

Geopolitics of Natural Gas

A joint study:

*Energy Forum of the Baker Institute
Rice University*

*Program on Energy and Sustainable Development
Stanford University*

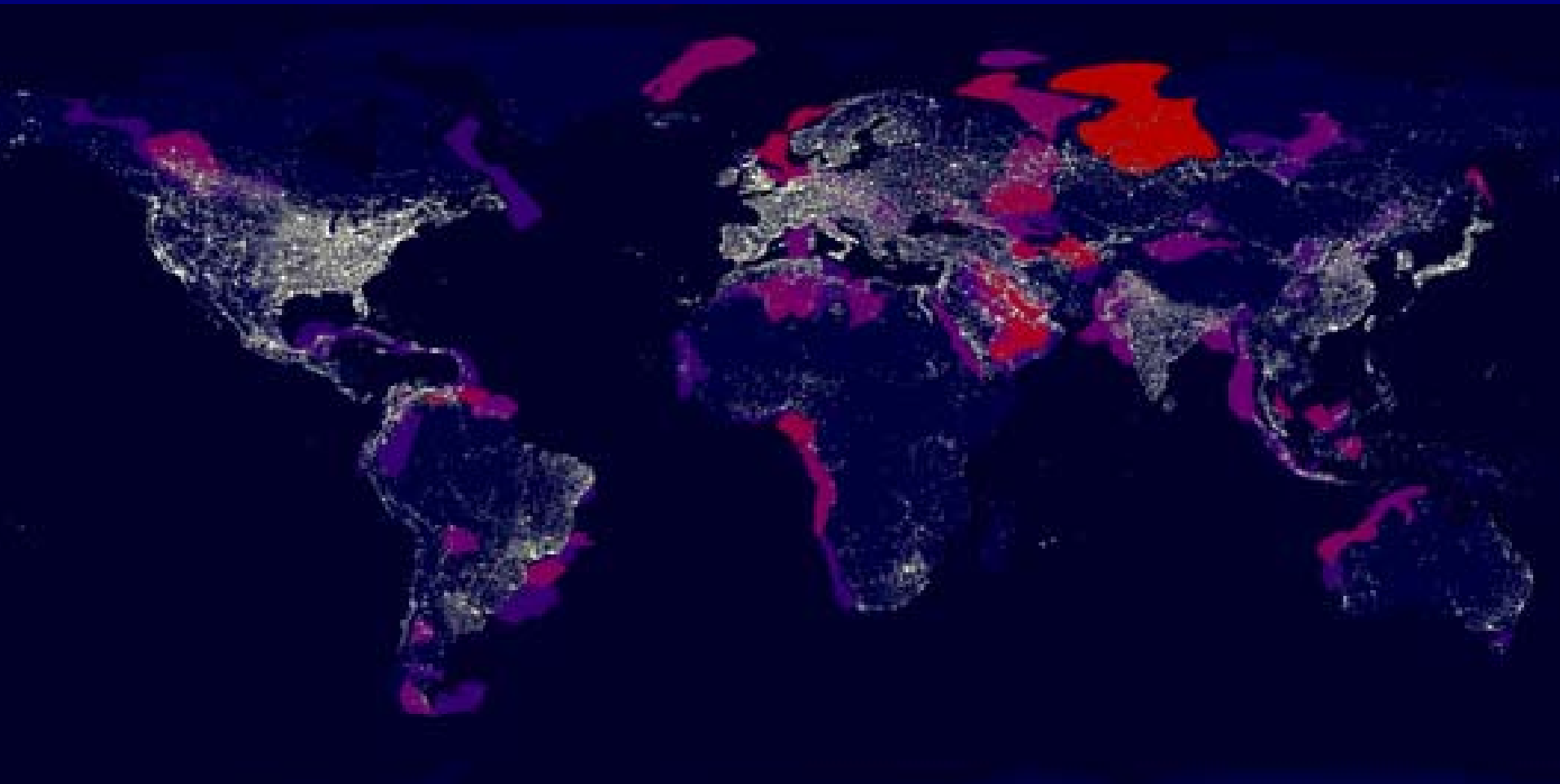
Amy M. Jaffe and David G. Victor

Study Conference

May 27, 2004

Houston

Supply and Demand



White: where the lights are on, satellite imagery

Blue → Red : Gas resources, with increasing size (USGS)

