INTERNATIONAL ENERGY AGENCY

World Energy Investment Outlook

Prospects and Challenges

FINDINGS FROM
WORLD ENERGY INVESTMENT OUTLOOK 2003

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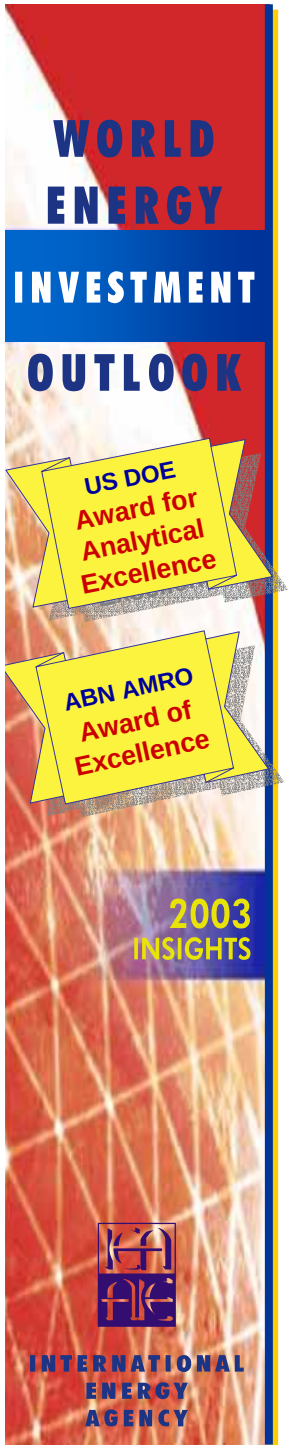
KEEI-IEA Joint Conference on Northeast Asia Energy Cooperation

March 16, 2004



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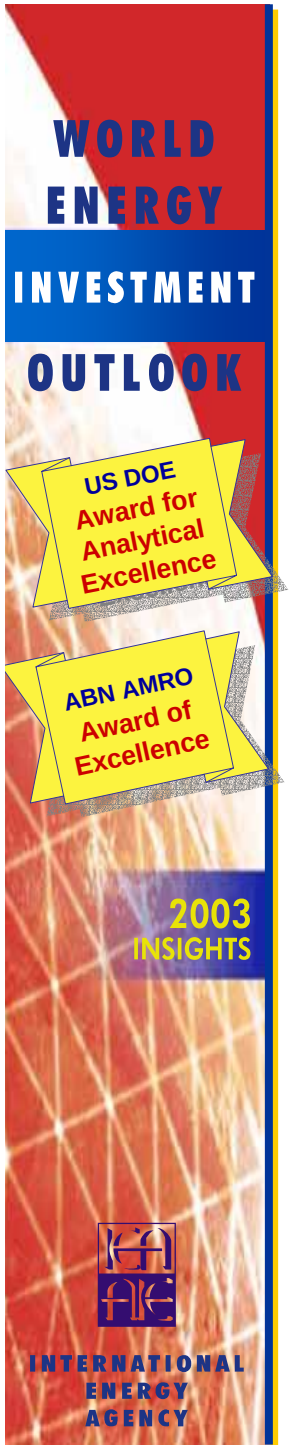

