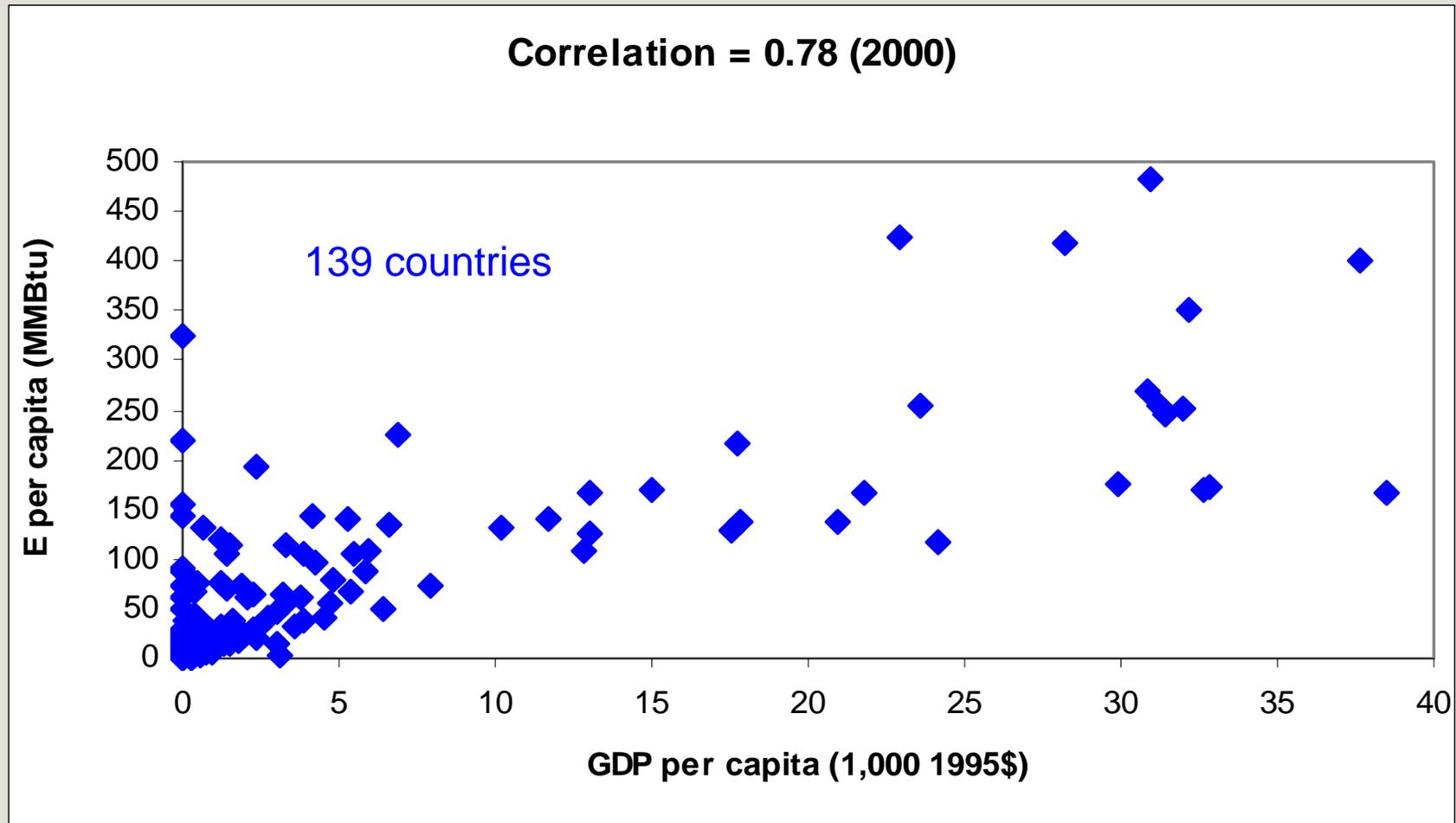


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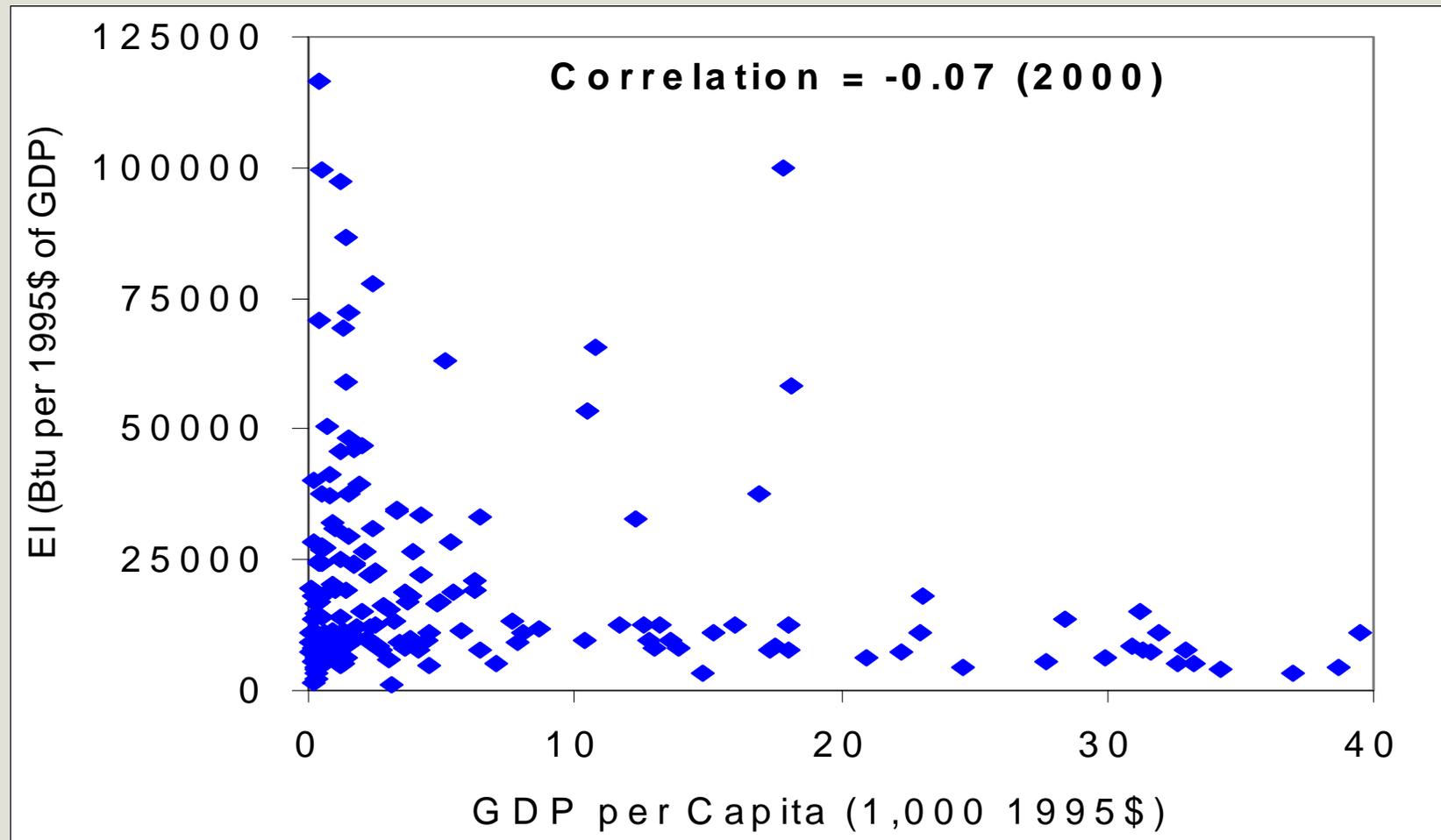


# Role of Institutions in Energy Investment

# Richer countries consume more energy per capita



# But, they use energy less intensely!



# Energy-Economy Relationship

<u>YEAR</u> <u>2000</u>	GDP per capita (1995 dollars)	Energy cons. per capita (Btus)	Electricity cons. per capita (kWh)	Energy intensity (Btus per 1995 dollar of GDP)	Electricity intensity (kWh per 1995 dollar of GDP)
LI (60)	449	11,000	350	108,982	3.73
LMI (49)	1,733	48,000	1,490	36,469	1.08
UMI (29)	4,736	90,000	2,590	20,086	0.59
HI (46)	23,396	282,000	8,060	15,087	0.37