The Baker/Stanford Approach:

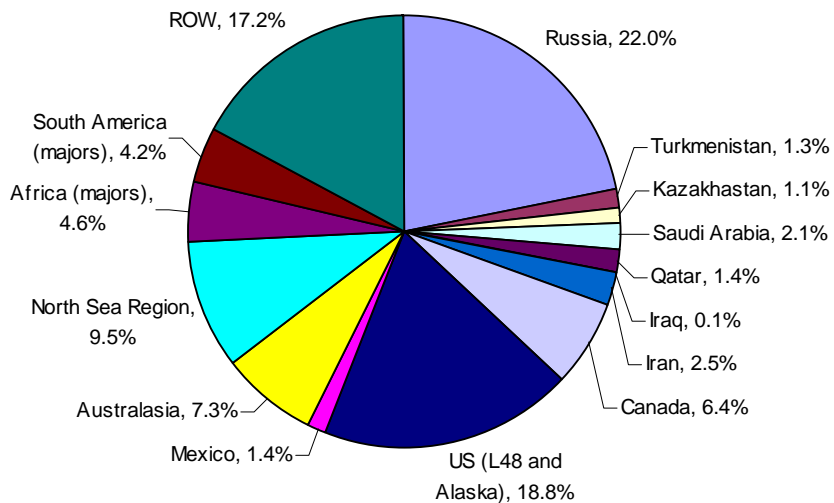
- Historical Case Studies
 - Key “first of a kind” projects
 - Compare built projects with alternatives
- Model of Future Gas Market
 - “World Gas Trade Model” (WGTM”)
 - All major resources and supply curves
 - All major demand centers
 - All major gas transmission technologies

Seven Historical Case Studies

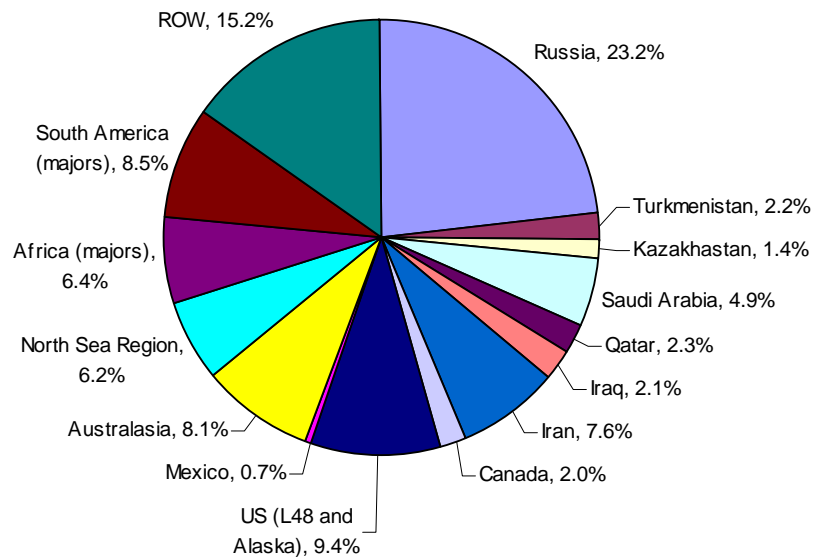
Built Projects	Author
1. Indonesia LNG to Japan	Lewis & von der Mehden
2. Algeria to Italy	Hayes
3. Russia to Poland and Germany	Victor & Victor
4. Turkmenistan (to Iran, to Russia, to Pakistan & India)	Olcott
5. Qatar to Japan	Hashimoto
6. Trinidad LNG to U.S.	Shepherd & Ball
7. Southern Cone (Bolivia to Argentina; Argentina to Chile; Bolivia to Brazil)	Mares