Introduction

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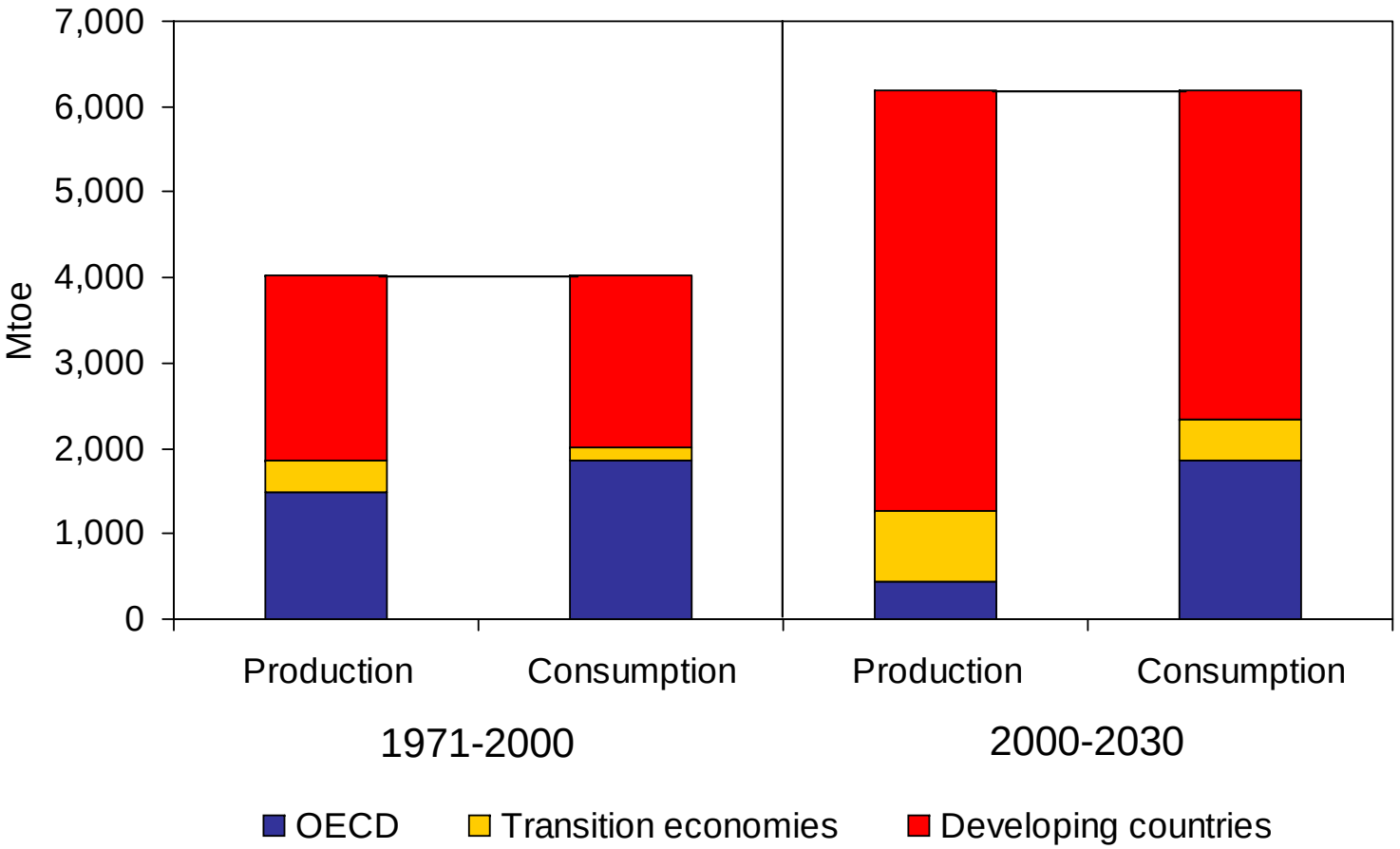
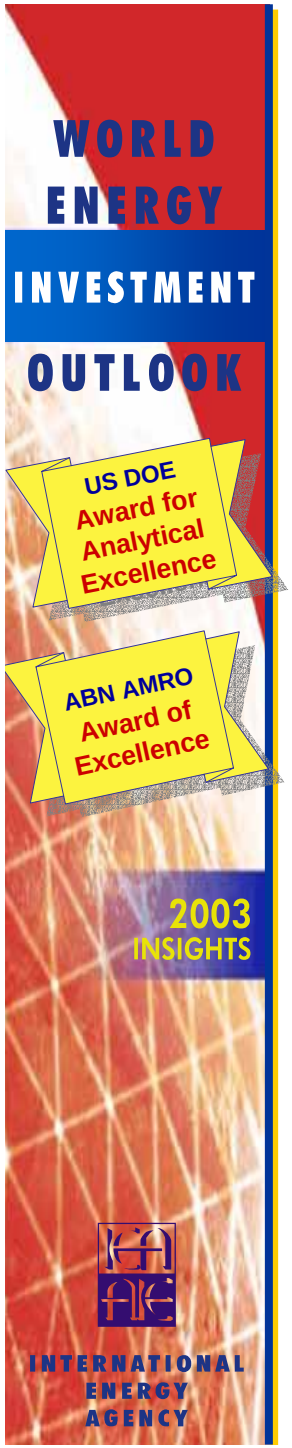
Increase in World Energy Production and Consumption

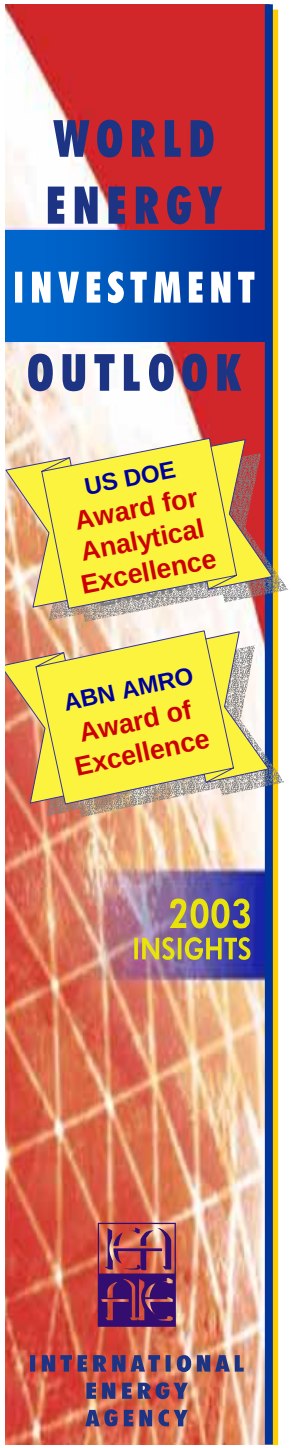


More than 70% of energy demand growth and almost all energy production growth over the next three years will come from outside the OECD



Central Findings

- *Unless policies change*, energy demand, CO_2 emissions and import dependency will continue to grow steadily
- Fossil fuels will remain dominant in the energy mix
- Energy markets will shift toward developing countries
- China will emerge as a strategic buyer in international energy markets
- The projections highlight four strategic energy challenges:
  - Security of energy supplies
  - Threat of environmental damage caused by energy use
  - Investment in energy infrastructure
  - Uneven access of the world's population to modern energy



