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International Natural Gas Market Developments to 2030

Peter Hartley

Professor, Economics Department

Kenneth B Medlock III

Fellow in Energy Studies, James A Baker III Institute for Public Policy

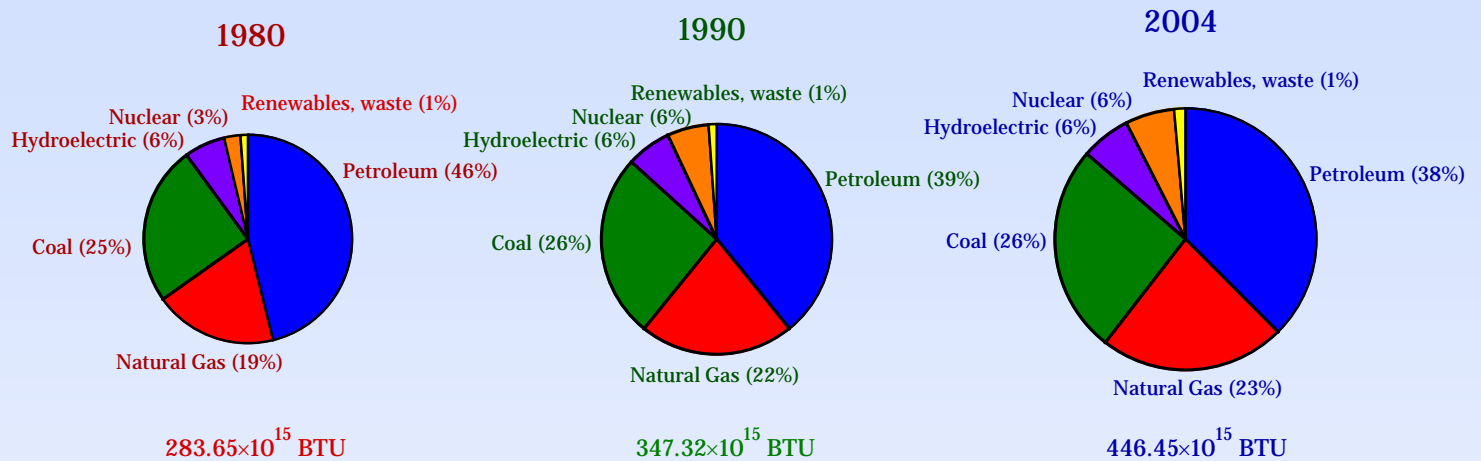
Adjunct Assistant Professor, Economics Department