A Vision for 2030

**2002
Production Share**



**2030
Production Share**



Geopolitical Implications:

four points

1. New Market Structures

- Regional to Global

2. Changing Roles for Governments

- From Builder to Facilitator

3. Supply Security

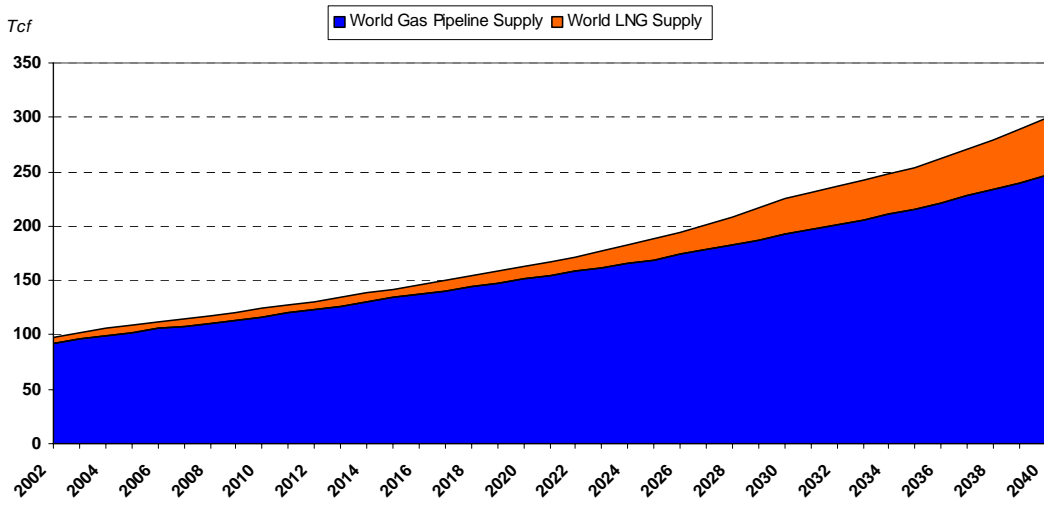
- A Viable Cartel?