Global Energy Investment Outlook

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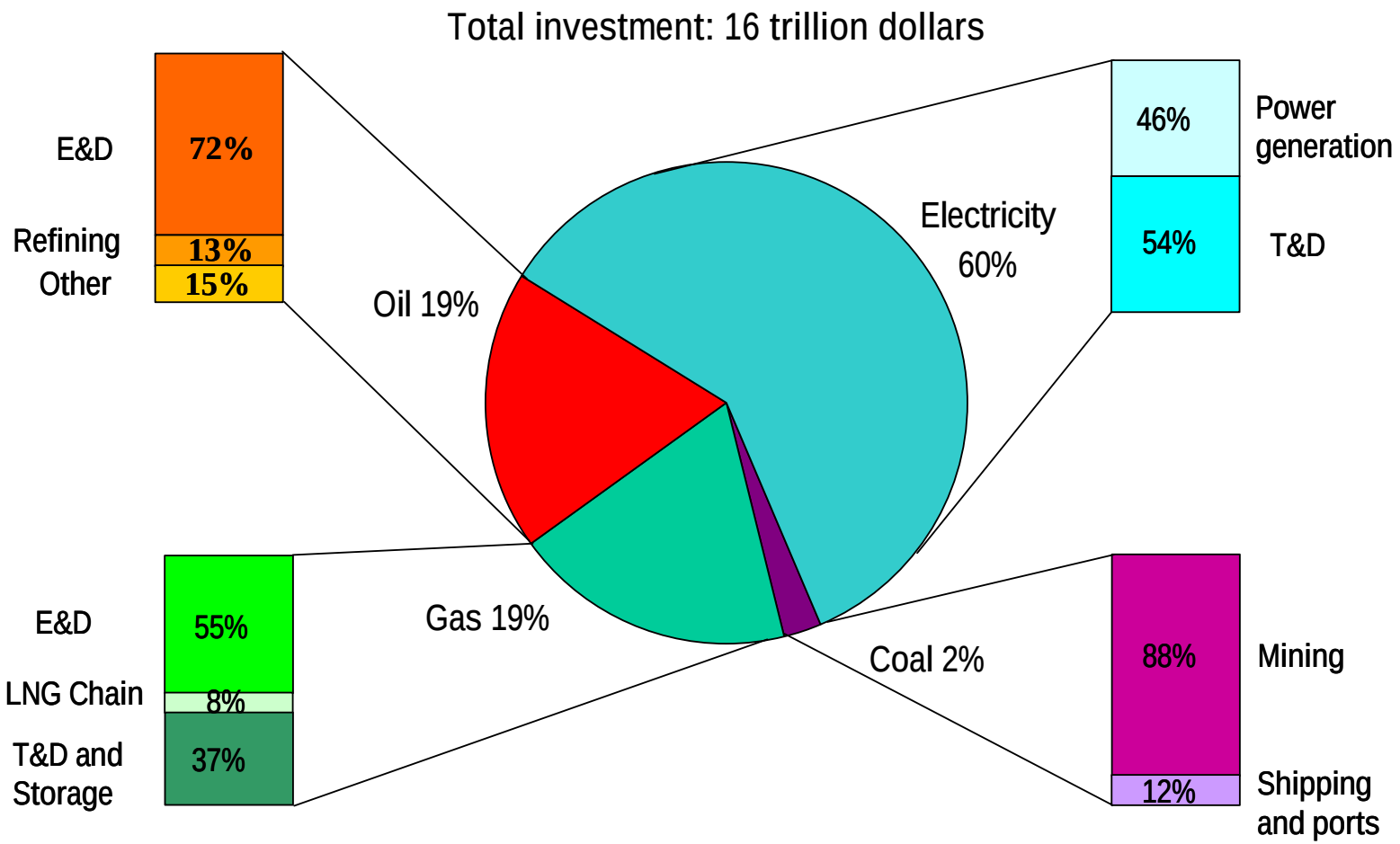
World Energy Investment

2001-2030



Electricity investment will dominates. In each sub-sector, production accounts for the majority of investment – except for electricity