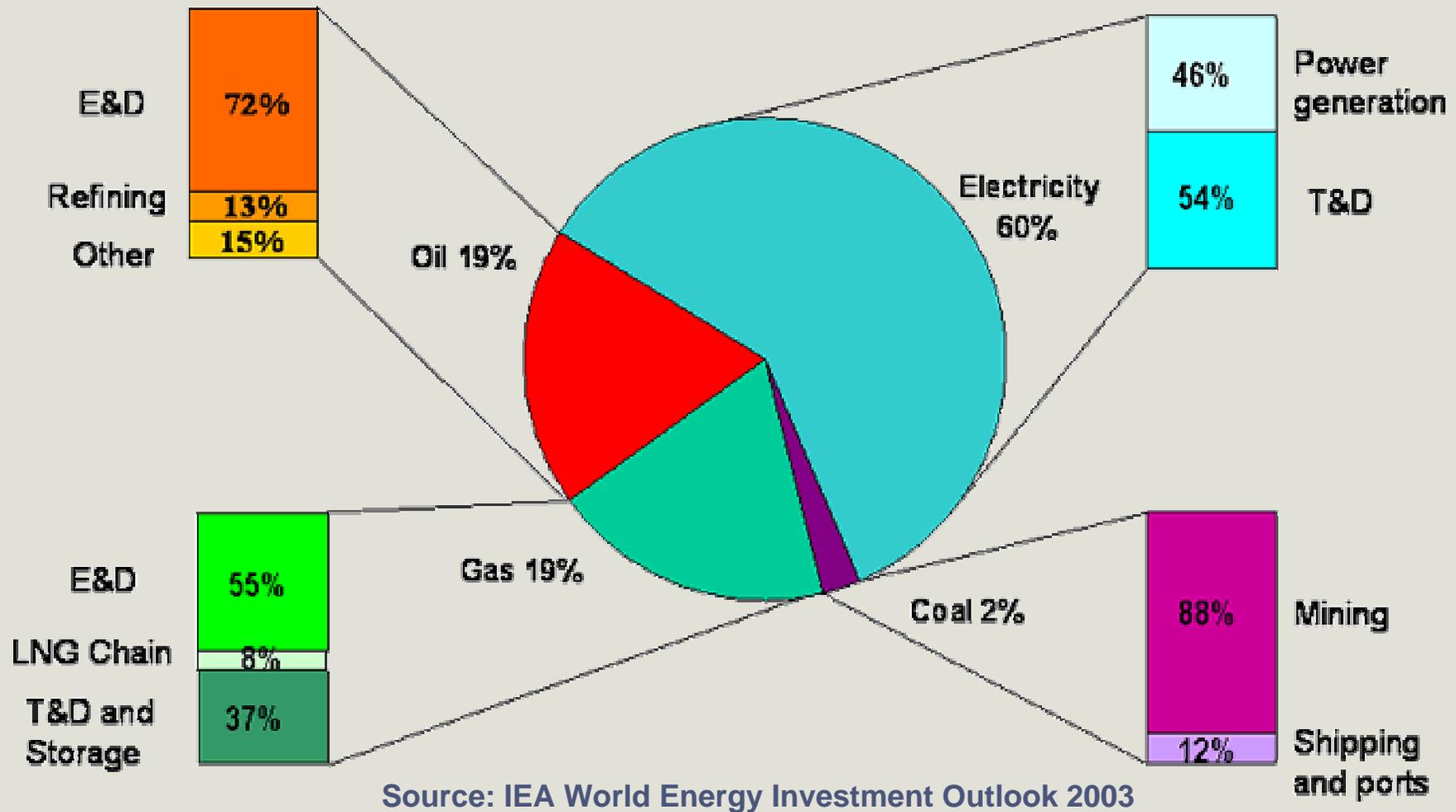
Source: EIA web site, <http://www.eia.doe.gov/emeu/international/total.html>

# Average Percentage Change between 1980 and 2002

	GDP	Energy cons.	Elect. cons.	GDP per capita	Energy cons. per capita	Elect. cons. per capita	Energy intensity	Elect. intensity
LI	122%	484%	252%	29%	250%	103%	98%	74%
LMI	113%	226%	321%	44%	98%	164%	49%	97%
UMI	118%	163%	289%	50%	82%	163%	38%	129%
HI	104%	115%	192%	60%	61%	111%	1%	46%

Source: EIA web site.

# \$16 trillion of energy investment 2001-2030



# Electricity Investment Indicators

	Electrification			People without access	2001-2030 Investment
	Urban	Rural	Total		
North Africa	99.3%	79.9%	90.3%	28 million <sup>1</sup>	
Sub-Sahara	51.3%	7.5%	22.6%	509 million	
<b>Africa</b>	<b>63.1%</b>	<b>16.9%</b>	<b>34.3%</b>		<b>\$609 billion</b>
South Asia	68.2%	30.1%	40.8%	801 million	\$783 billion
Latin America	98.0%	51.5%	86.6%	56 million	\$744 billion
East Asia/China	98.5%	81.0%	86.9%	241 million <sup>2</sup>	\$2,712 billion <sup>3</sup>
Middle East	98.5%	76.6%	91.1%		\$258 billion
<b>Developing Countries</b>	<b>85.6%</b>	<b>51.1%</b>	<b>64.2%</b>		
<b>World</b>	<b>91.2%</b>	<b>56.9%</b>	<b>72.8%</b>	<b>1,635 million</b>	<b>\$5,106 billion</b>