James A. Baker III Institute of Public Policy
RICE UNIVERSITY



Global Trends in Natural Gas

- World natural gas demand doubled from 1980-2004
- Average annual growth of 2.5% is triple that of oil and double the coal growth rate

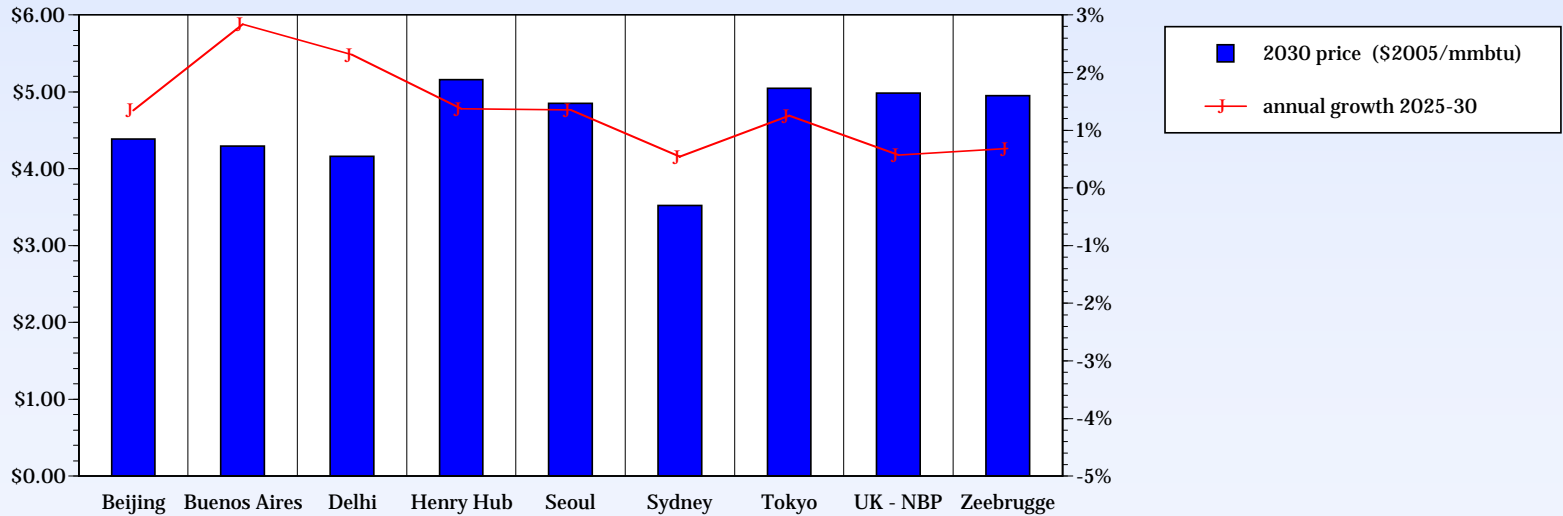
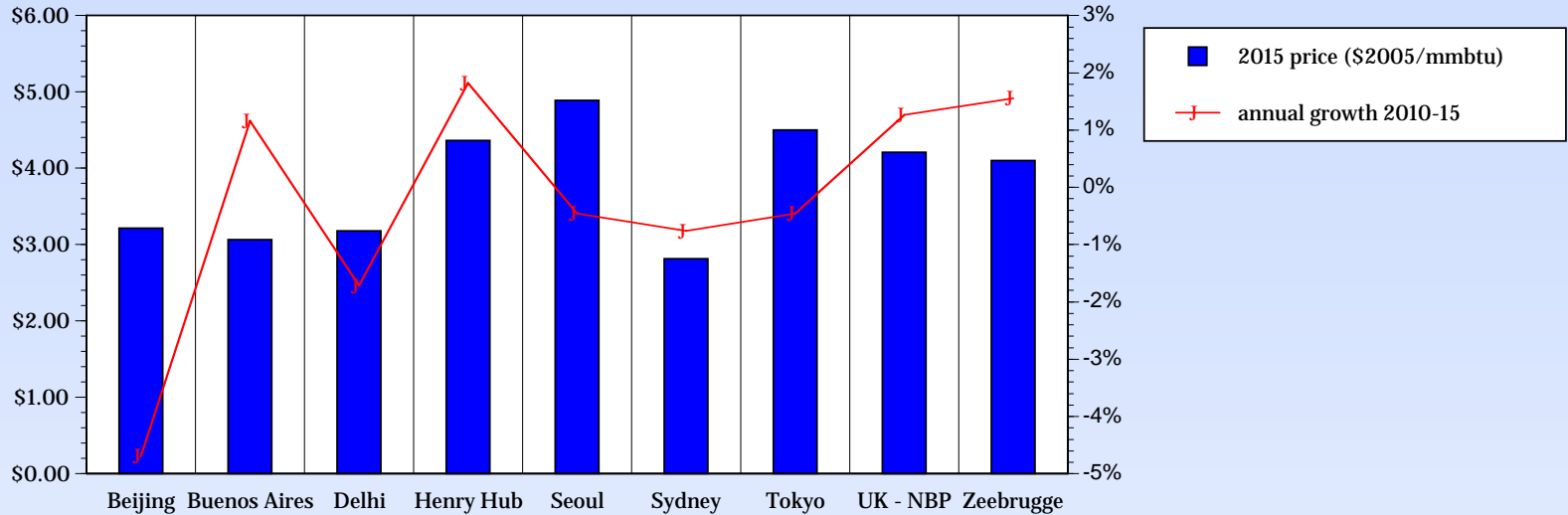