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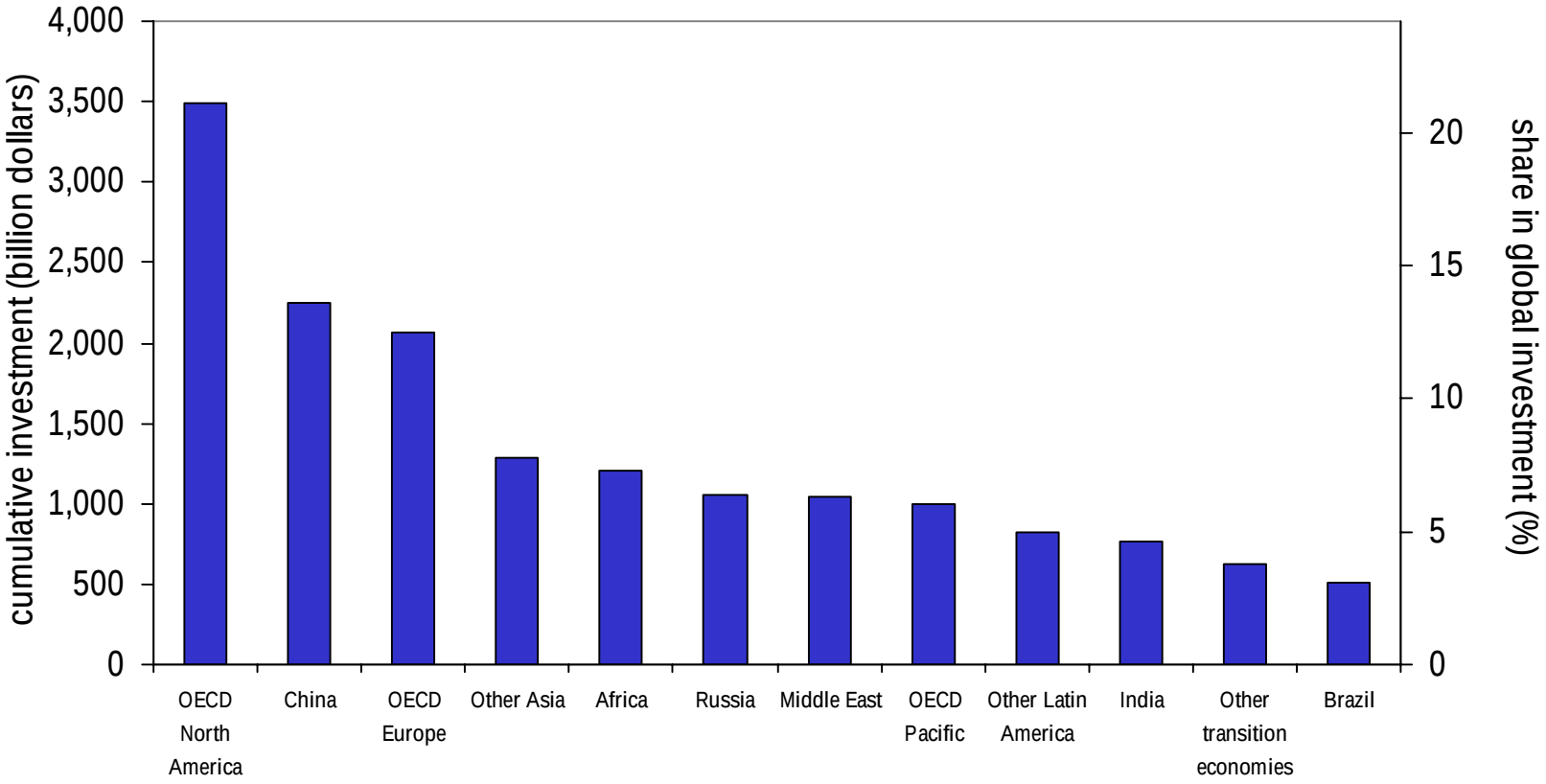
Energy Investment by Region
2001-2030



Nearly a third of energy investment requirements of $16 trillion will be needed in East Asia

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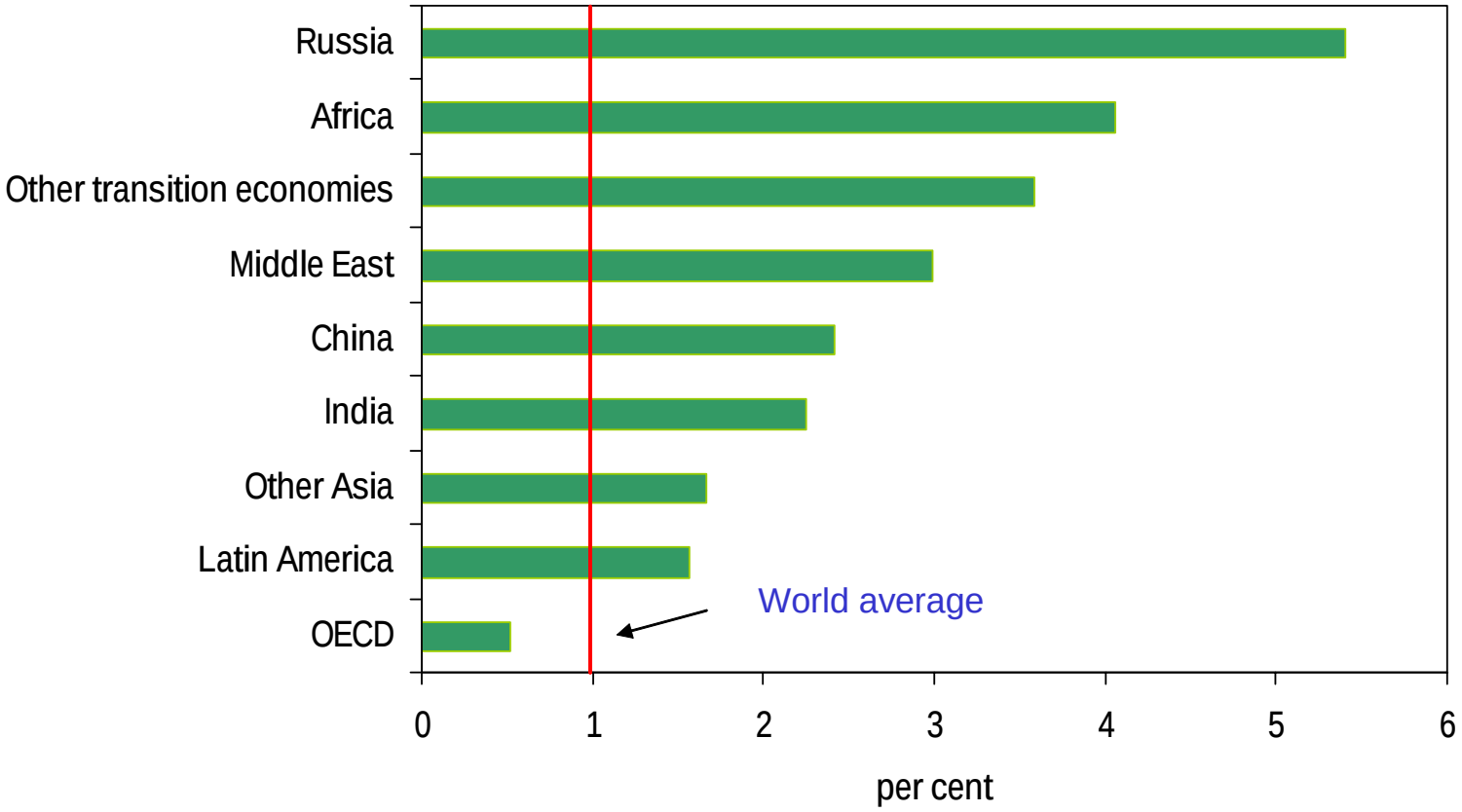
Energy Investment Share in GDP

