



Geopolitics of Natural Gas

*A joint study from PESD Stanford University
and the Baker Institute Rice University*

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3 December 2003

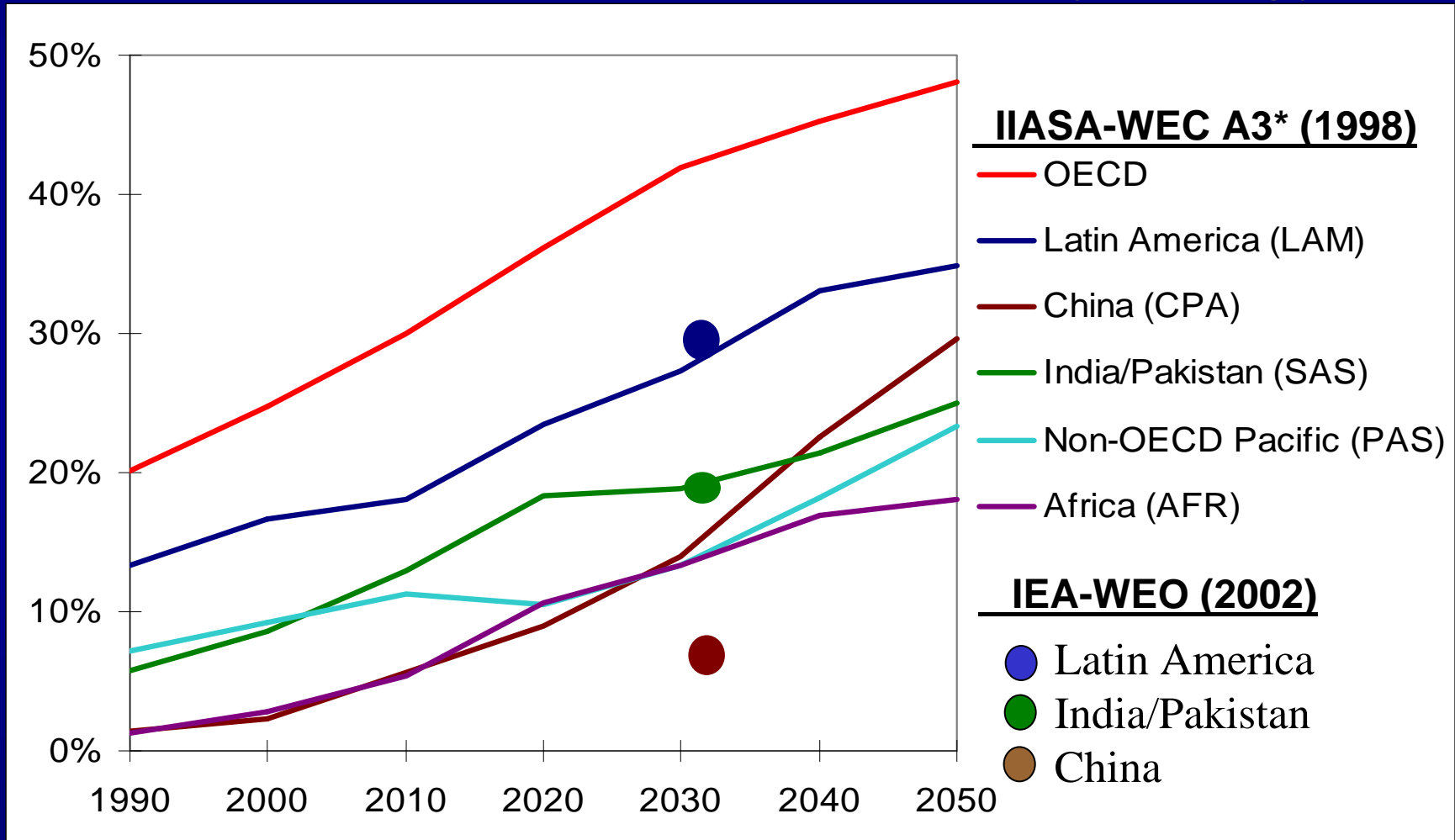
Program on Energy & Sustainable Development

- Established with EPRI gift to Stanford, 2001
- Focus: Politics, Law, Institutions
- Four Research Platforms
 - Futures for gas
 - Electricity Markets in developing countries
 - Low-income, rural energy markets
 - Futures for climate policy
- Network operation; half Stanford, half overseas

Major Points

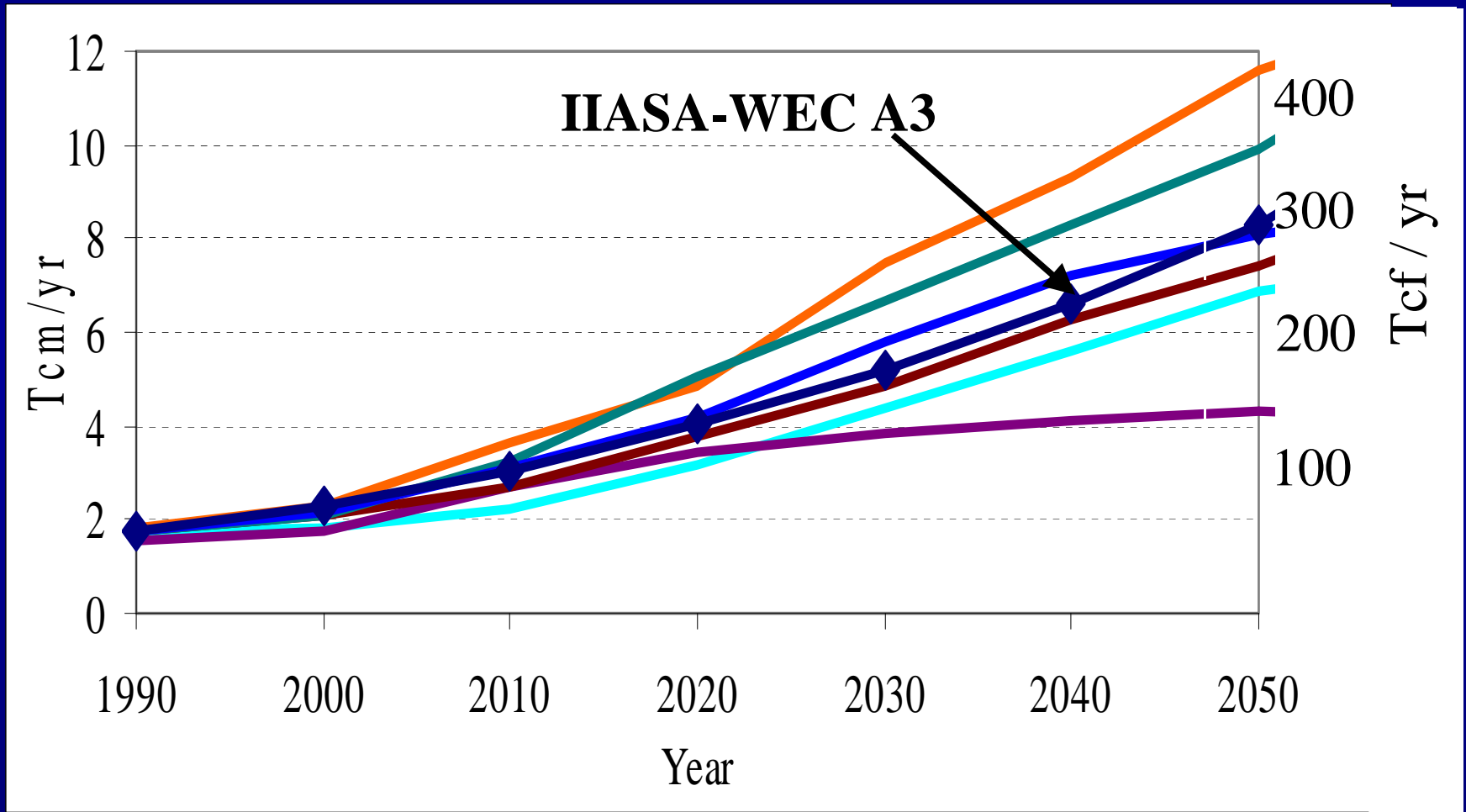
- Introduction to the Problem:
 - Expected Gas Demand
 - The Need for Infrastructure
- Our approach
- Initial Findings
 - Methodological & Substantive