Source: The IEA, *World Energy Outlook 2002* and *World Energy Investment Outlook 2003*

<sup>1</sup> includes parts of Middle East

<sup>2</sup> 18 million in China

<sup>3</sup> \$1,913 billion is for China alone

## Investment Requirements in the Oil Sector (\$ billion)

	2001–2010	2011–2020	2021–2030
Exploration & Development	\$689	\$740	\$793
Unconventional Oil	49	60	96
Refining	122	143	147
Tankers	37	79	76
Pipelines	20	23	23
<b>TOTAL</b>	<b>\$917</b>	<b>\$1,045</b>	<b>\$1,135</b>

Source: International Energy Agency

# Where are the funds?

- It does not seem likely for public funds and inefficient state enterprises to provide this level of investment.
- Nor is it possible to count on development assistance.
- Private investment needs to be attracted back into developing countries and in significantly larger quantities.
- The governments need to offer commercial frameworks conducive to private participation in the electricity sector.

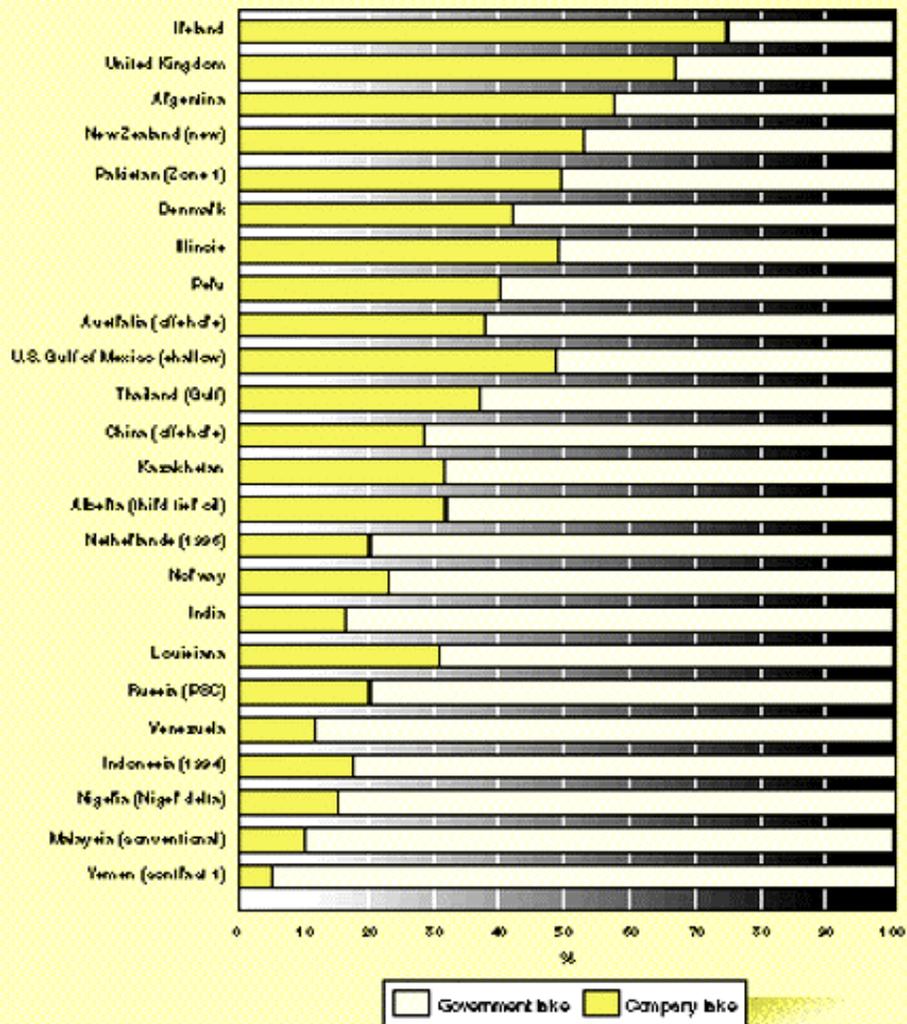
# Upstream Country Frameworks and Risk/Reserve Position