Source: EIA

- Key reasons for the increase in demand :
 - ◆ Environmental pressure, wholesale electricity market competition, technical change (combined cycle gas turbines) and economic growth in Asia
- The gas share may continue to rise if gas supplies transportation fuel
- Possible challenges to a gas future include:
 - ◆ Lack of investor confidence, political instability in supplier nations, local opposition to infrastructure, slowdown to electricity reforms, alternative energy technologies perhaps assisted by further improvements in long-distance electricity transmission

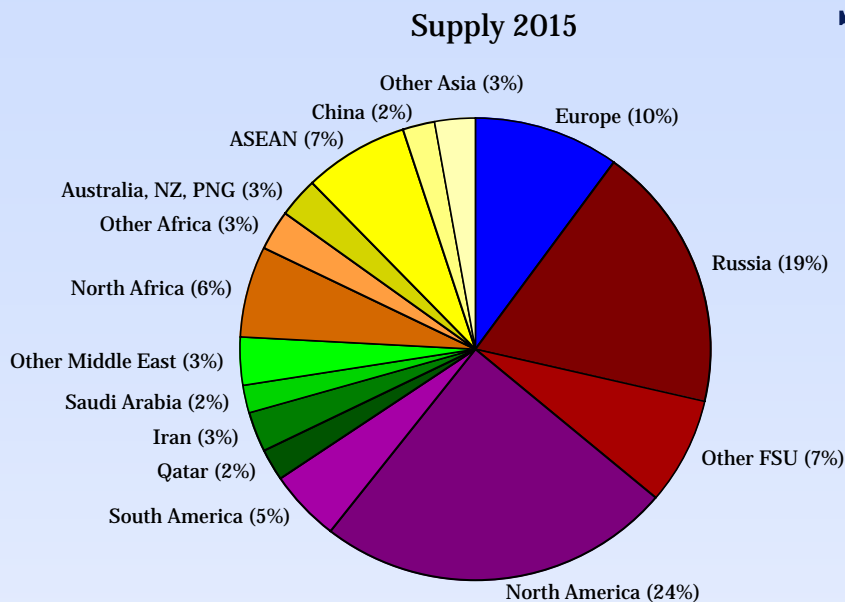


Prices 2015, 2030

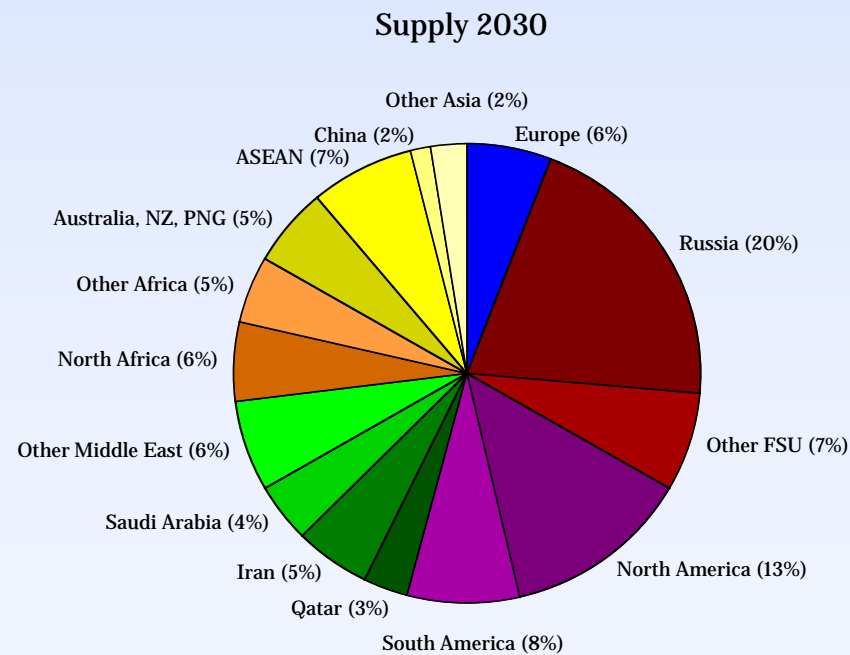




Supply 2015, 2030



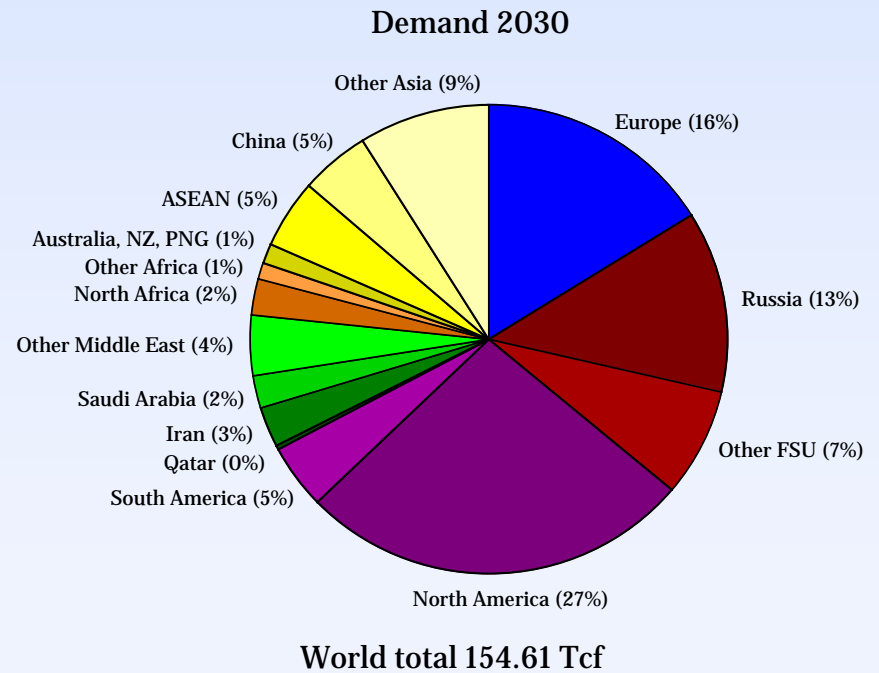
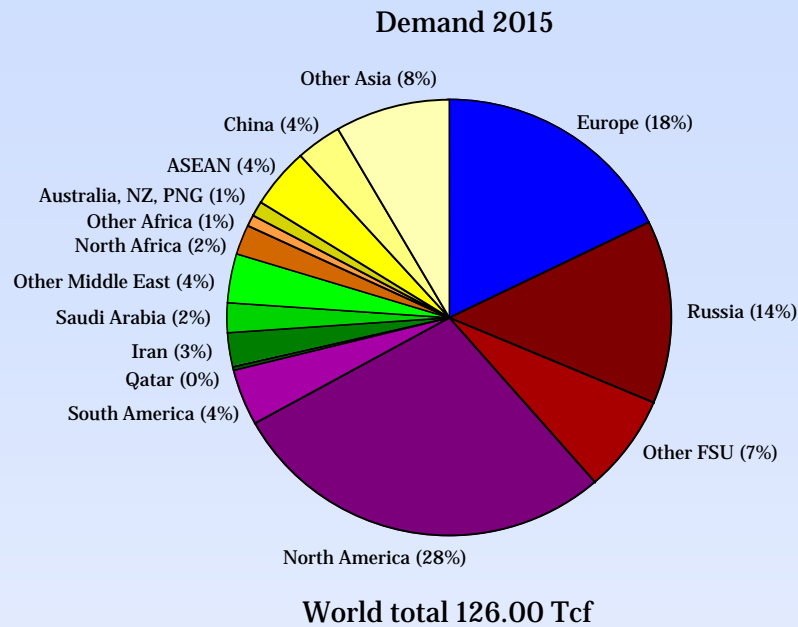
World total 128.51 Tcf