Increasing Role of Gas in all Regions: Gas as Fraction of Total Primary Energy

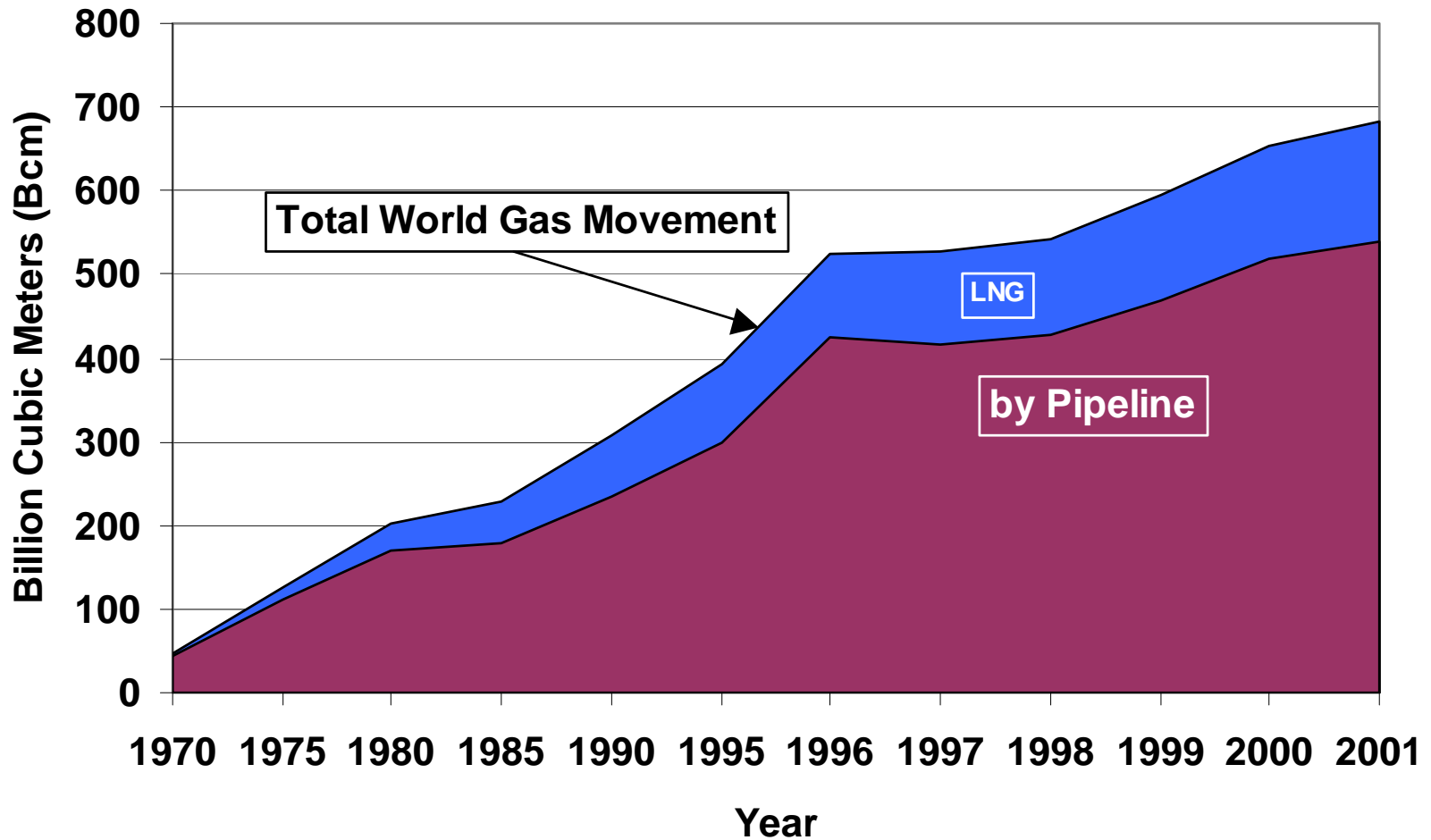


*Note: A3 is a high growth scenario that emphasizes renewables, nuclear, as well as gas

Global Gas Consumption: IPCC ‘Illustrative’ Scenarios & IIASA-WEC A3



World Gas Trade



Geopolitics of Natural Gas Study

Two Research Tracks:

1. Historical Case studies

- Look to the past for insights into why some projects are built, and their consequences.

2. Gas Market Modeling

- World Gas Trade Model
- Political Economy Applications

Six 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. Southern Cone (Bolivia to Argentina; Argentina to Chile; Bolivia to Brazil)	Mares



Research Protocol:

Why are Some Projects Built, others not?

1. Context: Project Economics and Technology
2. Other Key Explanatory Factors:
 1. Political and Policy Drivers
 2. Investment climate in host countries
 3. Transit countries
 4. Offtake quantity and price risk
 5. International institutions

Seven Initial Observations

- 1) Methods
- 2) The “gas weapon”
- 3) Transit countries
- 4) State control vs. markets
- 5) The roles of long-term contracts and short term markets
- 6) Regional Institutions and the “peace dividend”
- 7) Spillovers benefits to under-served

Observation #1: Methods

- Research Question: Why are some key projects built but others not?
- Danger: Focus on built projects only
 - Built projects are visible; failures usually not
 - Case “selection bias”
- Our solution: studies of “alternative projects” (APs)

Observation #2: The Gas Weapon

- To date, very few political interruptions
 - Non-commercial markets → many interruptions (e.g. Ukraine 1990s)
 - The only severe example: early 1980s Algeria
- Why?
 - Gas pipelines are fixed infrastructures, costly to leave empty
 - Unlike oil using the weapon is usually costly
 - Severe effects on reputation
 - Long-term damage to Algeria's export potential

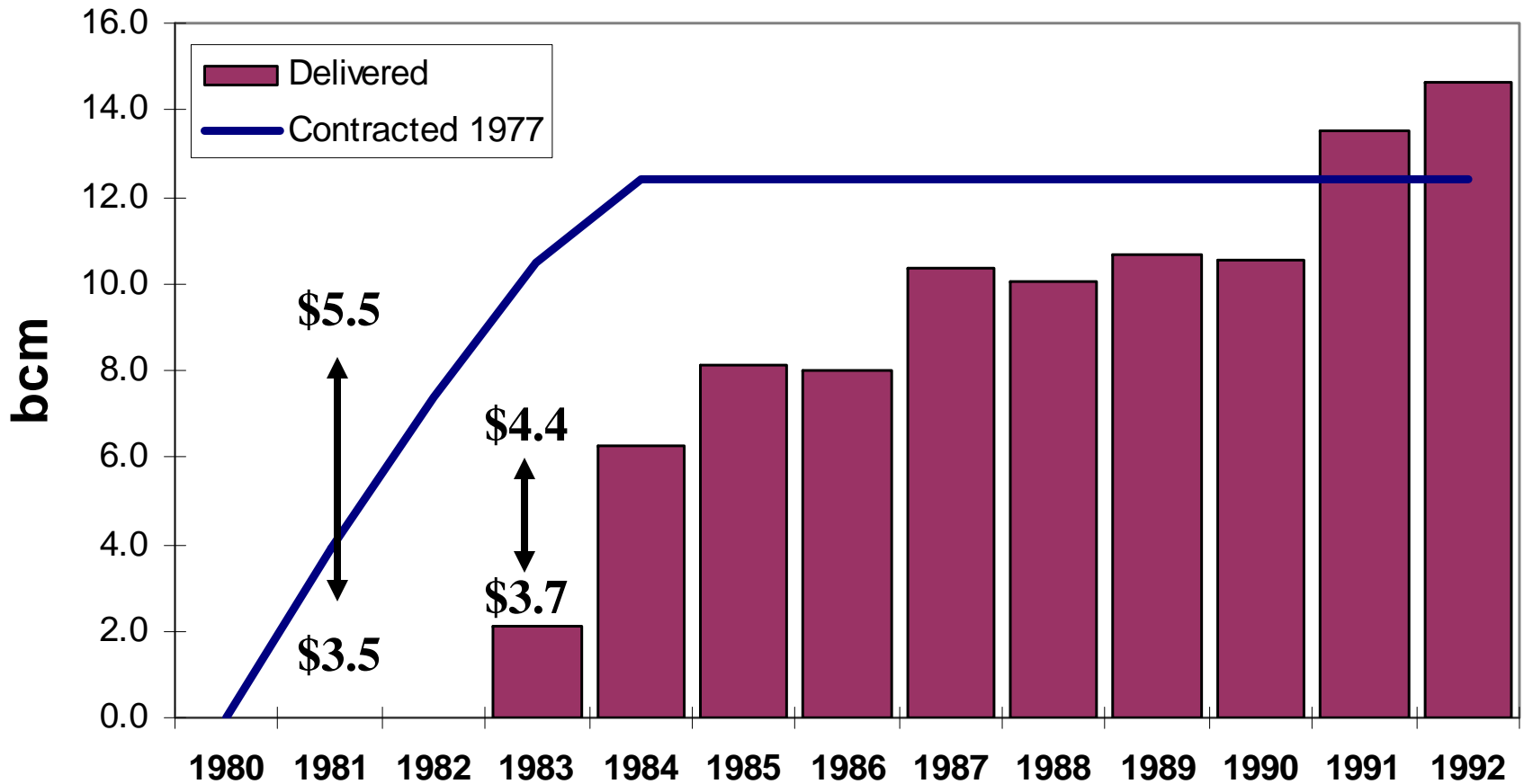
Transmed Gas Pipeline

“Magrheb” (not built)