*(An Inverse Relationship for Private Investment)*

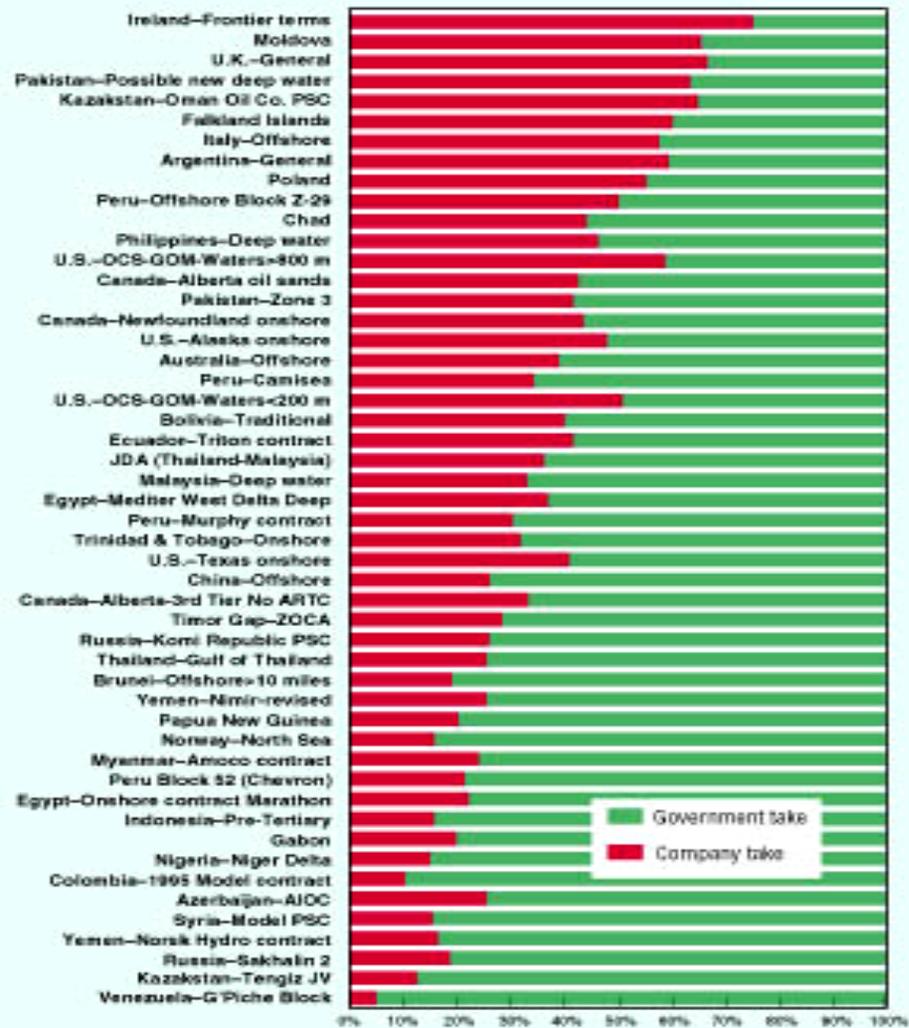


Source: Michot Foss, et. al., 1999. Approximation, only.

## How 24 Fiscal Systems Compare



## Undiscounted Government Take in 50 Selected Fiscal Systems



Sources: Governments cut takes to compete as world acreage demand falls, *Oil & Gas Journal*, April 24, 1995 & Government takes decline as nations diversify terms to attract investment, *Oil & Gas Journal*, May 26, 1997 by Pedro Van Meurs.

# Gas/Power “Marketization”

*Increasing Private Control → Decreasing Government Role*

## Phases of Development

- **Privatization:** Increasing private ownership
- **Liberalization:** Relaxation of newly privatized or strong state controlled sectors, decontrol of pricing/planning
- **Commercialization:** Delegate management, face competition
- **Regulation:** Establish legislation, identify regulatory function, establish regulatory rules and procedures (“regulatory technology”)
- **Deregulation/Re-regulation:** Reduce or alter regulatory role, change regulatory framework to increase competition
- **Full Deregulation:** Complete removal of government control

# Sources of Uncertainty

Region or Country	Issues
Canada	Monopoly Crown corporations for electricity, cost of electricity restructuring, market design, regulatory coordination (provincial, federal); <i>Ontario roll back</i>
U.S.	Costs of electricity restructuring, market design, regulatory coordination (state, federal)
Mexico and Latin America	Role of national energy companies; independence of regulators, market depth; <i>northern Andes political risk</i>
Western Europe	Monopolies (non-UK), market design, regulatory authority, <i>role of ECJ</i>
Central, Eastern Europe	Market design, monopolies, market depth, economic risk, EU expansion
CIS	Market facilitation, national energy companies, market depth, economic and political risk – <i>Russian influence</i>