World total 159.80 Tcf



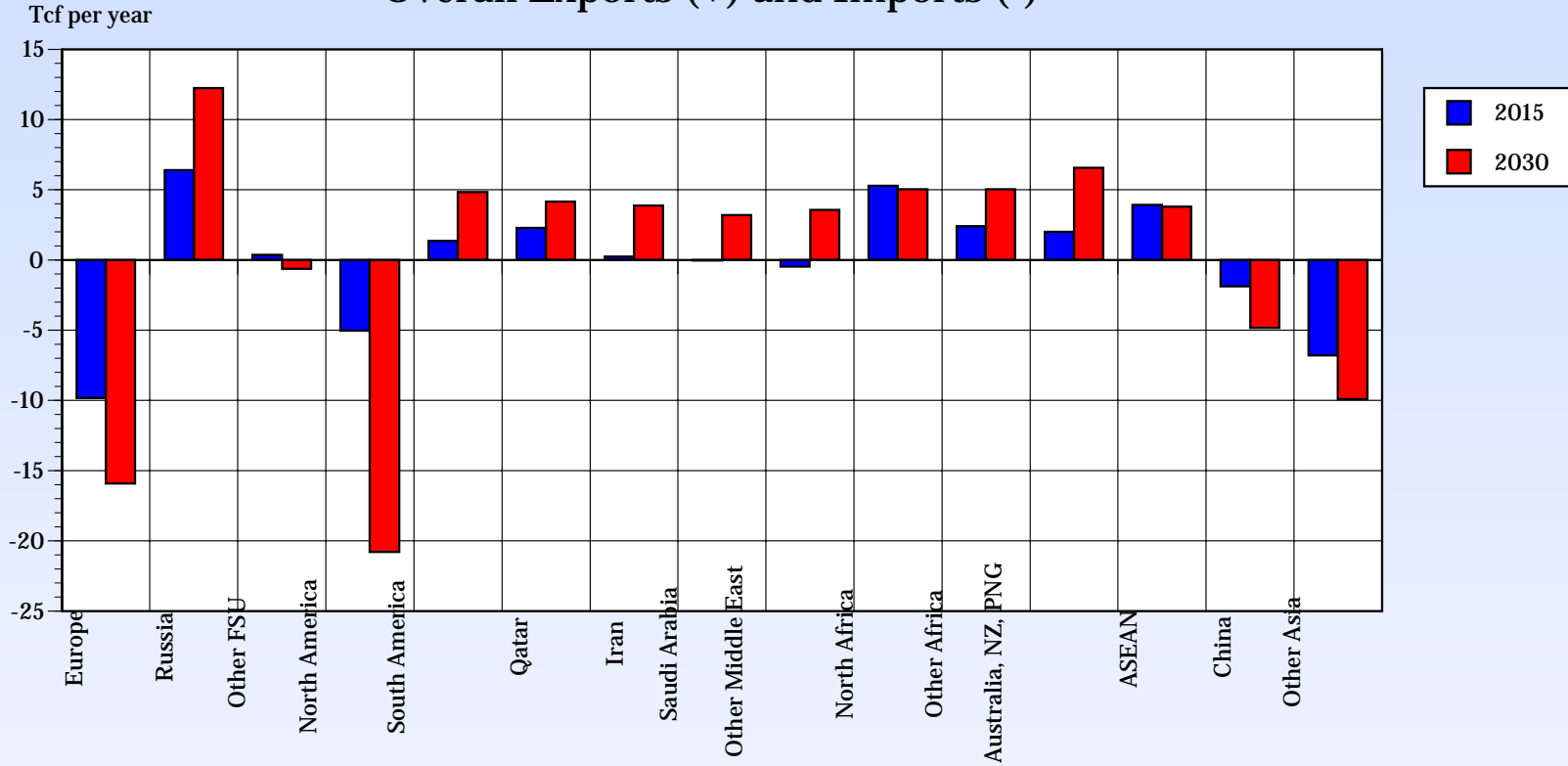
Demand 2015, 2030





Natural gas trade

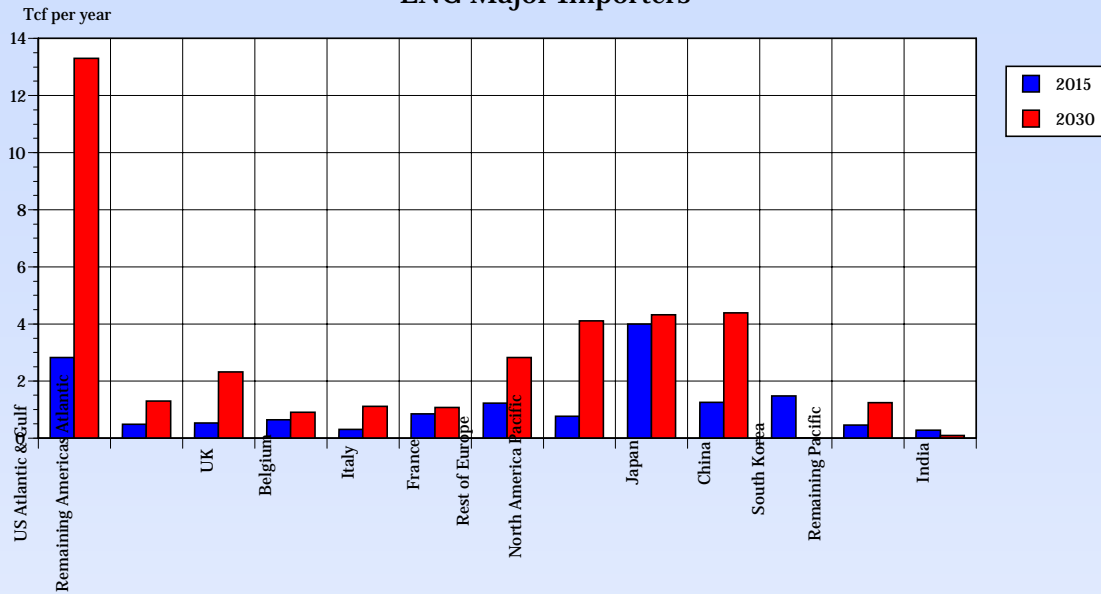
Overall Exports (+) and Imports (-)