Algeria Gas Exports to Italy

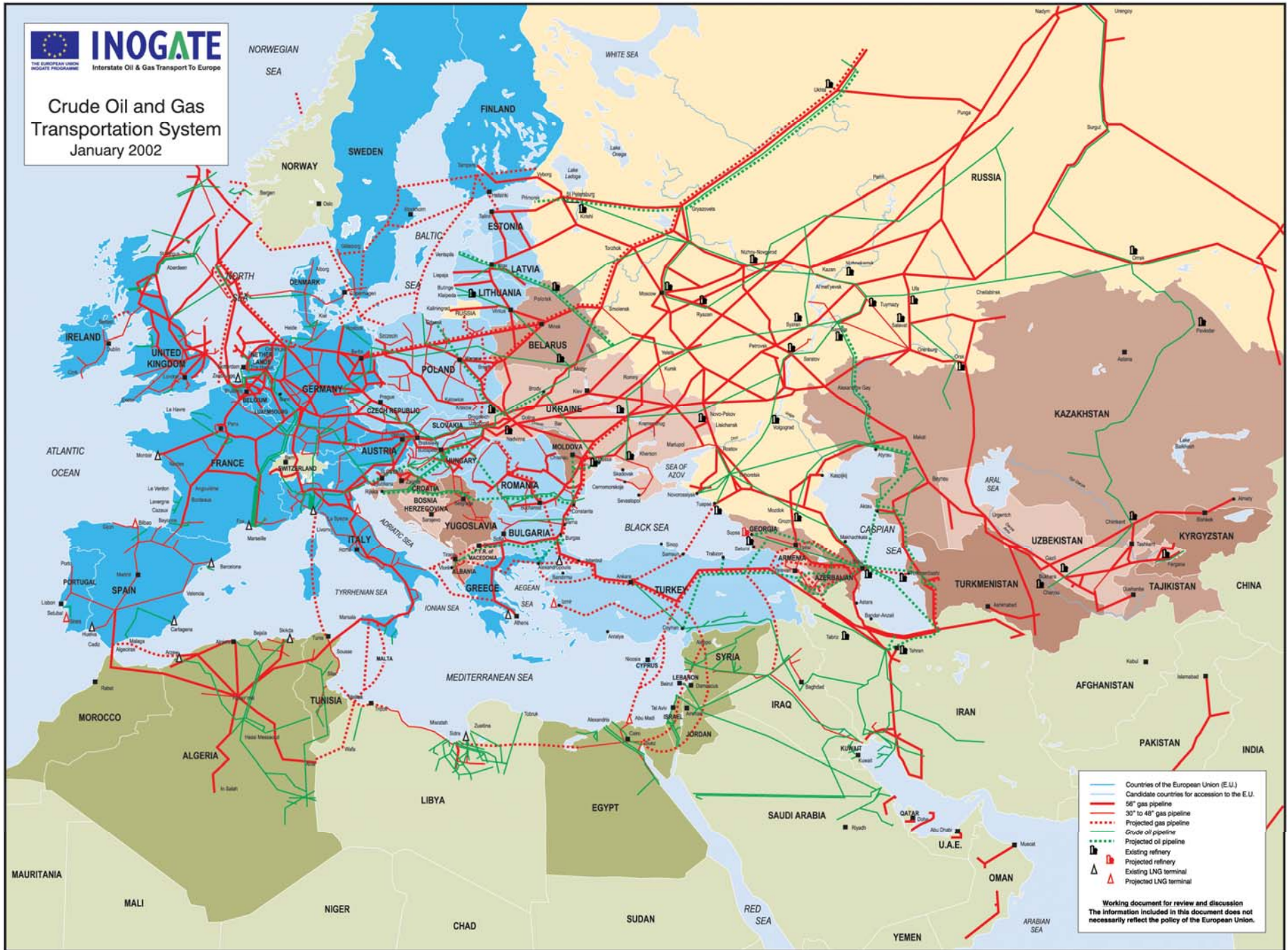






*Price in \$/mmbtu

Observation #3: Transit Country Risks

- Project design vs. project operation.
- Example: Soviet/Russian gas exports
- Project design:
 - Soviet era: zero concern for transit “countries”
 - Today: transit country concerns dominate new project design
- Project operation:
 - Transit country risks remarkably low
 - Mainly about rent allocation (Are there credible alt.’s?)

**Crude Oil and Gas
 Transportation System**
 January 2002



- Countries of the European Union (E.U.)
- Candidate countries for accession to the E.U.
- 56" gas pipeline
- 30" to 48" gas pipeline
- - - Projected gas pipeline
- Crude oil pipeline
- - - Projected oil pipeline
-  Existing refinery
-  Projected refinery
-  Existing LNG terminal
-  Projected LNG terminal

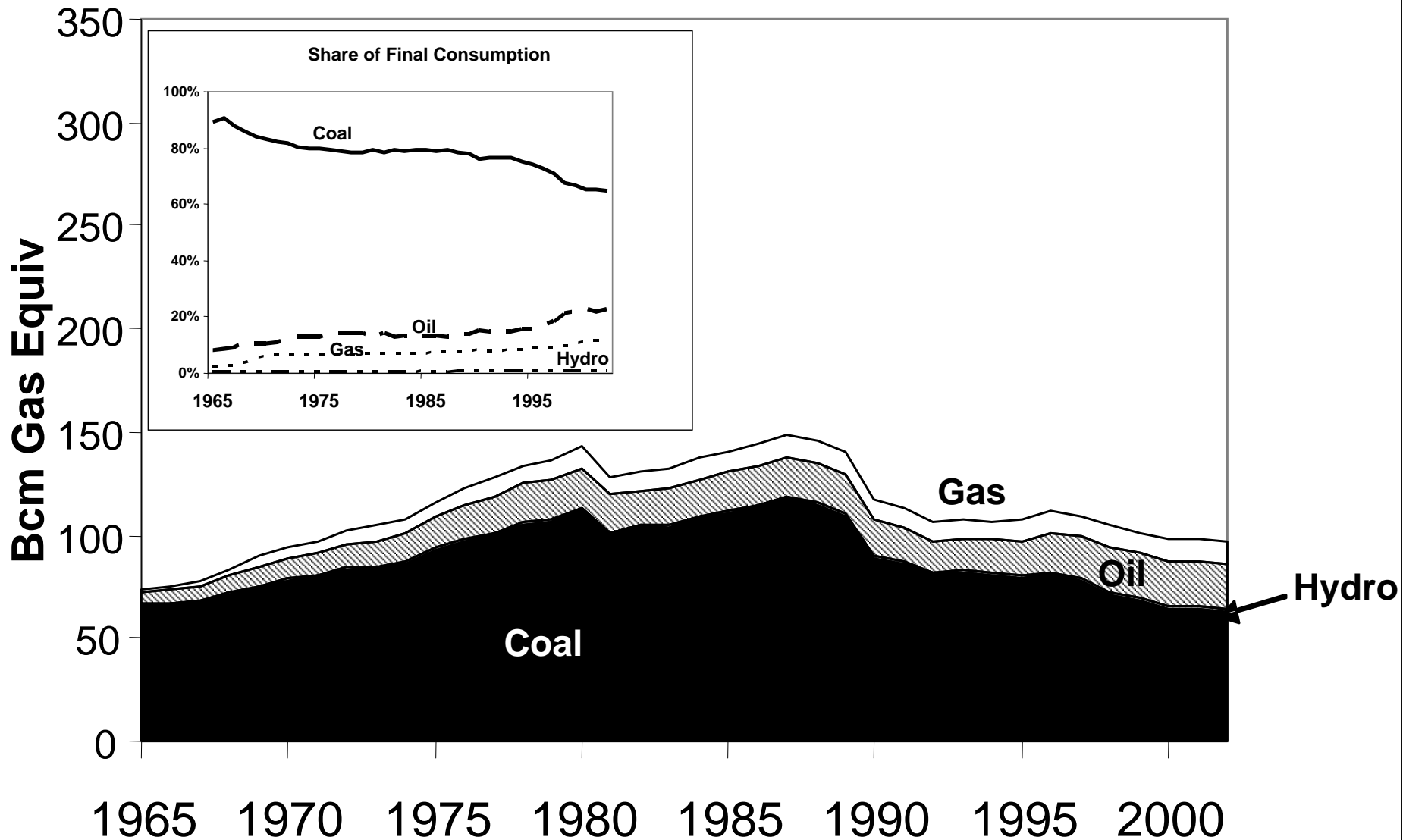
Working document for review and discussion
 The information included in this document does not
 necessarily reflect the policy of the European Union.

Observation #4:

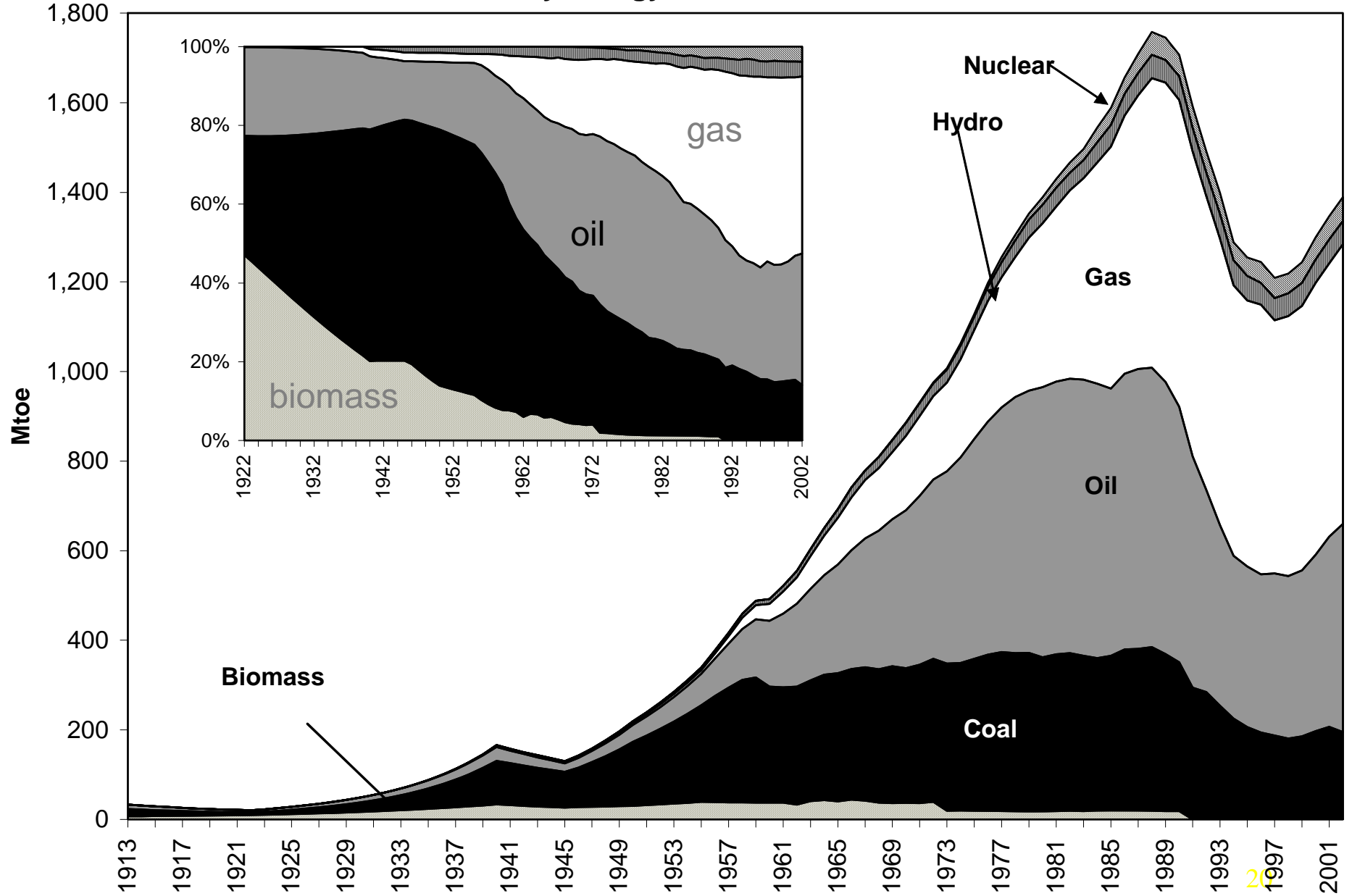
States and Markets

- Today: Great Transition from “states” to “markets”
 - Poses difficulty for case selection
- One (of many) issues:
 - Will shift to markets speed or slow the diffusion of gas technology?
 - UK example: markets accelerate dash to gas
 - Most other countries: state itself created gas niches
 - Contrast Russia and Poland
 - Not obvious what the impact of liberalization is on gas use