2001-2030



The share of energy investment in the economy is much higher in developing countries and the transition economies than in the OECD

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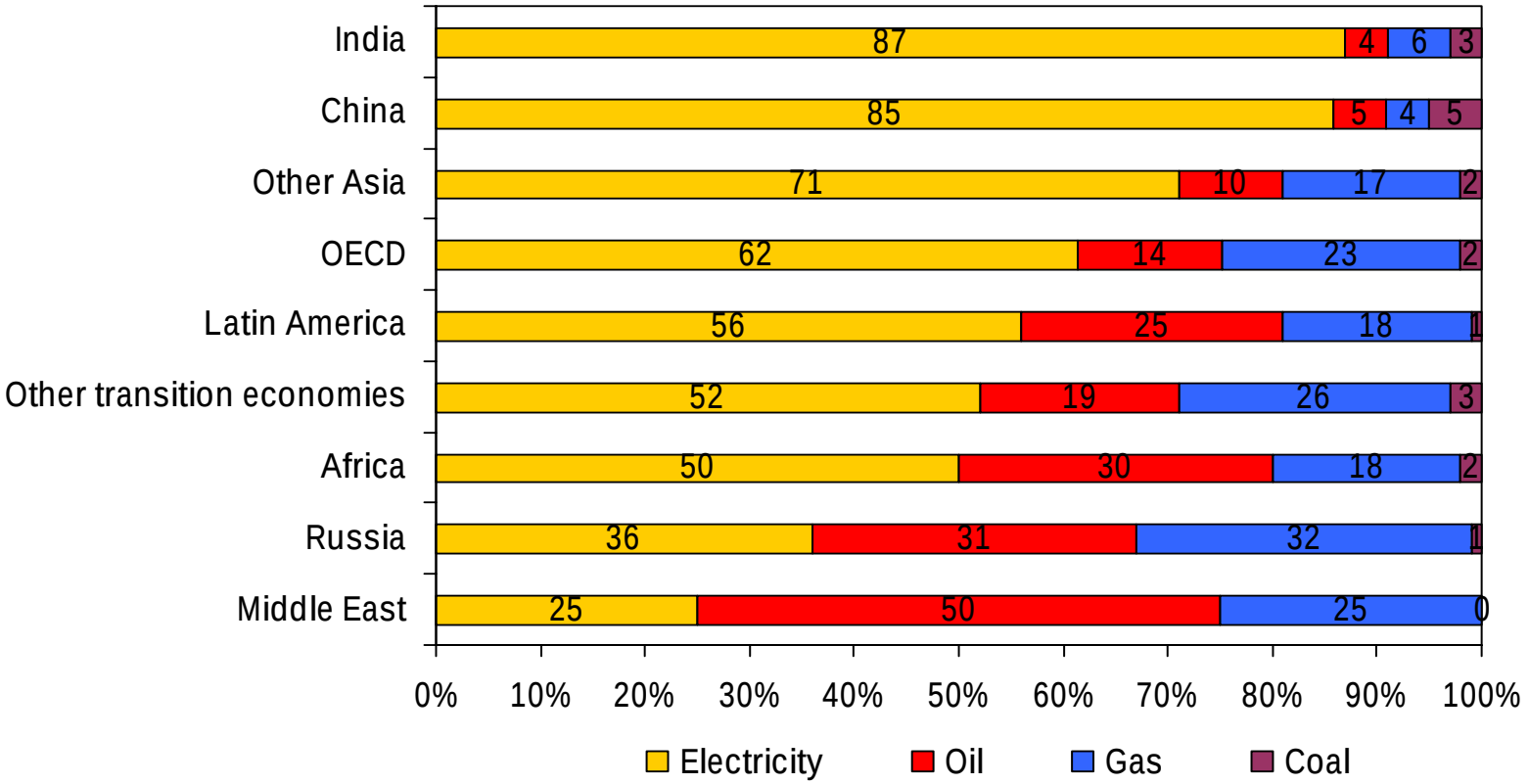
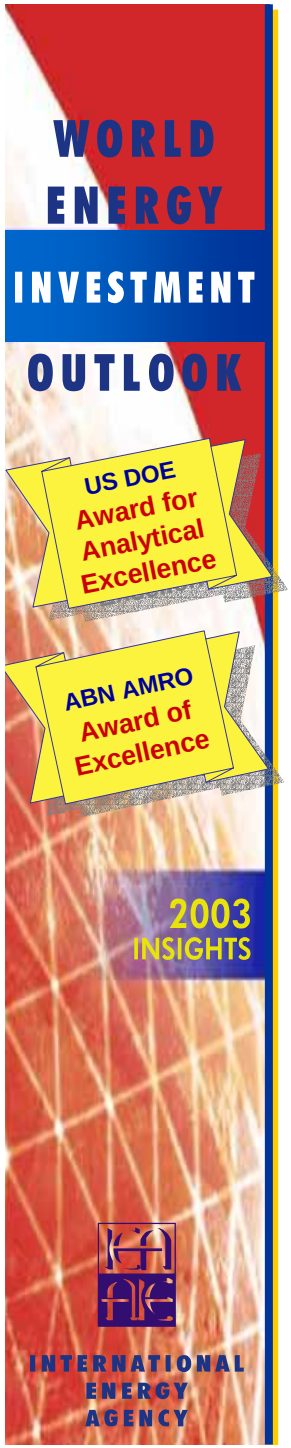
Fuel Share in Energy Investment Requirements