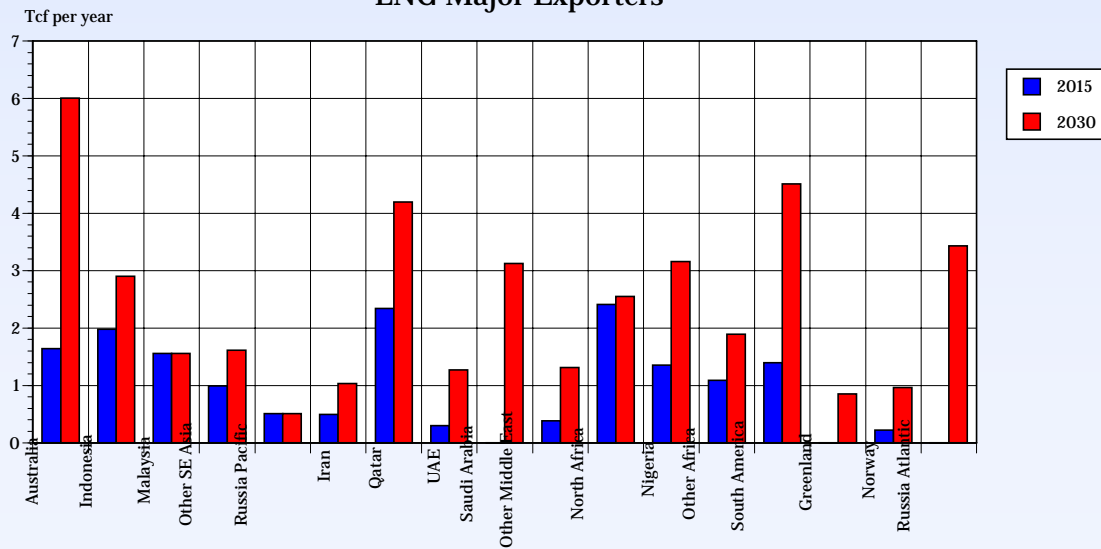


LNG trade

LNG Major Importers



LNG Major Exporters



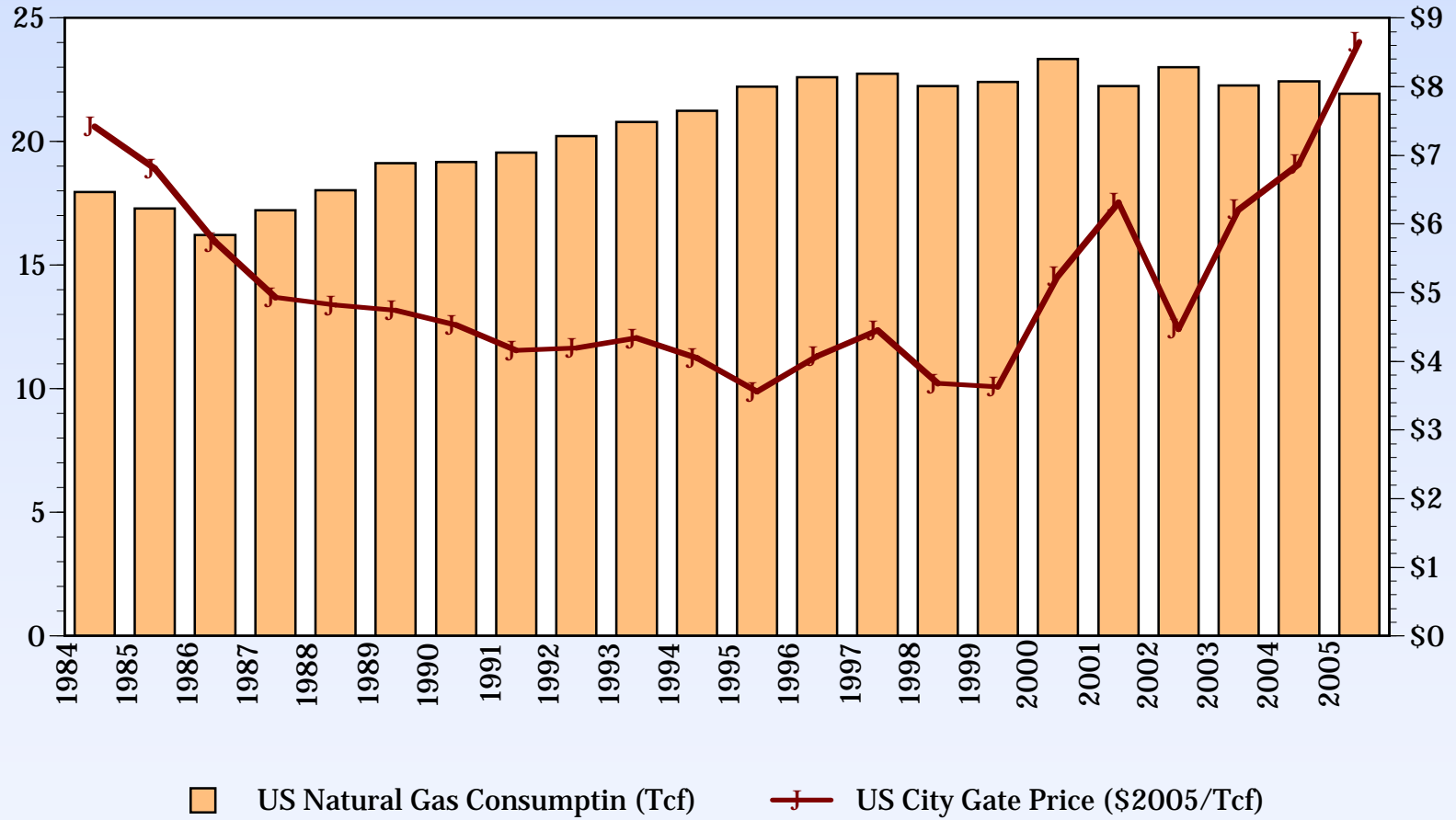


Natural Gas Demand: Short and Long Run Substitution



US Natural Gas Demand: 1984-2005

- The US experience provides evidence of fuel switching