Poland: Primary Energy



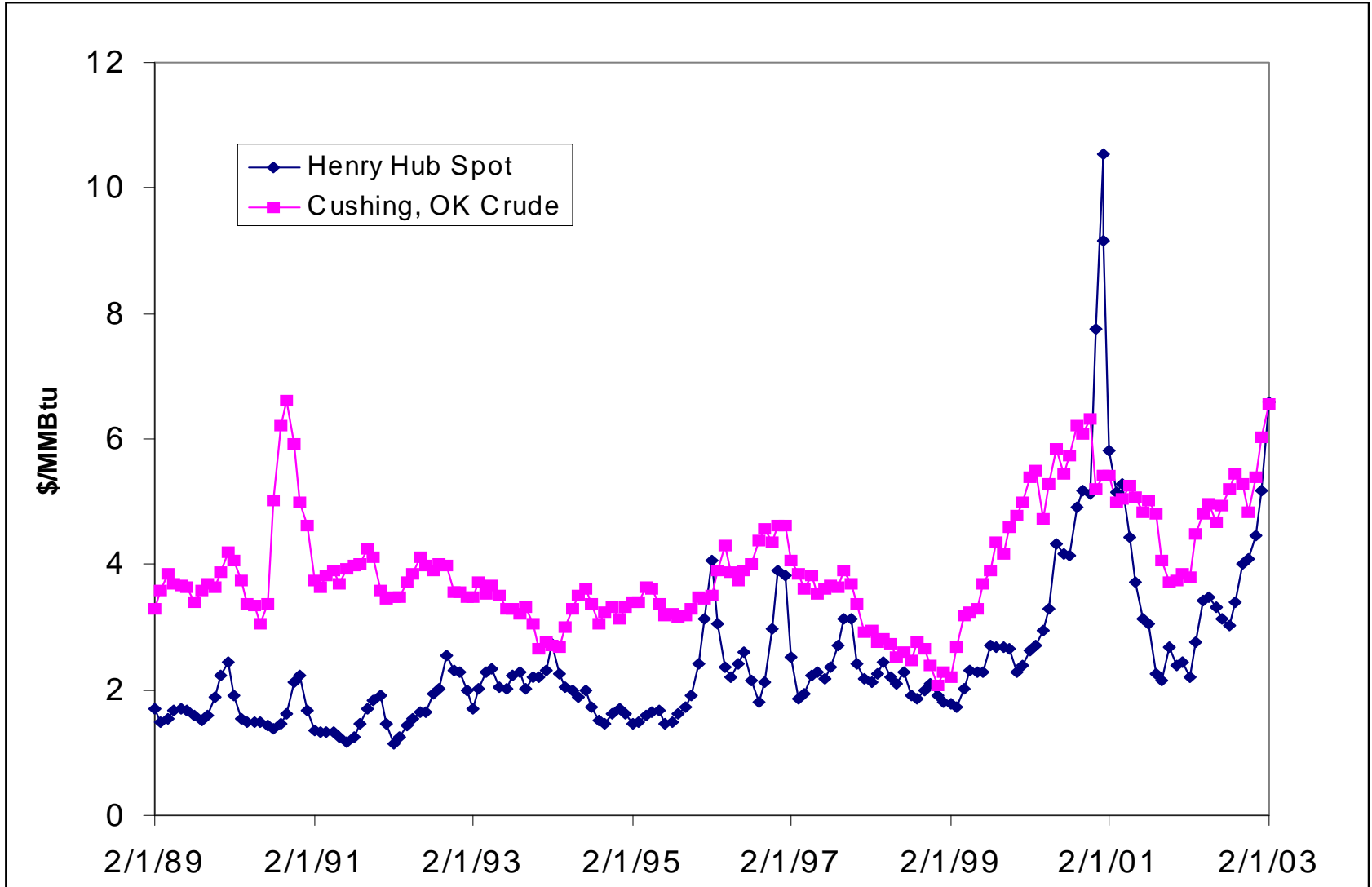
FSU: Primary Energy Production, 1913-2002



Observation #5: Contracts and Spot Markets

- First Projects: Always Anchored in Long-term contracts
 - What is a “contract?”
 - Renegotiation clauses, price & quantity
 - Enforcement of contracts
 - Self-enforcing contracts (esp. pipelines)
 - Outside enforcers (World Bank, western firms)
 - A shift to merchant markets?
 - Example of U.S. gas market and LNG

Gas and Crude Prices



Observation #6:

A Peace Dividend from Pipelines?

- Analogy: European Coal and Steel Community and the Treaty of Rome (1957)
- Same true for pipelines?
 - Southern Cone example
 - No evidence supports this hypothesis
 - Causal arrows run opposite direction—peace and institutions allow gas, not vice-versa

Southern Cone: Gas Interconnections

Before 1990

Current and Future



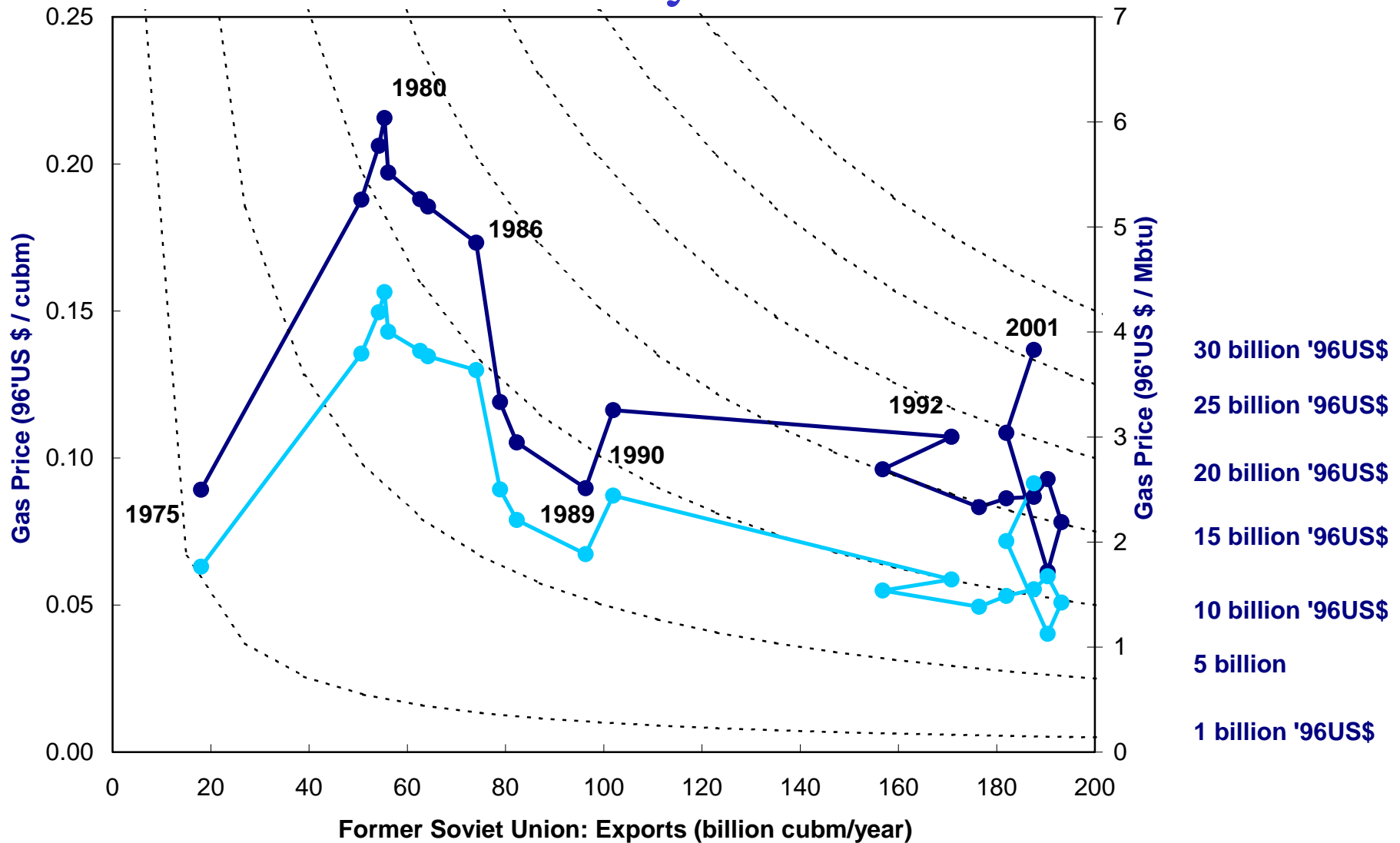
Observation #7: Benefits to Under-served

- Do large-scale infrastructure projects generate spillover benefits and public goods?
- Results: as theory would predict
 - State-driven projects assembled through political negotiations: spillovers are key
 - Southern Italy example
 - Market-driven projects: private benefits and scalability dominate decision-making
 - GasAndes example

What Next?

- Refining the results
 - And, new questions
 - E.g., does the “resource curse” apply to Gas?
- Three Trials in the World Gas Trade Model
 - Real vs. estimated projects in '90s
 - Making a market: China
 - State-owned enterprises: Russia