2001-2030



Electricity sector dominates investment in most regions, especially in Asian countries



Oil Investment Outlook

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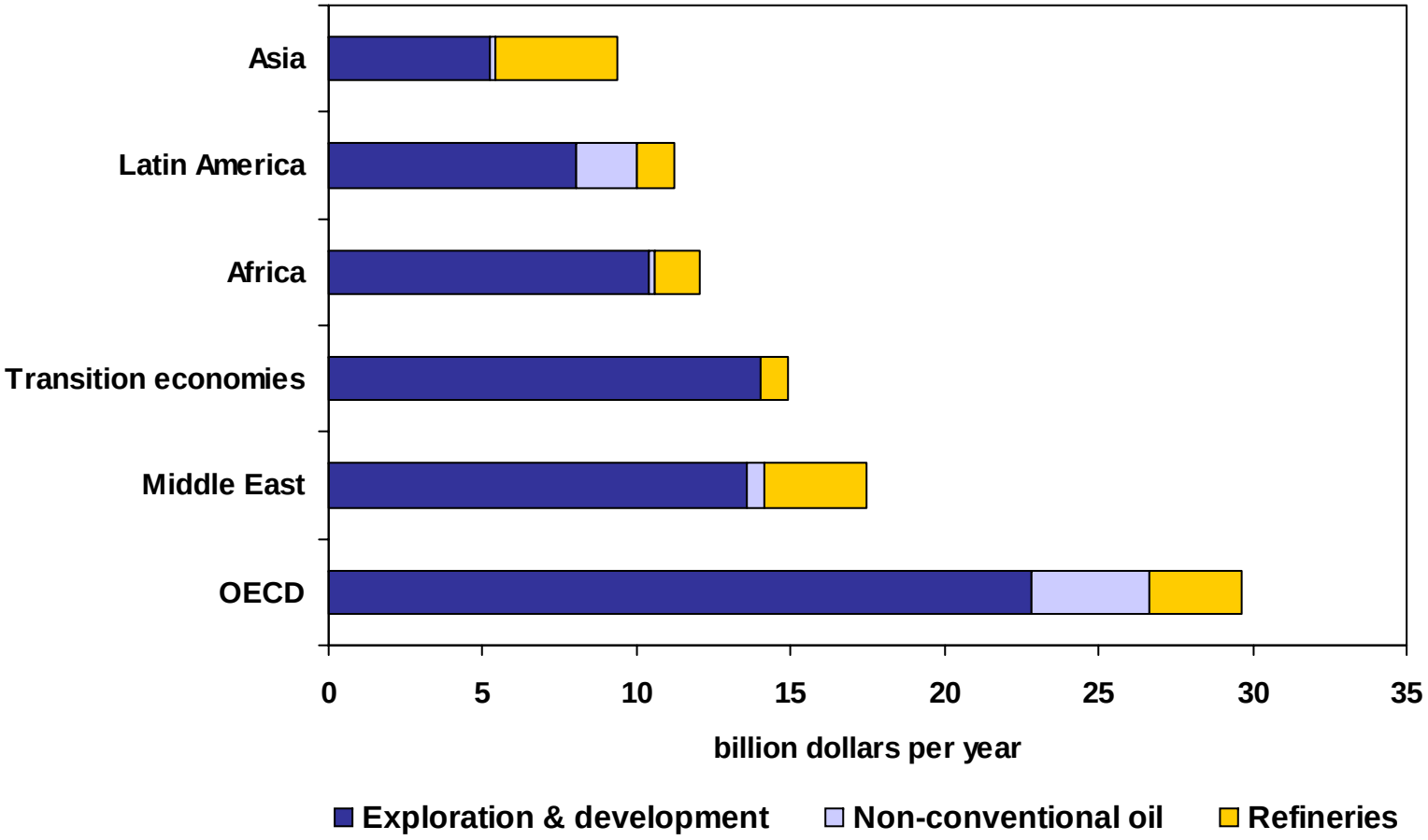
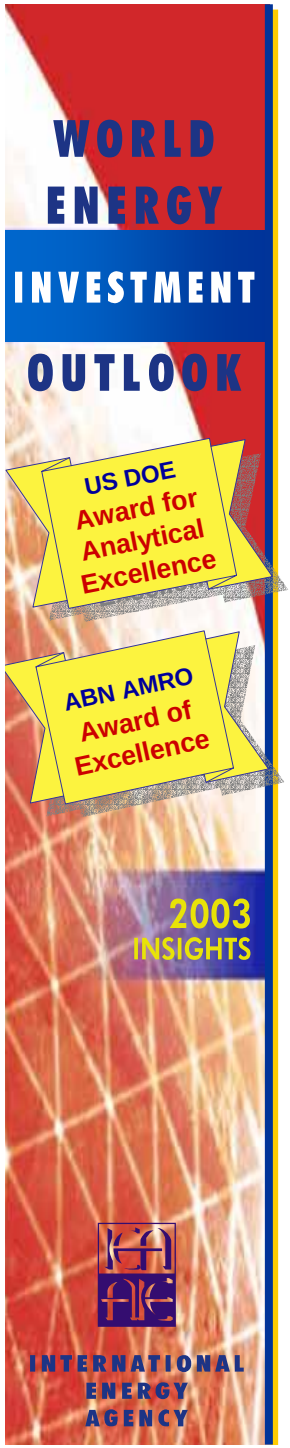
Oil Investment by Region