4. Challenges to Gas Future

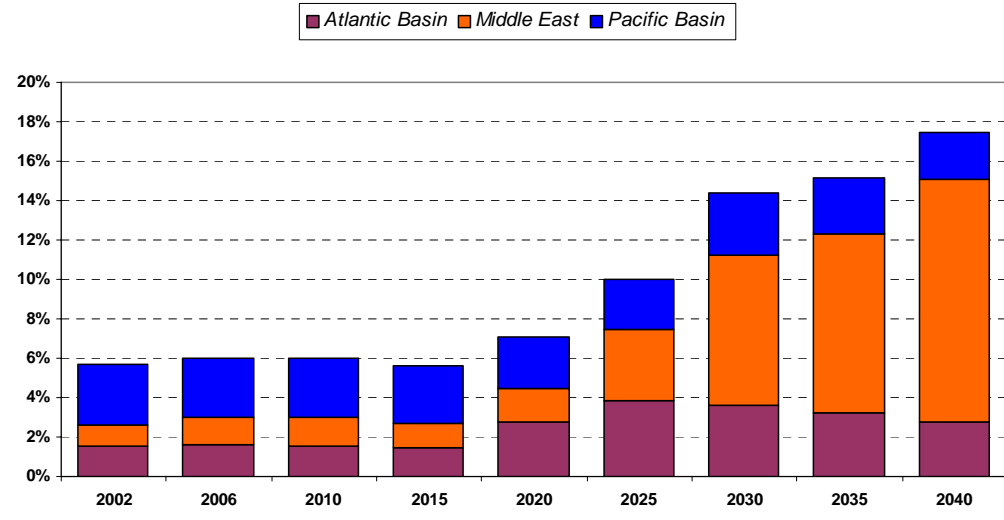
- Four Possible Pitfalls

1. New Market Structures

Global Market Supply by Source

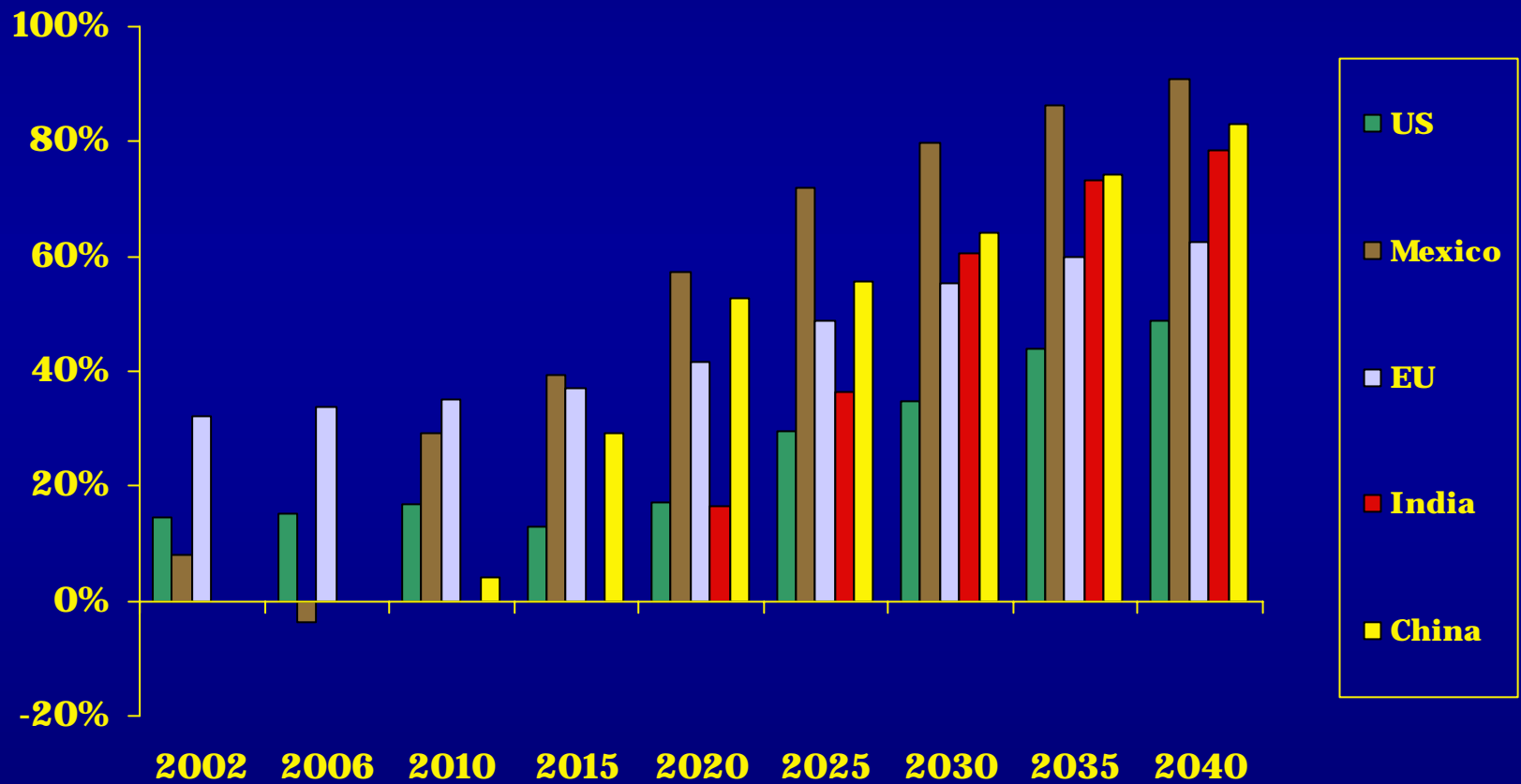


LNG Share of World Supply by Region



More countries import more gas

Net import share in own demand



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

	Exports	Production		Reserves	
	(bcm)	(bcm)	Rank	(tcm)	Rank
1 Russia	128.22	554.9	1	47.57	1
2 Canada	108.8	183.5	3	1.7	19
3 Norway	61.19	65.4	7	2.19	13
4 Algeria	57.76	80.4	5	4.52	7
5 Netherlands	42.7	59.9	9	1.76	18
6 Indonesia	35.83	70.6	6	2.62	11
7 Malaysia	20.52	50.3	12	2.12	14
8 Qatar	18.59	29.3	19	14.40	3
9 United States	15.12	547.7	2	5.19	6
10 United Kingdom	14.16	103.1	4	0.70	30