\*Denotes specific IELE white papers, publications, commentary

# Sources of Uncertainty

Region or Country	Issues
Middle East	Market facilitation for downstream infrastructure investment, economic and political risk – <i>regime stability</i>
South Africa	Market design, natural gas entry, regulatory authority, market depth; <i>political stability</i>
India	Market facilitation, economic and political risk (role of state electricity boards), market depth
China	Market facilitation, national energy companies, economic and political risk – <i>Central and NE Asia</i>
Japan	Market facilitation, monopolies, regulatory authority, regional cooperation and coordination
Australia	Market design, regulatory coordination across jurisdictions (state, federal)

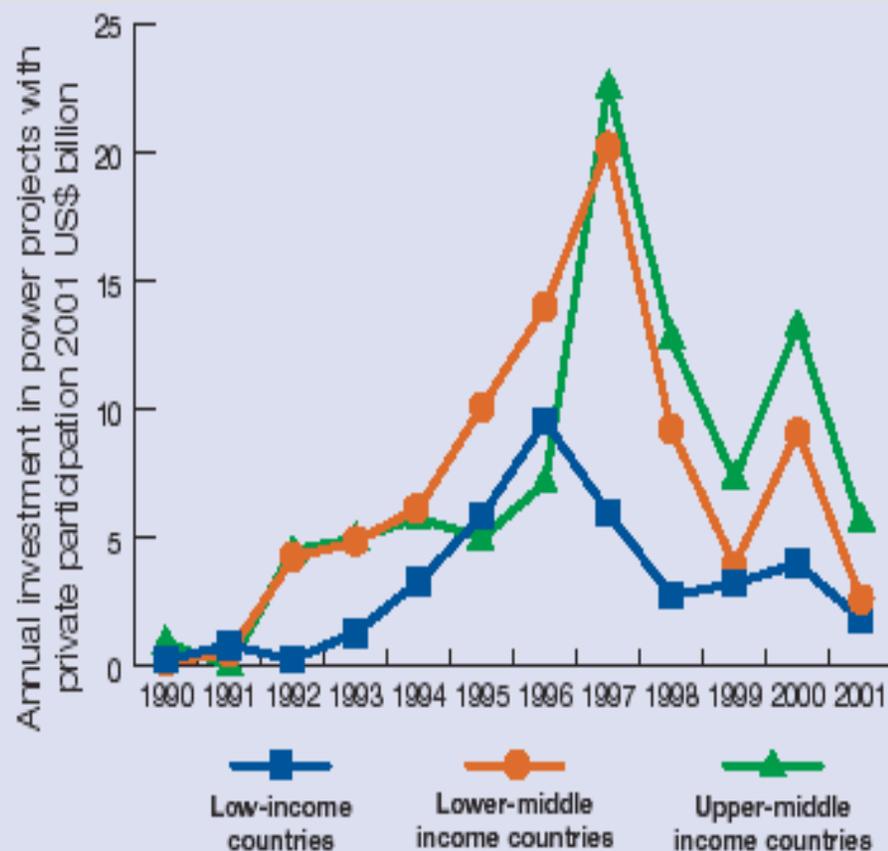
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# World Trends: Reality Check