- The demand driver has also changed from industrial activity and space heating to power generation

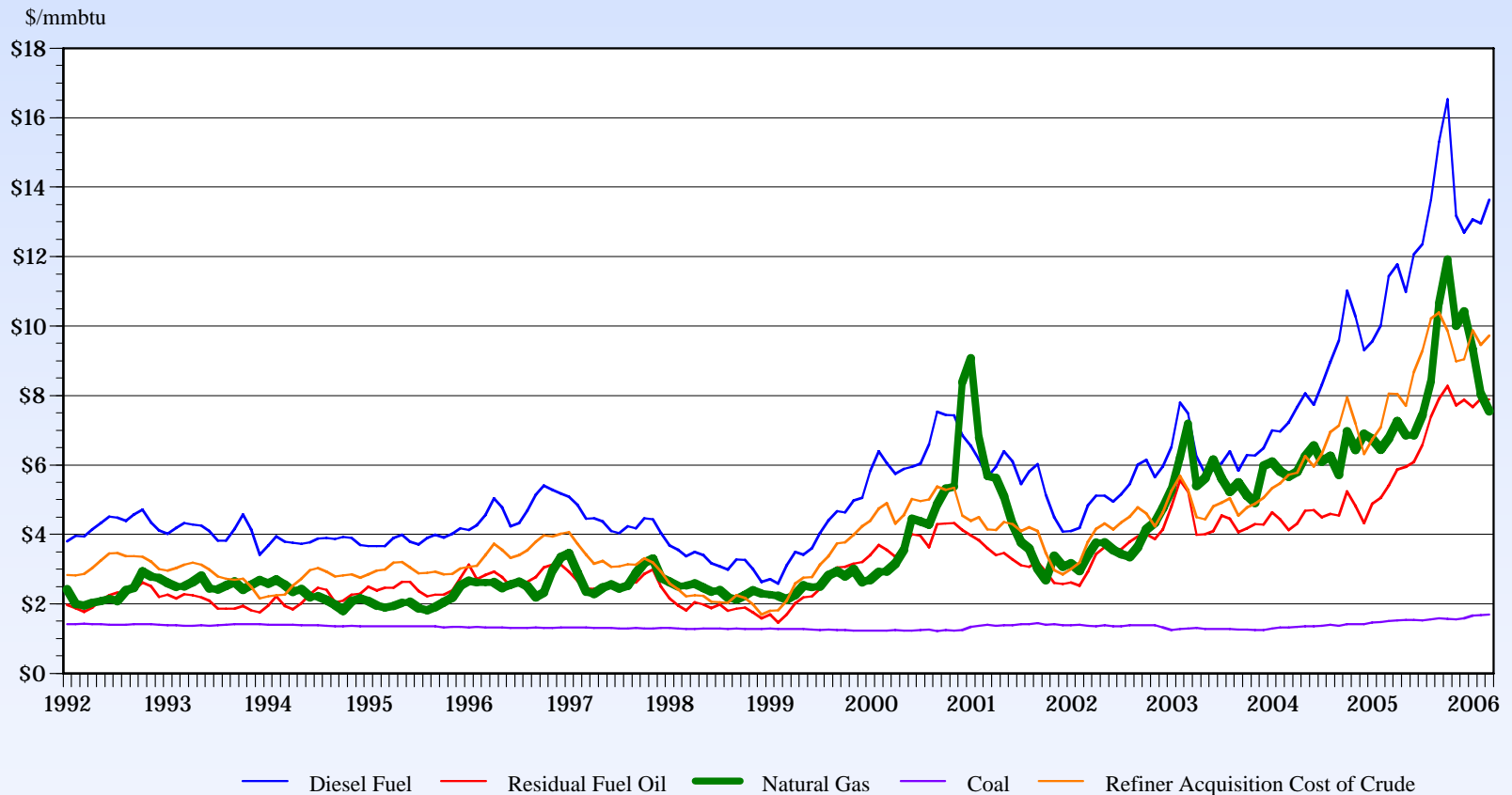


Average Annual Growth Rate approximately 1% per year



Linkage of crude oil and natural gas prices

- US markets show strong evidence of a link between natural gas and oil prices:





What links oil and gas prices?