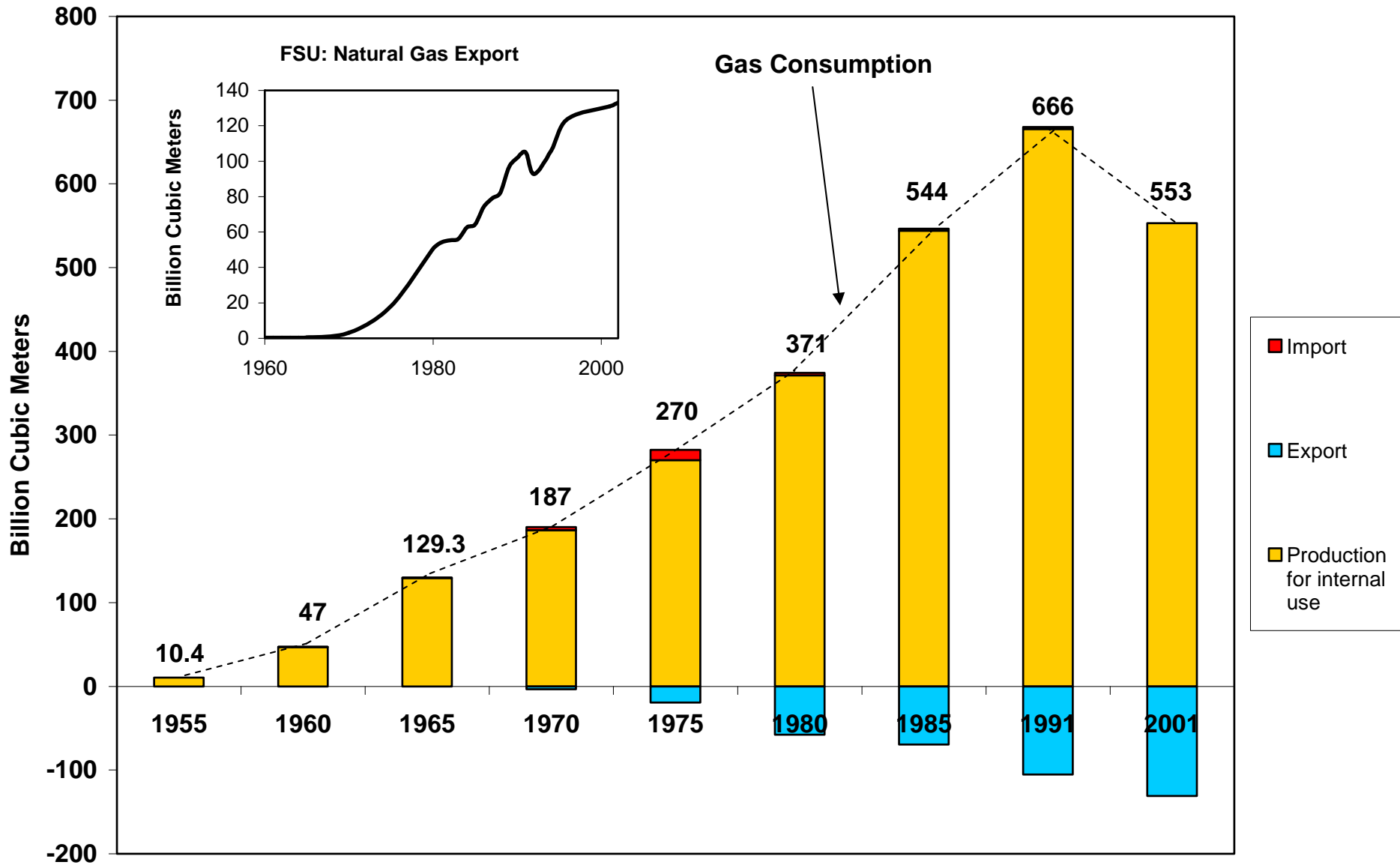
The Value of Soviet & Russian Gas Exports: The Difficulty of SOE reform



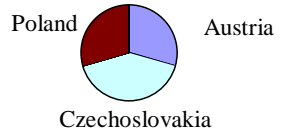
Note: Prior to 1992 FSU export, excludes movements between FSU countries.
Data source: BP(1975-1990), EIA (1992-2001)

Backup slides follow

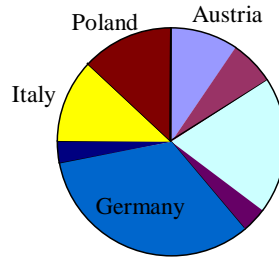
FSU: Natural Gas Production, Export, Import and Consumption



