% 0% 20% 40% 60% 80% 100%


US
Mexico
EU
India
China
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?
Old World: State “creates” demand
Long Term Contracts

• Old World
  – State-to-state agreements
  – Low enforceability when inconvenient

• New World
  – Private agreements
  – High enforceability, but shorter terms

Are Long term contracts essential?
3. Security of Supply and Cartels

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

• Is a Gas Cartel Feasible?
  – Gas Exporting Countries Forum (GECF)
  – Large competitive fringe
  – Policy responses
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
In the Long Run...

• Possible emergence of LNG “swing producers”

• Rice World Gas Trade Model estimates:
  – Russian dominance in Europe and Asia
    • pipeline gas is cheaper than LNG
    • Arbitrageur between Europe and East Asia
  – Iran; Saudi Arabia
    • Constrains possible Russian market power?
4. Challenges to Gas Future

a) Investor Confidence

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

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Exports (bcm)</th>
<th>Production (bcm)</th>
<th>Reserves (tcm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Russia</td>
<td>128.22</td>
<td>554.9</td>
<td>47.57</td>
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<tr>
<td>2</td>
<td>Canada</td>
<td>108.8</td>
<td>183.5</td>
<td>1.7</td>
</tr>
<tr>
<td>3</td>
<td>Norway</td>
<td>61.19</td>
<td>65.4</td>
<td>2.19</td>
</tr>
<tr>
<td>4</td>
<td>Algeria</td>
<td>57.76</td>
<td>80.4</td>
<td>4.52</td>
</tr>
<tr>
<td>5</td>
<td>Netherlands</td>
<td>42.7</td>
<td>59.9</td>
<td>1.76</td>
</tr>
<tr>
<td>6</td>
<td>Indonesia</td>
<td>35.83</td>
<td>70.6</td>
<td>2.62</td>
</tr>
<tr>
<td>7</td>
<td>Malaysia</td>
<td>20.52</td>
<td>50.3</td>
<td>2.12</td>
</tr>
<tr>
<td>8</td>
<td>Qatar</td>
<td>18.59</td>
<td>29.3</td>
<td>14.40</td>
</tr>
<tr>
<td>9</td>
<td>United States</td>
<td>15.12</td>
<td>547.7</td>
<td>5.19</td>
</tr>
<tr>
<td>10</td>
<td>United Kingdom</td>
<td>14.16</td>
<td>103.1</td>
<td>0.70</td>
</tr>
</tbody>
</table>
More Challenges

b) “Resource Curse”
   • Arun, Algeria, Russia: all affected
   • Yet projects went forward
   • New world: higher scrutiny and new schemes

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
Final Question: A Peace Dividend from Pipelines?

- Are pipeline infrastructures analogous to European Coal and Steel Community and the Treaty of Rome (1957)

- Results
  - Mixed evidence
  - Causal arrows
    - peace and integration $\Rightarrow$ allow gas
    - Once built, gas reinforces integration
Southern Cone: Gas Interconnections

Before 1990

- Brazil
- Peru
- Bolivia
- Paraguay
- Argentina
- Uruguay
- Bermejo-Ramos 1988

Current and Future

- Brazil
- Peru
- Bolivia
- Paraguay
- Argentina
- Uruguay
- de la Vega, 2000

Gas pipeline:
- Bolivia-Argentina 1972
- Bolivia-Chile
- Atacama 1999
- Norandino 1999
- GasAndes 1997
- Gas pipeline del Pacífico 1999
- Gas pipeline Paisandú 1998
- Gas pipeline Methanex 1996
- Gas pipeline Santa Cruz-Sao Paulo 1999
- Gas pipeline Bolivian-Paraguayan-Brazil
- Gas pipeline Mercosur
- Gas pipeline Uruguayan 2000
Supply projections

2030

- Russia 24%
- Canada 2%
- ROW 16%
- US (L48 and Alaska) 9%
- Mexico 1%
- Australasia 8%
- Turkmenistan 2%
- Kazakhastan 1%
- Saudi Arabia 5%
- Qatar 2%
- Iraq 2%
- Iran 8%
- South America (majors) 8%
- America (majors) 6%
- North Sea Region 6%
- ROW 16%
Growth in LNG trade

- Atlantic Basin
- Middle East
- Pacific Basin

- Chart showing growth percentages from 2002 to 2040.