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 → allow gas
 - Once built, gas reinforces integration

Southern Cone: Gas Interconnections

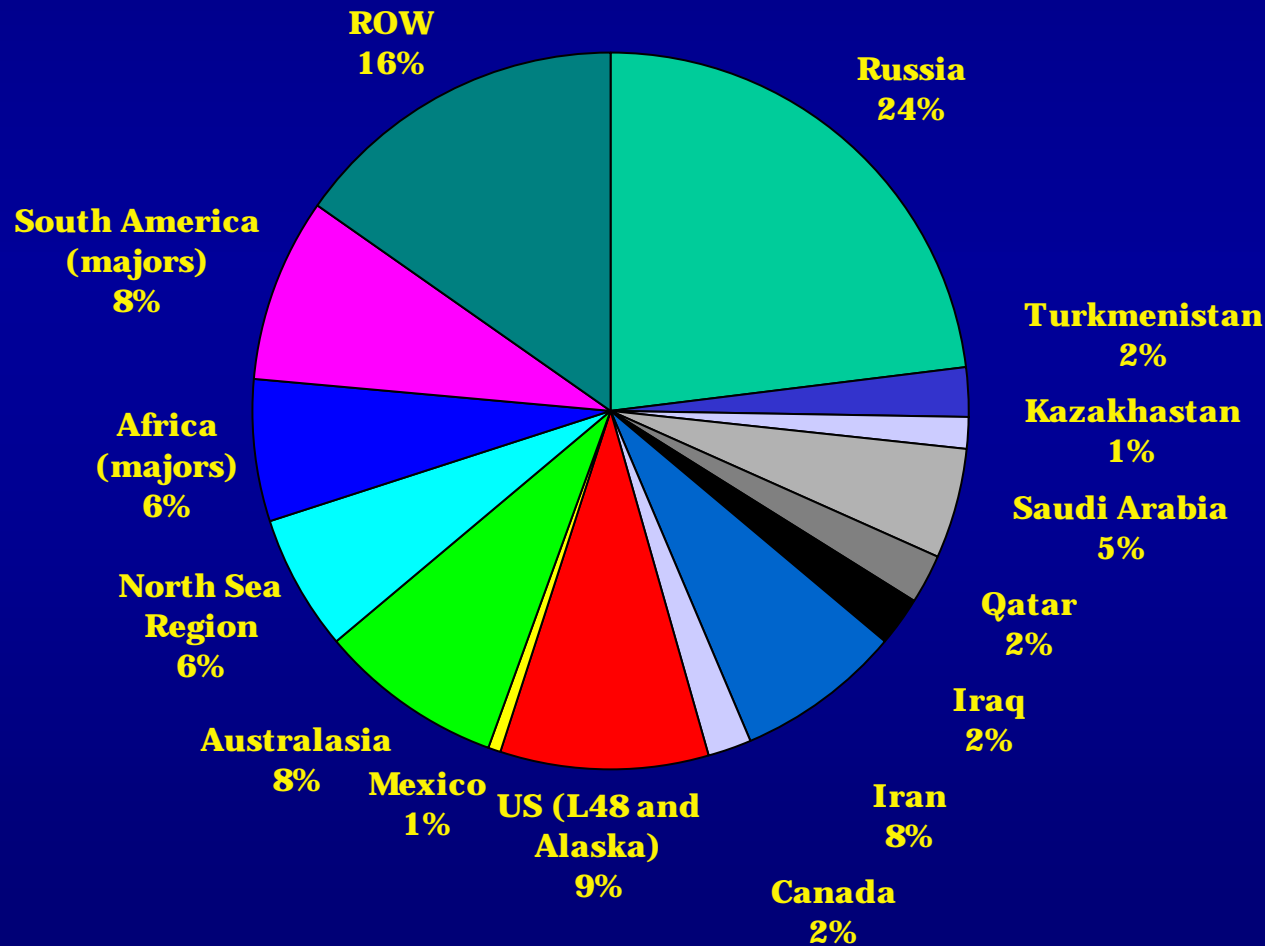
Before 1990

Current and Future



Supply projections

2030



Growth in LNG trade