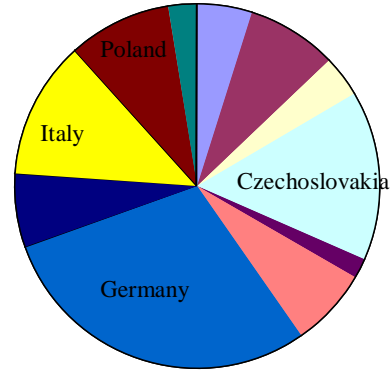
1970, 3.4 Billion Cubic Meters



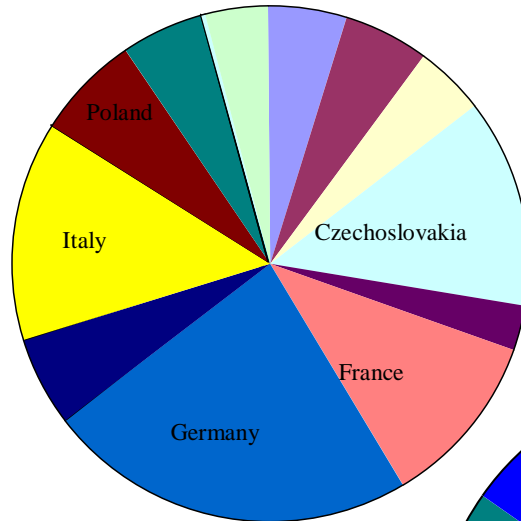
1975, 19.3 Billion Cubic Meters



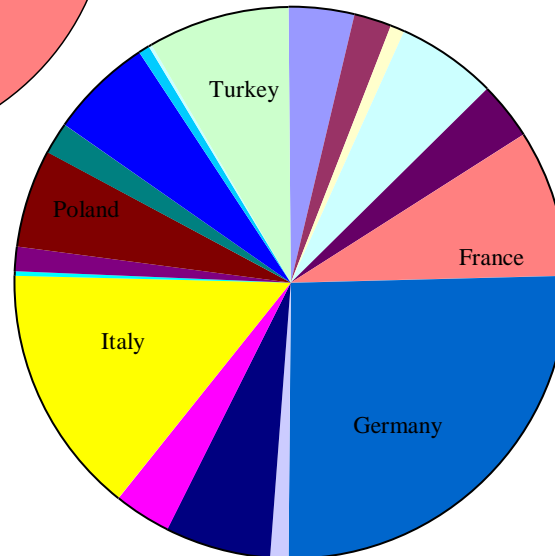
1980, 57.6 Billion Cubic Meters



1991, 105.2 Billion Cubic Meters

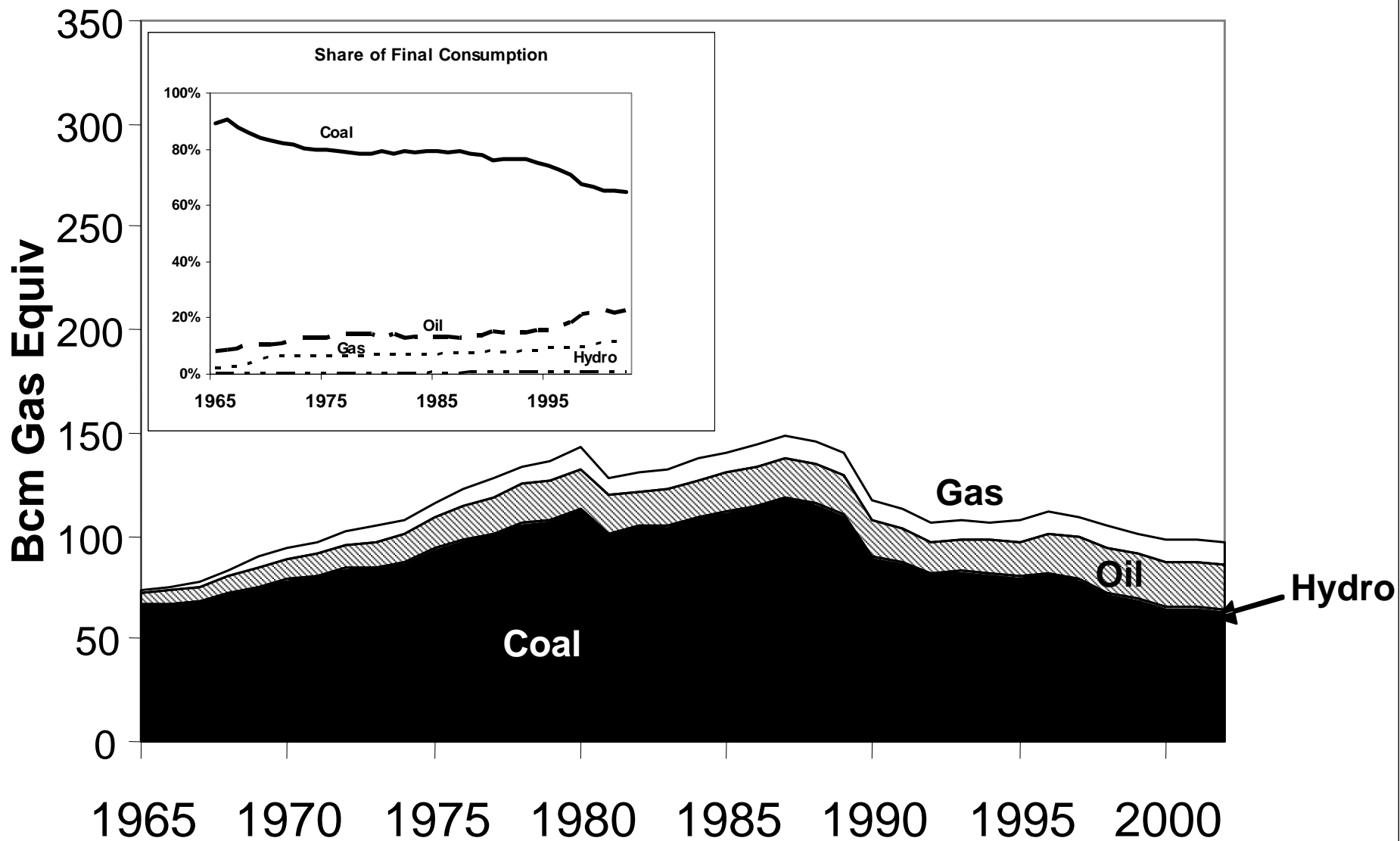


2001, 131.06 Billion Cubic Meters

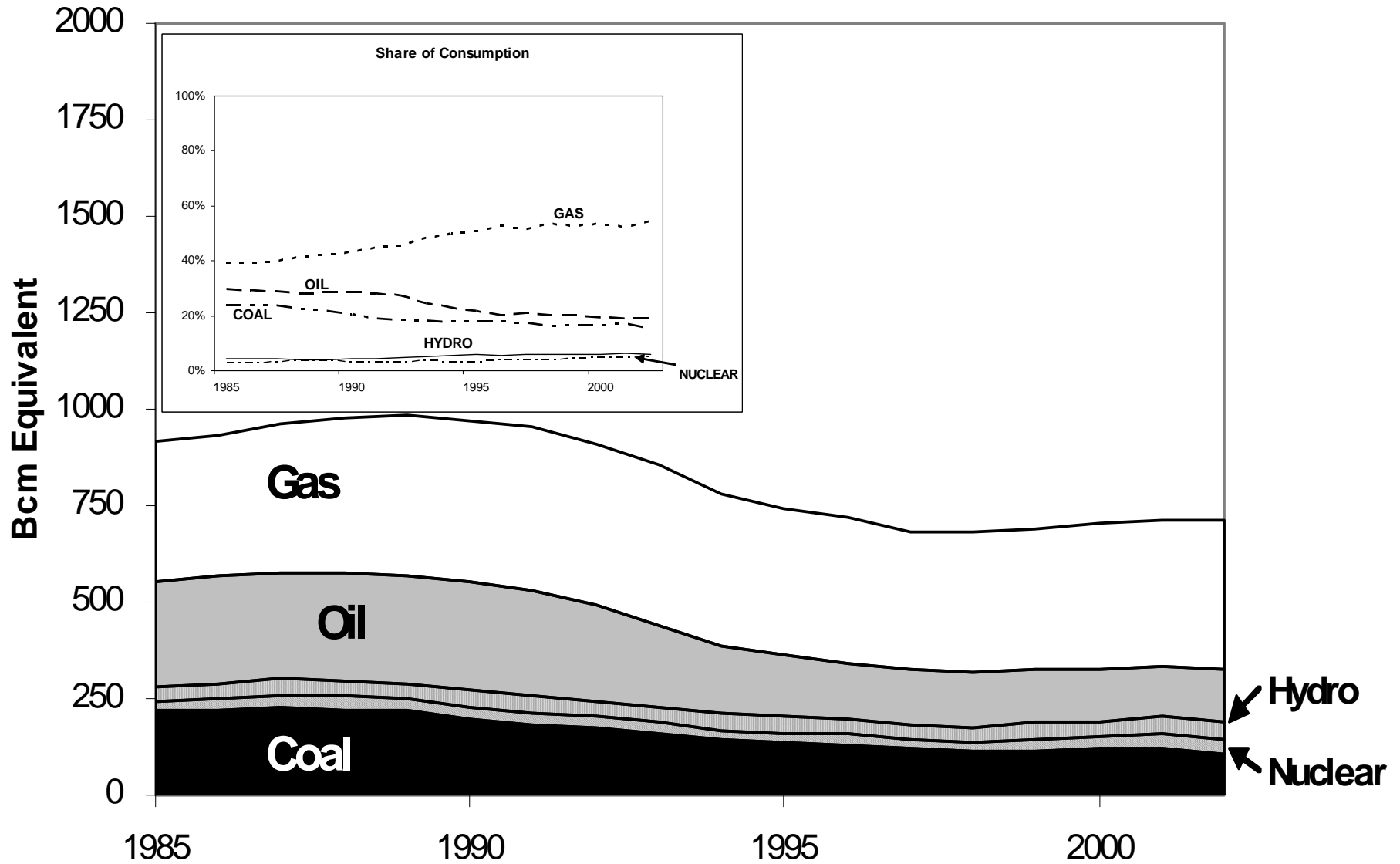


- | | |
|----------------|-------------|
| Austria | Hungary |
| Bulgaria | Iran |
| Croatia | Italy |
| Czech Republic | Netherlands |
| Finland | Others |
| France | Poland |
| Germany | Romania |
| Greece | Slovakia |
| | Turkey |