*Results from the World Bank survey of  
power industry investors, 2003*

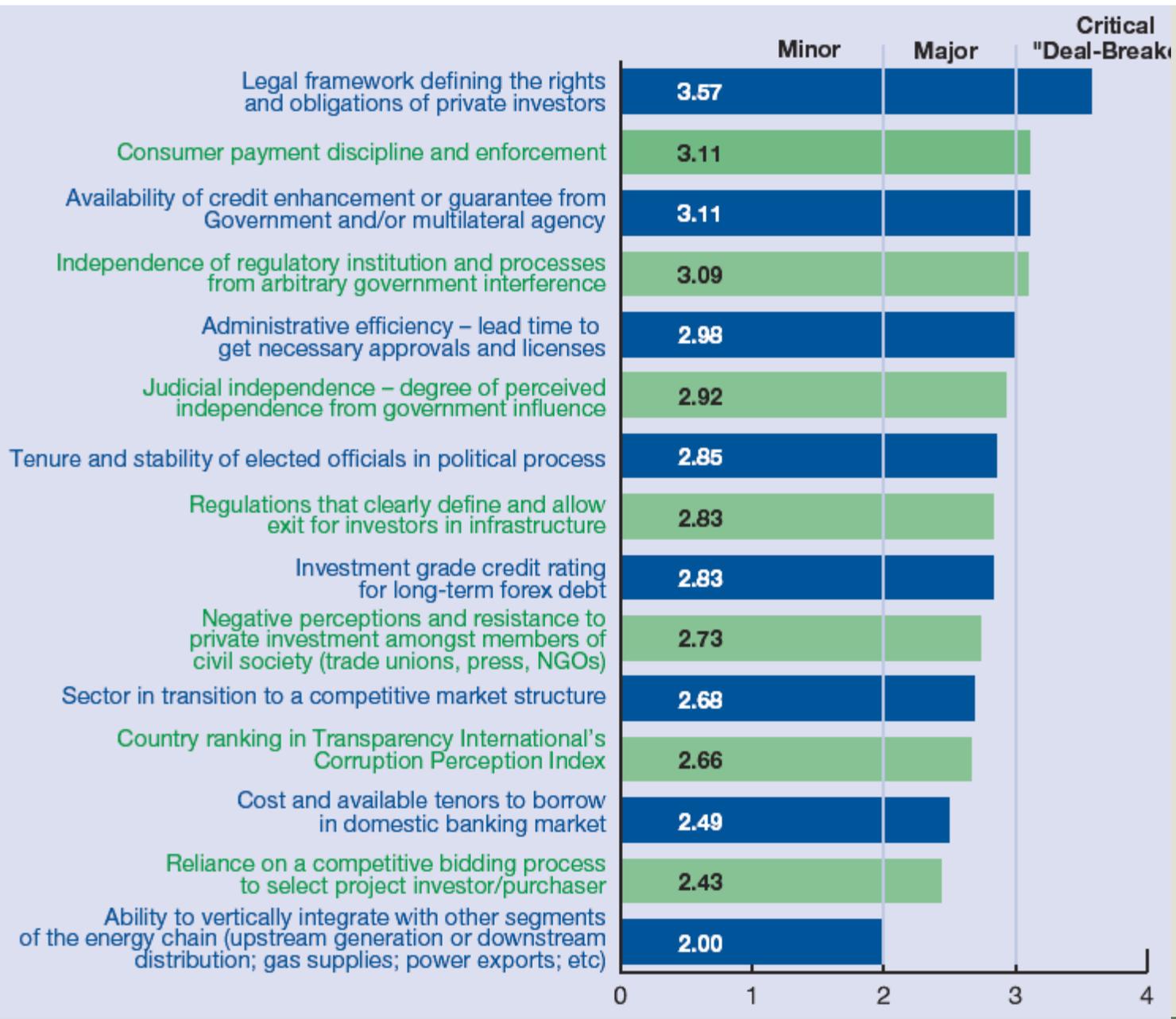
- Half of the investors (~50 companies) are less interested in developing country power sectors as compared to the 1990s
- Several priorities for governments:
  - Ensure adequate cash flow (adequate tariff levels and collection)
  - Maintain stability and enforceability of laws and contracts
  - Improve responsiveness to investors' needs
  - Minimize government interference (with operations and management in particular)

# Private Investment in Developing Country Power Sectors



Source: World Bank, *Private Participation in Infrastructure (PPI) Project Database*

- About \$200 billion were invested, mostly in East Asia and Latin America
- Still significantly less than the investment levels estimated by the IEA