Most investment outside the OECD will be needed in the Middle East and the transition economies mainly in the upstream, while refinery investment will be largest in Asia



Oil Investment Challenges

- $3 trillion over the next three decades
- Investment more sensitive to decline rate than rate of demand growth – most investment needed just to maintain current production level
- Major uncertainties about opportunities and incentives to invest, notably
  - Access to reserves and production policies – OPEC (and Iraq)
  - Oil prices and rate of returns
  - Investment regime and risks
- National oil companies financial resources
  - Retained earnings – government budget needs
  - Access to and cost of external financing
- Wild card – short and longer term prospects for Iraqi oil industry

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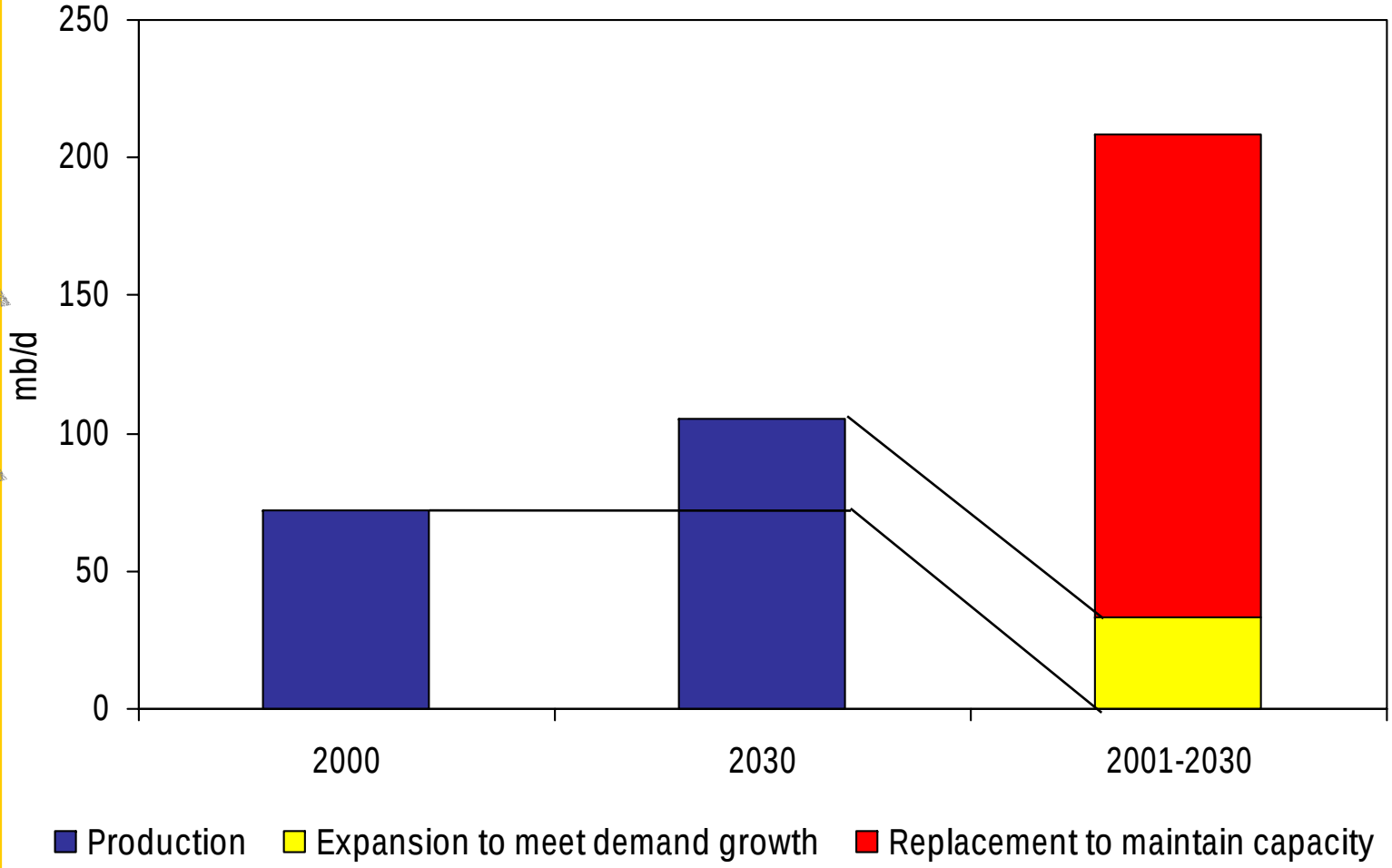
Oil Production and Capacity Additions