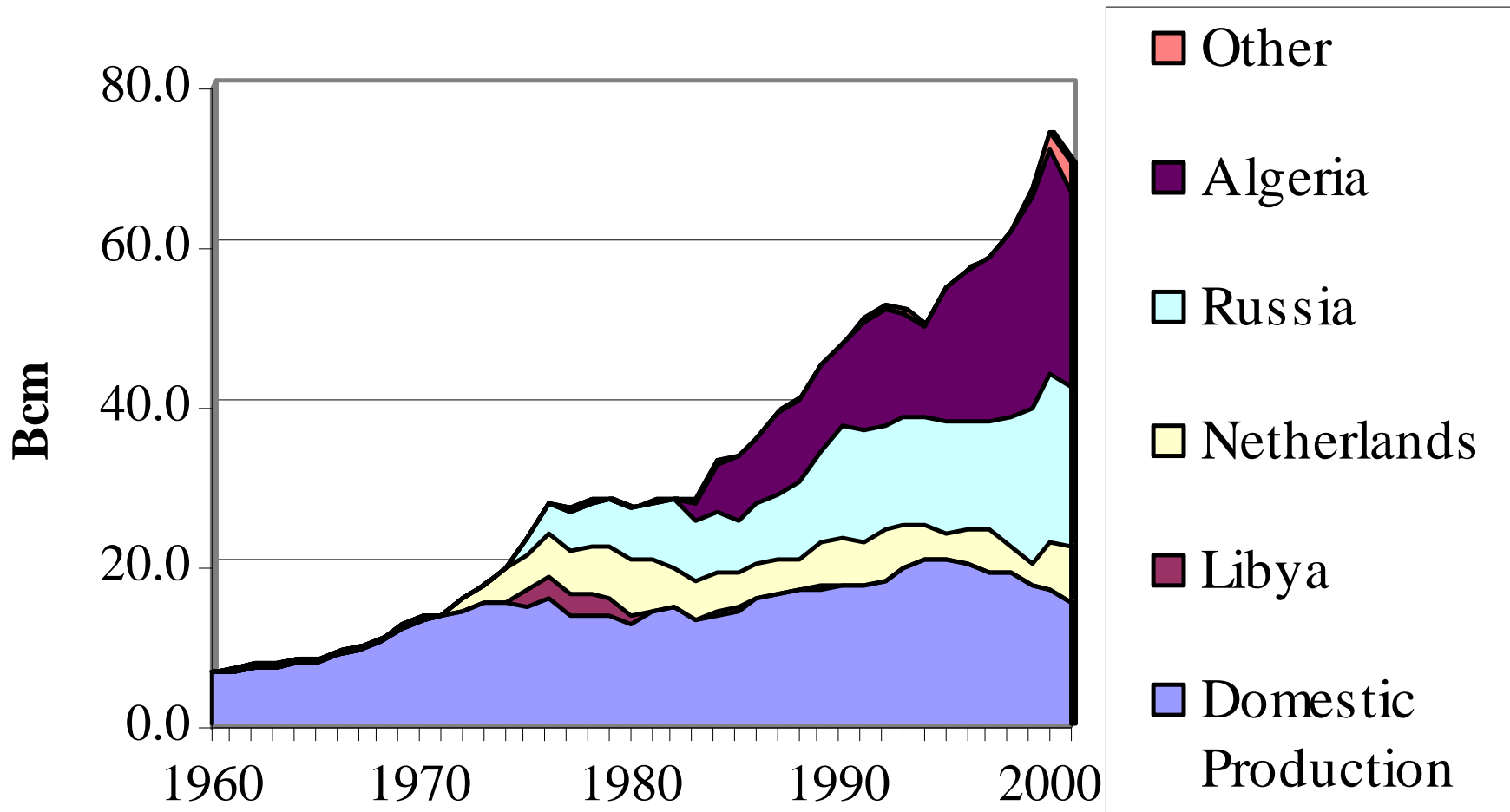
Poland Primary Energy Consumption



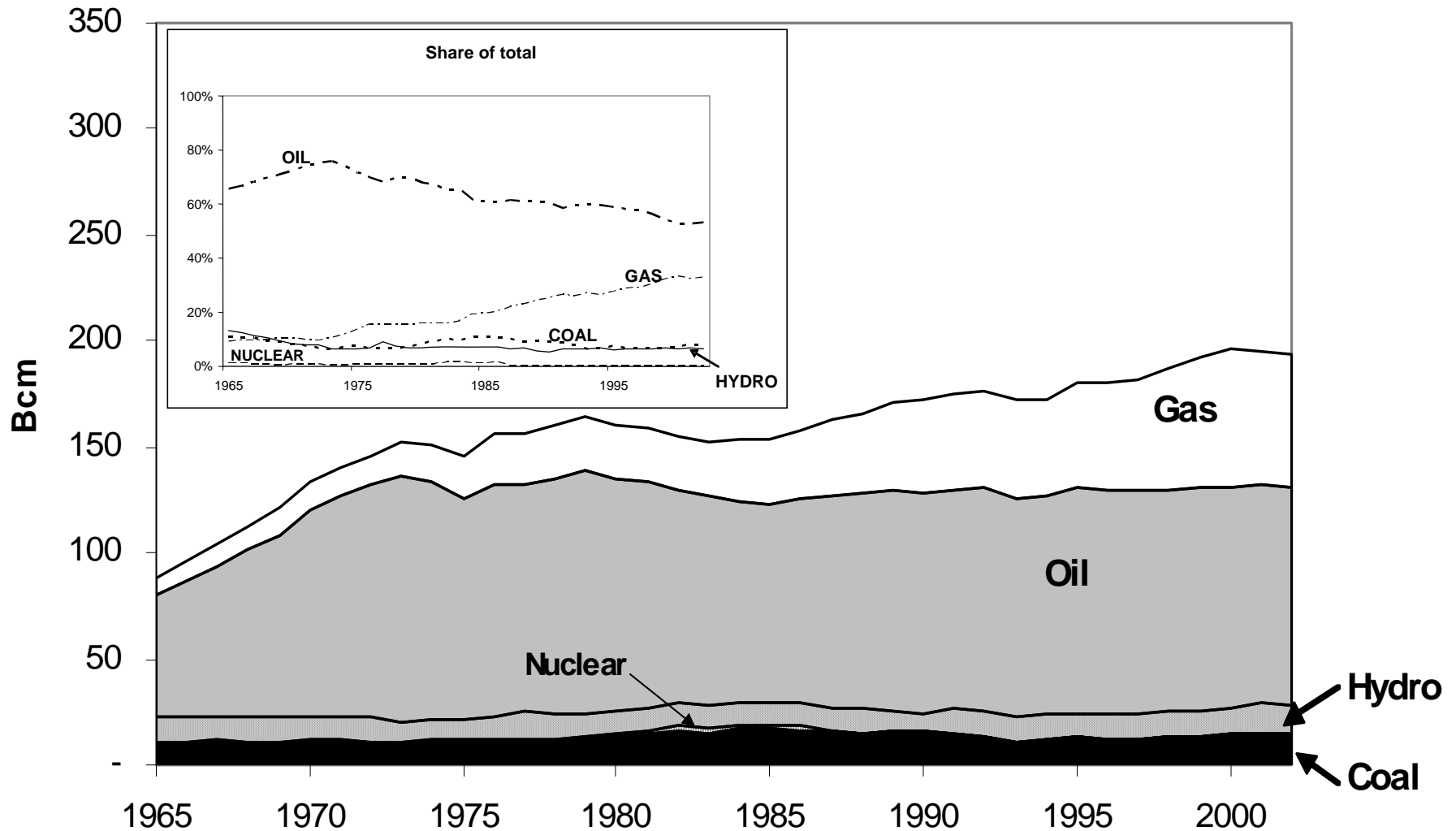
Russian Primary Energy Balances



Italian Gas Supply by Source

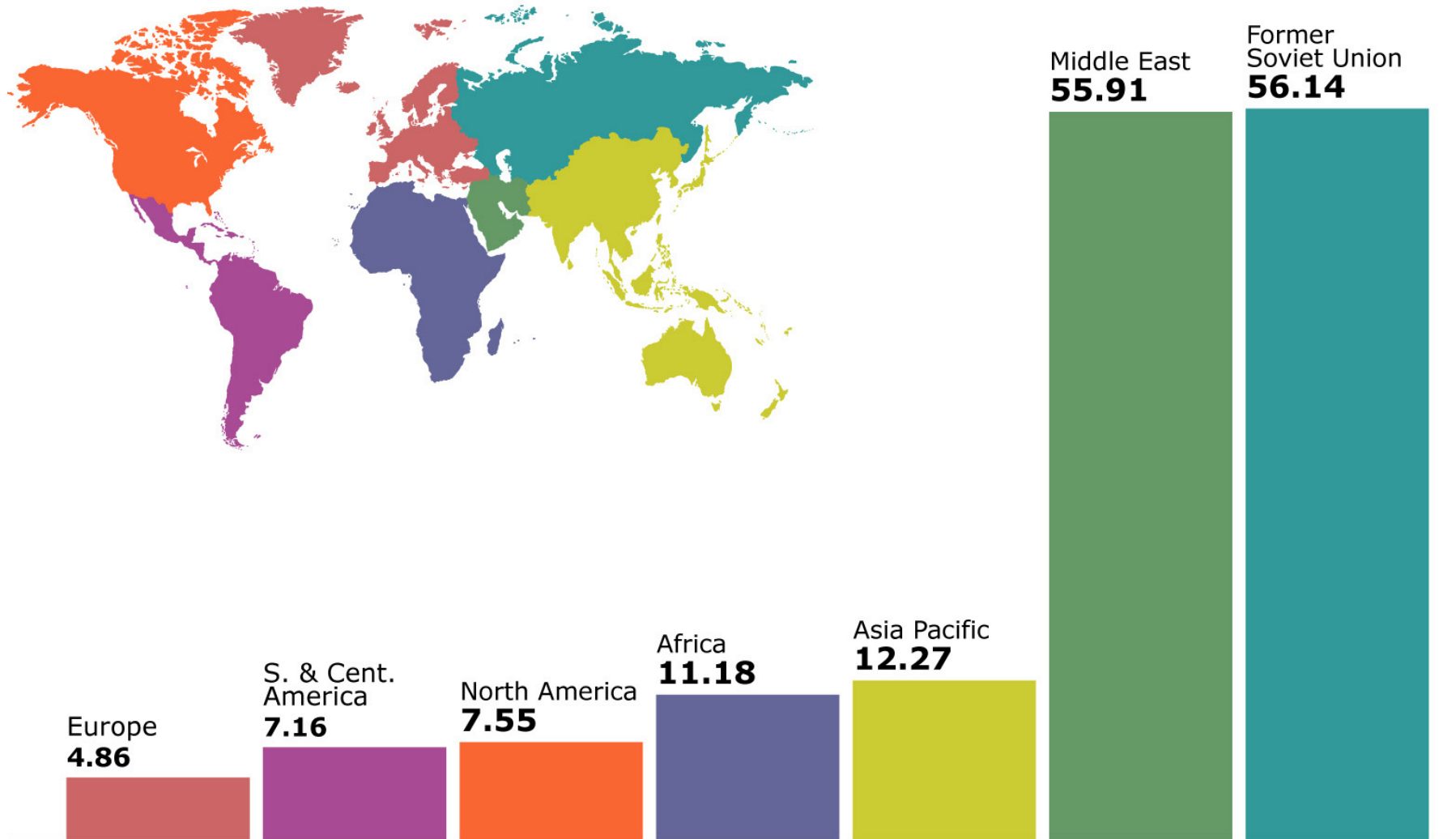


Italian Primary Energy Consumption

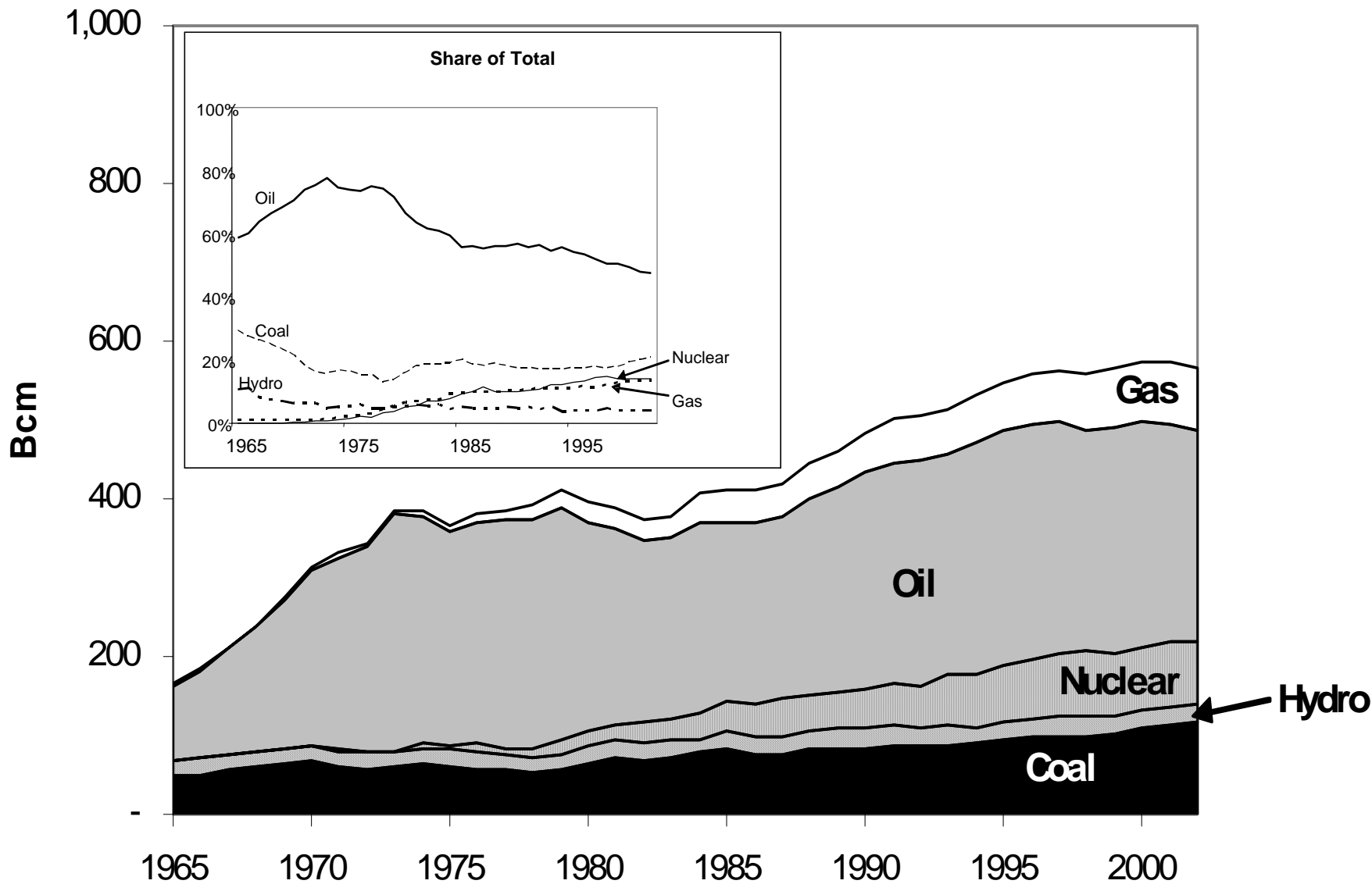