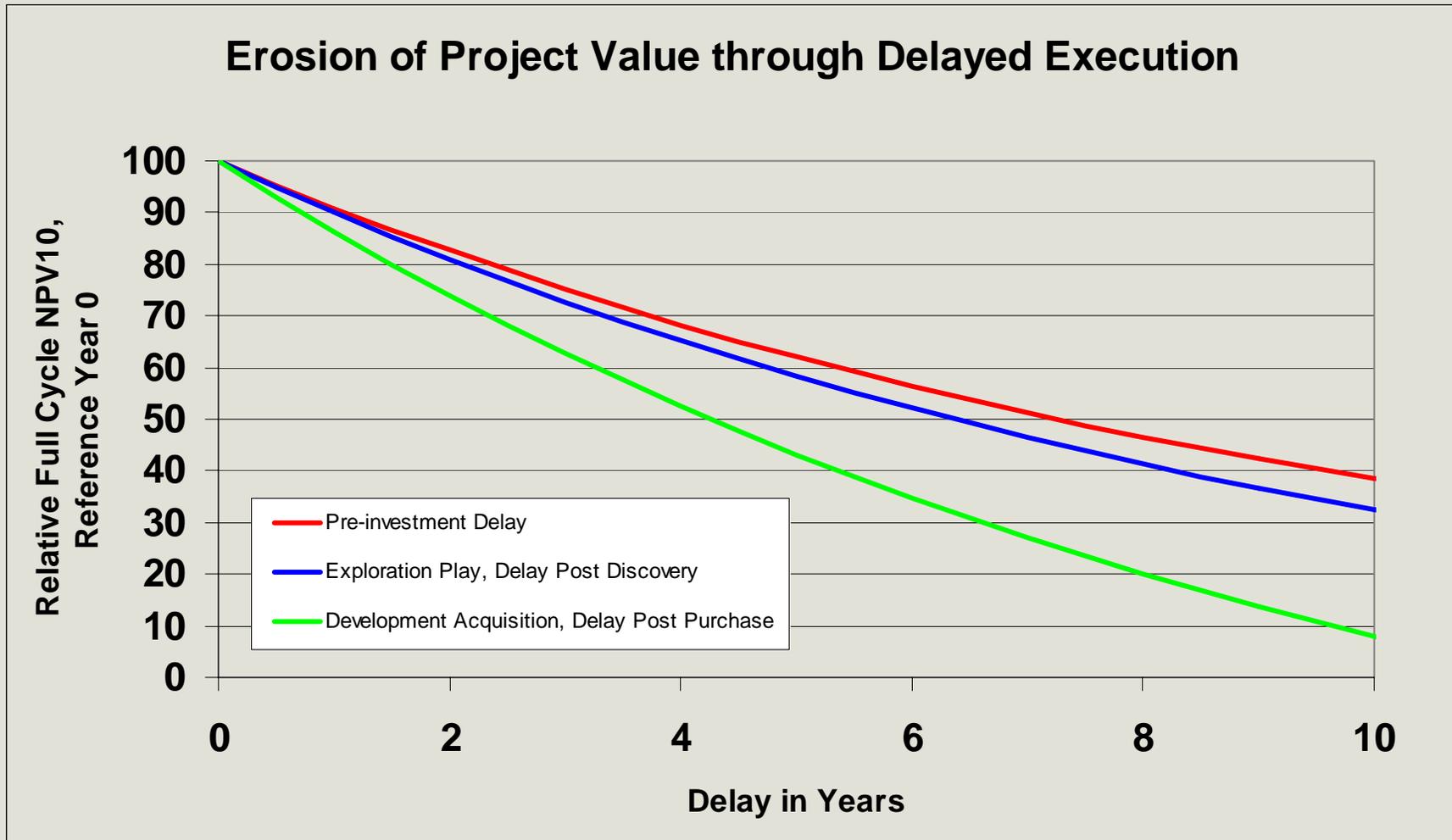
# What Accounts for Best Projects

1. adequacy of retail prices and collection discipline to meet cash flow needs,
2. ability to exercise effective operational and management control of the project,
3. government meeting all commitments of state-enterprise performance and exchange conversion,
4. enforcement of laws and contracts (e.g., disconnections, payment by counter-parties, etc.),
5. availability of limited recourse financing,
6. non-arbitrary adjudication of tariff adjustments and dispute resolution,

# What Accounts for Best Projects

7. no oversupply or capacity utilization problems (demand growth as projected),
8. sustained regulatory commitment through long-term contract,
9. responsiveness of government to investor needs and timeframes,
10. existence of a competitive selection process,
11. presence of government guarantee of state-enterprise performance and revenue sufficiency, and
12. public-private partnership.

# Delayed Execution Erodes Value



# Economic Literature on Institutions

*...countries with better institutions, such as secure property rights and non-corrupt governments, invest more in physical and human capital, use these factors more efficiently and achieve a higher level of income...*

- *Structure and Change in Economic History*, by Douglas North (1981)
- “Economic Performance through Time,” AER by Douglas North (1994)
- “Why do some countries produce so much more output per worker than others?” QJE by Robert Hall & Charles Jones (1999)
- “The colonial origins of comparative development: an empirical investigation” AER by Acemoglu, Johnson & Robinson (2001)
- “Reversal of fortune: geography and institutions in the making of the modern world income distribution” QJE by Acemoglu, Johnson & Robinson (2002)

# Foreign Investment and Institutions

- Kalemli-Ozcan, Alfaro & Volosovych (2003) finds that “institutional quality is the most important variable explaining the Lucas Paradox...variables such as government stability, bureaucratic quality, non-corruption and law & order play a particularly important role in explaining the lack of flows to poor countries.”

# Kalemli-Ozcan, Alfaro & Volosovych (2003)

- Regression of Net Inflows of Capital per capita on
  - Capital Stock per capita
  - Human Capital
  - Institutional Quality
  - Distantness
  - Inflation Volatility
  - Capital Controls
- Robustness is checked by including variables such as Removal of Capital Controls, Corporate Taxes, Government Infrastructure, Capitalization, etc.

# Our Goal

- To replace Net Inflows of Capital per capita with Energy Investment per capita (or sector-specific: oil & gas upstream versus electricity)
- To add energy sector specific institutional variables such as the quality of regulatory agency (based on previous research at IELE)

# Data Challenge

- Energy-specific cross sectional investment data is not easy to find
- We will try to use data from the World Bank's Private Participation in Infrastructure Project Database (only electricity)
- Any other data sources?