Natural Gas and Energy Security

Christof Rühl, London, September 27, 2007
Outline

• Energy Security – concept and trade-offs
• Natural Gas and other fossil fuels: security issues
• Segmented markets – segmented security
• Medium term perspectives
Energy Security

Consumers

Available

Resources

Reliable

Affordable

Price

Sustainable

Clean

Climate

Footprint

Producers

Markets

Fair
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Energy Prices

Index 1991=100

- Oil (dated Brent)
- Gas basket
- Coal basket
- Weighted average
World Energy Consumption Growth

Average annual growth

- World Primary Energy
  - 1996-2001: 2%
  - 2001-2006: 4%

- OECD
  - 2001-2006: 1%

- Non-OECD
  - 2001-2006: 5%

- Oil
  - Excl. China

- Gas
  - Excl. China

- Coal
  - Excl. China
Income Elasticities of Energy Demand

Elasticity

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<td>World Primary Energy</td>
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Share of Global Primary Energy Consumption

- Oil: 35.8%
- Coal: 28.4%
- Natural gas: 23.7%
- Hydro: 5.8%
- Nuclear: 6.3%
Security Issues

- Sustainability
- Availability
- Reliability
- Price
Regional Growth of Gas Production

5 year cumulative changes in natural gas production by region

Billion cubic metres

N America  | Europe  | S & C America | FSU | Africa | Middle East | Asia Pacific

Dislocation of Supply & Demand

3 Largest Energy Markets (N. America + Europe + Asia Pacific)

**OIL**
- Consumption: 72%
- Reserves: 9%

**GAS**
- Consumption: 60%
- Reserves: 14%

**COAL**
- Consumption: 88%
- Reserves: 65%

ROW
- Consumption: 28%
- Reserves: 91%
- Consumption: 40%
- Reserves: 83%
- Consumption: 12%
- Reserves: 35%
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Oil and Gas Exports as Share of Production

**Gas**

- 1986-1996 CAGR
  - Pipeline: 6.7%
  - LNG: 7.1%

- 1996-2006 CAGR
  - Pipeline: 5.2%
  - LNG: 7.5%

**Oil**

- Years: 1986 to 2006
Regional Fuel Shares, 2006

Europe
- Oil: 39%
- Natural Gas: 12%
- Coal: 19%
- Hydro electric: 6%
- Nuclear: 24%

USA
- Oil: 24%
- Natural Gas: 8%
- Coal: 3%
- Hydro electric: 41%

Asia Pacific
- Oil: 32%
- Natural Gas: 4%
- Coal: 11%
- Nuclear: 5%
- Hydro electric: 48%
Gas: Share of Net Imports in Total Supply, 2006

- **Europe**: 53% Domestic production, 36% Pipeline imports, 11% LNG imports
- **USA**: 85% Domestic production, 13% Pipeline imports, 2% LNG imports
- **Asia Pacific**: 88% Domestic production, 12% Pipeline imports

But note: Japan and South Korea are 97% and 100%, respectively, dependent on LNG imports.
European Gas Consumption

Share of Supply in 2006

Consumption

Net imports as % of consumption (RHS)

Source: BP Statistical Review, Eurostat
European Countries Most Dependent on Russian Imports, 2006

Russia’s Share of Net Imports

Source: BP Statistical Review, Eurostat
Russia’s Dependence on Gas Exports to Europe

Gazprom Deliveries: 539.9 St Bcm in 2006
- Europe: 30%
- Domestic: 58%
- FSU: 12%

Gazprom Net Sales: US$ 51.9 billion in 2006
- Europe: 61%
- Domestic: 29%
- FSU: 10%

Gazprom Direct Taxes Paid: US$ 12.4 billion in 2006
- Europe: 87%
- Domestic: 4%
- FSU: 9%

Source: Gazprom
US Natural Gas Consumption and Imports

- Consumption
- Canadian imports as % of consumption (RHS)
- Share of Supply in 2006
  - Canadian imports, 15%
  - LNG, 2%
  - Domestic production and net exports to Mexico, 83%

Source: DOE/EIA
Asia Pacific Natural Gas Consumption and Imports

Share of Supply in 2006:
- Domestic production, 88%
- LNG, 12%

Graph showing consumption and LNG imports as a percentage of consumption from 2001 to 2006.
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World Gas Reserves over Time

Trillion M³

- Middle East
- S. & Cent. America
- Europe & Eurasia
- Africa
- Asia Pacific
- North America

Years: 1982 to 2006


Gas Reserves Representation:
- Middle East
- S. & Cent. America
- Europe & Eurasia
- Africa
- Asia Pacific
- North America
Oil, Gas and Coal Reserves in 2006

**Concentration ratios (3 largest reserve holding countries):**

- **Oil:** 43%
- **Gas:** 56%
- **Coal:** 57%