map of proved gas reserves at end 2001

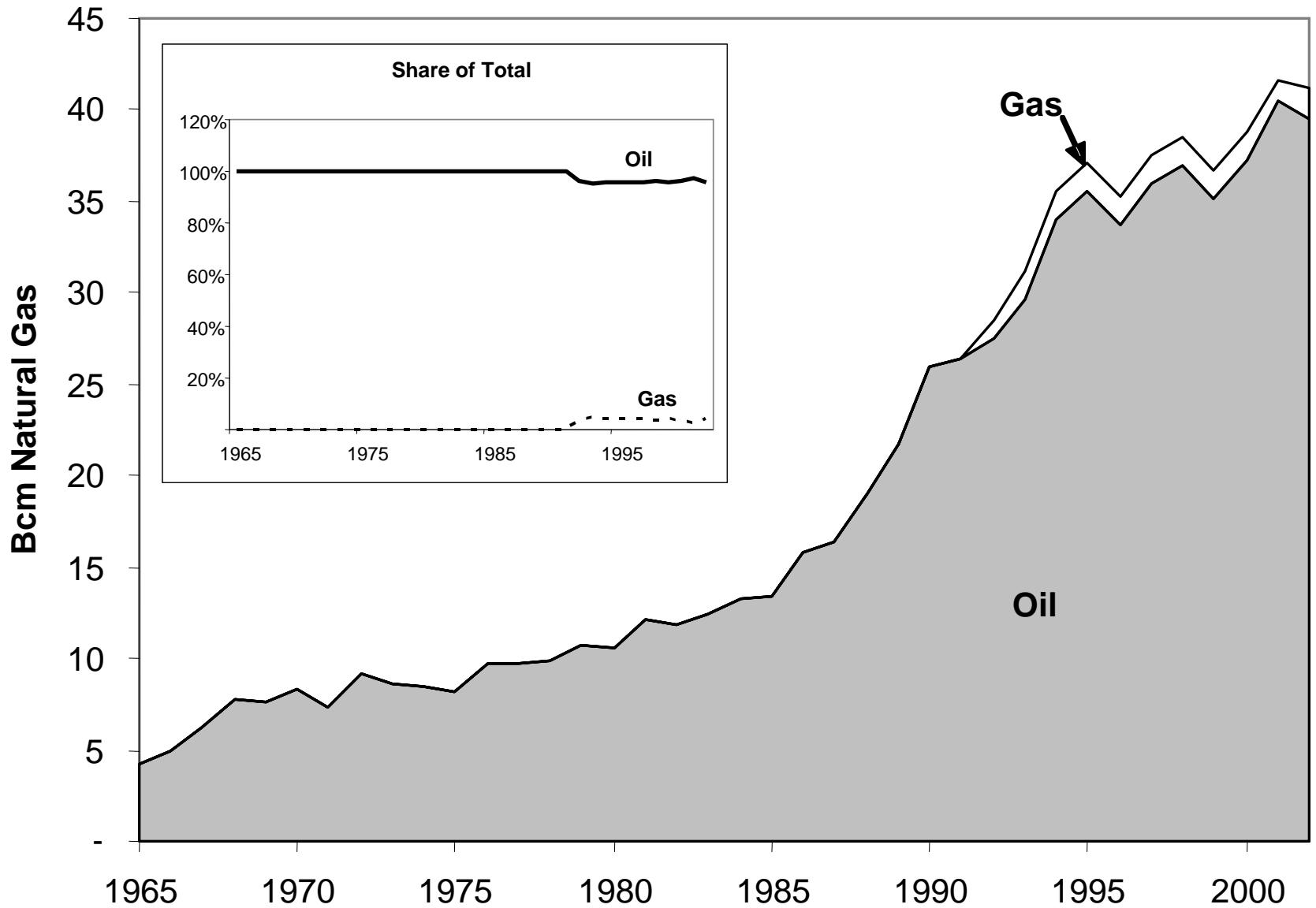
Trillion cubic metres



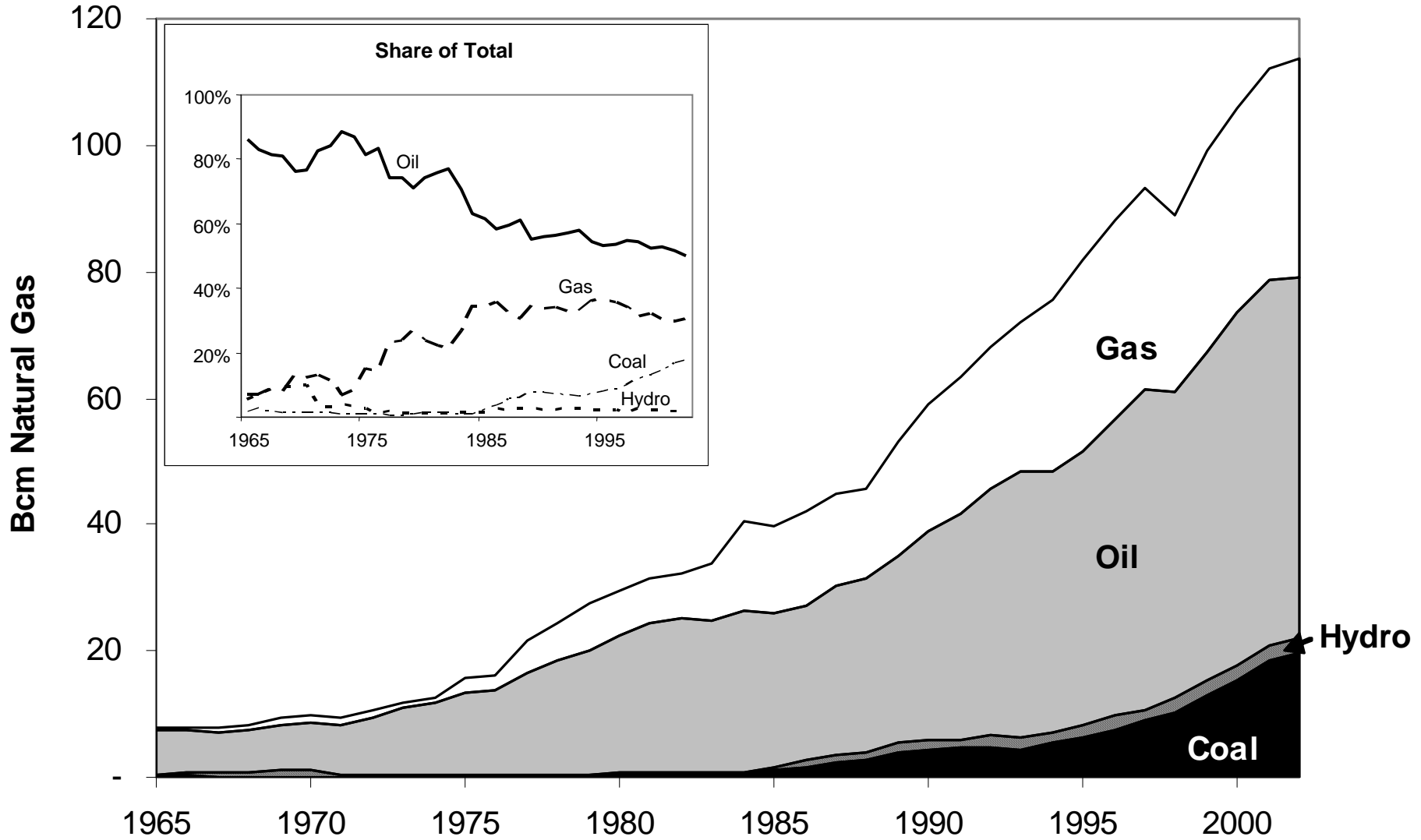
Japan's Primary Energy Balance

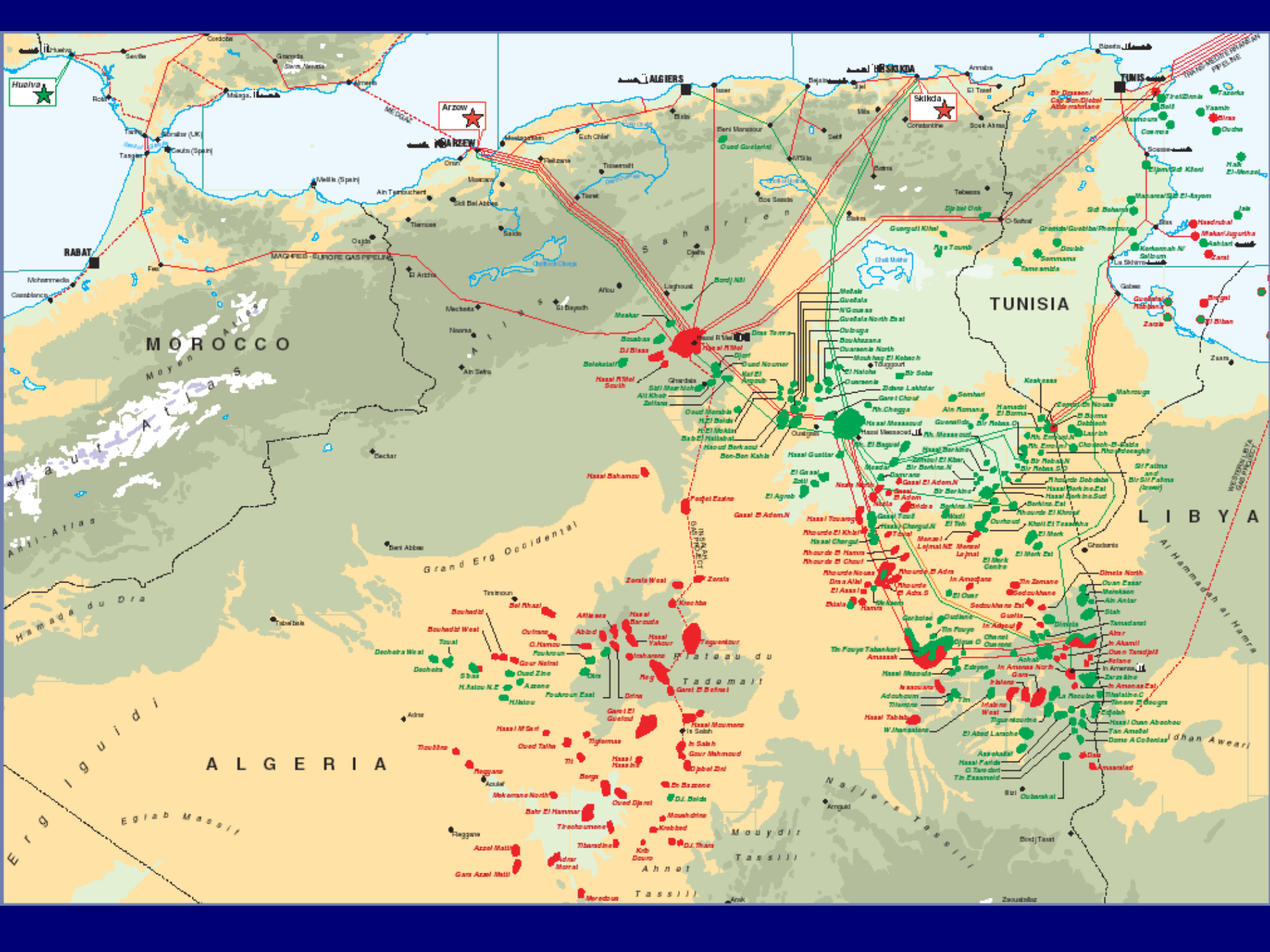


Singapore Primary Energy Supply



Indonesia Primary Energy Supply





Long-term Crude and Gas Prices