■ Demand factors

- ◆ Substitution in the generation of electricity
- ◆ Substitution in industrial processes –refining, electricity cogeneration – but in sectors such as chemicals high gas prices cut demand without fuel switching
- ◆ Substitution between gas and heating oil for space heating

■ Supply factors

- ◆ Joint production of natural gas and oil can have positive or negative effects
 - ❖ Increased oil production also yields additional associated gas
 - ❖ Higher oil prices also raise the value of non-gas liquids often produced with gas
 - ❖ However, gas can also be re-injected to enhance oil recovery
- ◆ Unconventional oil, such as Canadian tar sands, requires natural gas as input
- ◆ Gas-to-liquids (GTL) conversion (as in Qatar) can lead to direct competition between gas and oil for providing transportation fuel

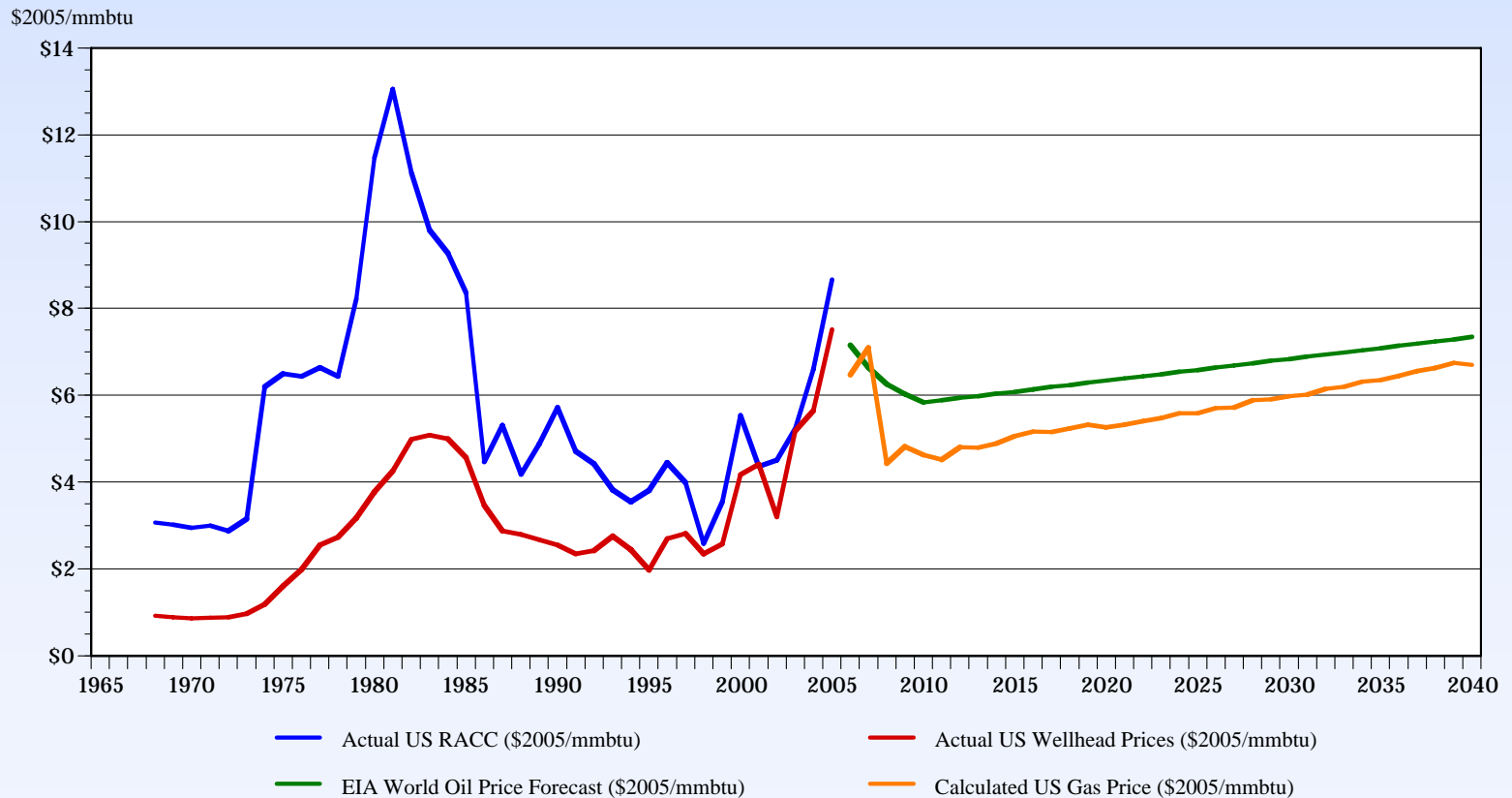
■ Impediments to substitution

- ◆ Environmental factors can affect demand side substitution of oil for gas
- ◆ Short run capital costs can slow development of alternative supplies
- ◆ Uncertainty about future energy prices limits willingness to invest
- ◆ Economies of scale for GTL versus LNG
 - ❖ GTL only makes economic sense for smaller scale projects or if oil prices are high



RWGTM Price Forecast in Historical Context

- Oil price forecast is from the US Energy Information Administration
- Gas price forecast is the equilibrium calculated by the RWGTM
- The generally rising ratio of gas to oil prices reflects the assumption that gas tends to supply more energy as economies develop





*Natural Gas Supply: Geography, Geology
and Geopolitics*



Supply estimates

Region	Proved Reserves ^a	Undiscovered Resource ^b	Share of Total Resource
Middle East	2565.4	1294.7	34.4%
Qatar	910.5	41.1	8.5%
Saudi Arabia	241.8	681.0	8.2%
Iran	971.2	314.6	11.5%
Former Soviet Union	1952.6	1611.3	31.8%
Russia	1680.0	1168.7	25.4%
Asia-Pacific	391.6	688.9	9.6%
Indonesia	97.8	107.7	1.8%
Australia ^c	27.6	338.4	3.3%
Africa	485.8	330.1	7.3%
Nigeria	184.7	123.2	2.7%
Algeria	160.5	49.0	1.9%
North America^c	265.1	451.5	6.4%
Central and South America	250.8	421.0	6.0%
Venezuela	151.4	101.2	2.3%
Europe	200.7	312.4	4.6%
Norway	84.3	183.0	2.4%
World Total^d	6112.1	5109.8	

a - *Oil and Gas Journal* as of Jan. 1, 2006

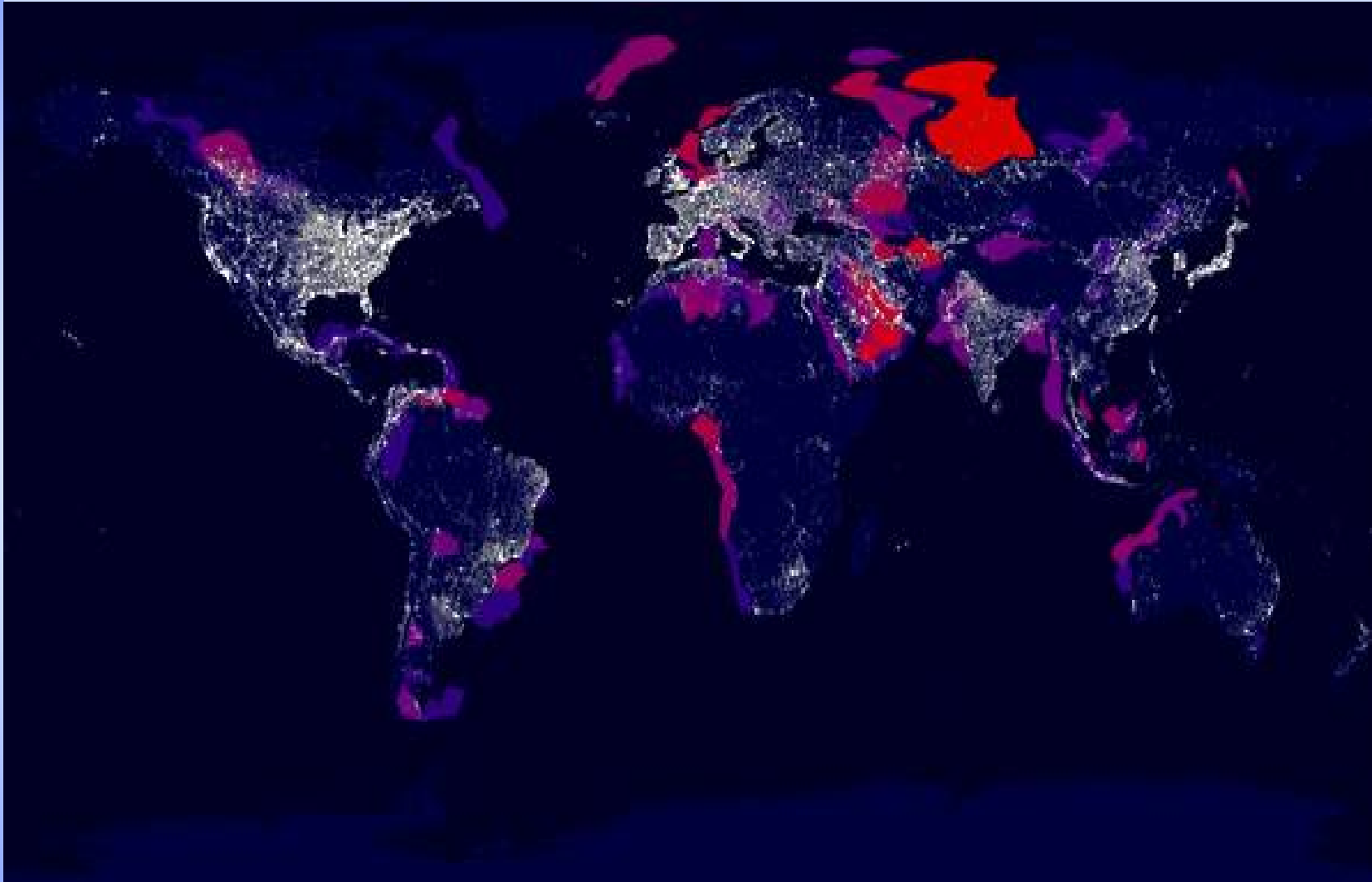
b - Compiled from USGS, ABARE, and other national sources

c - Includes assessed non-conventional natural gas resources

d - Does not include future growth in existing fields. USGS estimates the World Total at 3305 tcf.



Linking supply with demand





Concluding Remarks



Concluding Remarks

- Modeling illustrates the key roles Russia and the countries of the Middle East will play in the world gas market
- Prices will be linked through global arbitrage
 - ◆ Trade need not actually occur, there simply needs to exist the ability to trade – LNG provides this capability
- Long distance international gas trade provides opportunities for countries to gain from cooperation, but also to lose from conflict
- Absent political constraints, there appears to be substantial gas available to satisfy demand at a reasonable price
 - ◆ Political constraints may, however, present the largest impediment to globalization
 - ◆ Such political constraints may encourage alternative sources of supply and ultimately alternative sources of energy
 - ◆ The development of alternative energy sources later this century will likely mean that substantial natural gas resources will not be exploited for a very long time, if at all