The bulk of additions to crude oil production capacity will be needed simply to maintain both existing and future capacity

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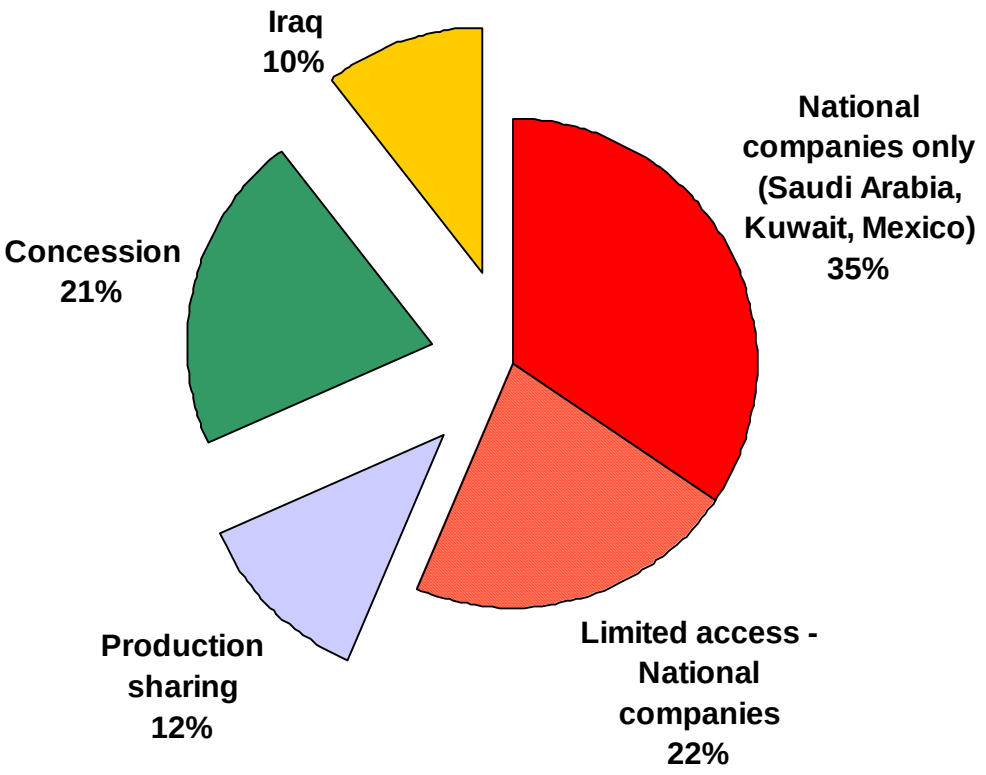
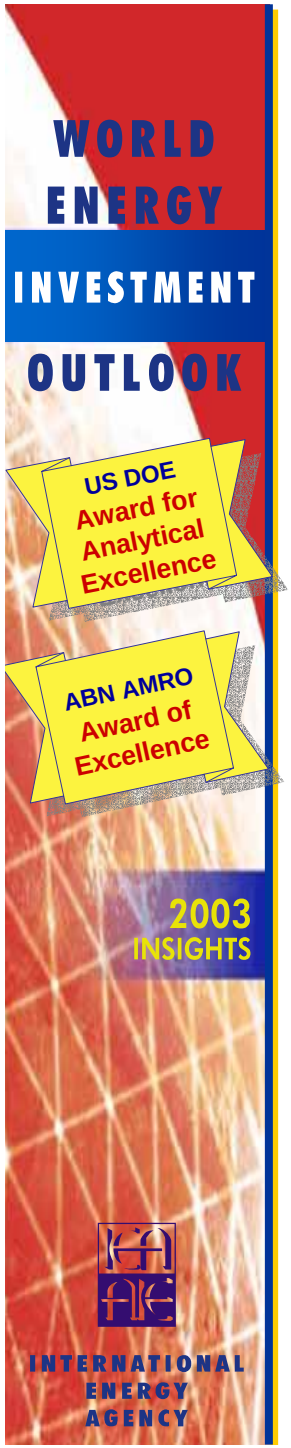
Access to Oil Reserves



1,032 billion barrels

Access to much of the world's remaining oil reserves is restricted



Natural Gas Investment Outlook

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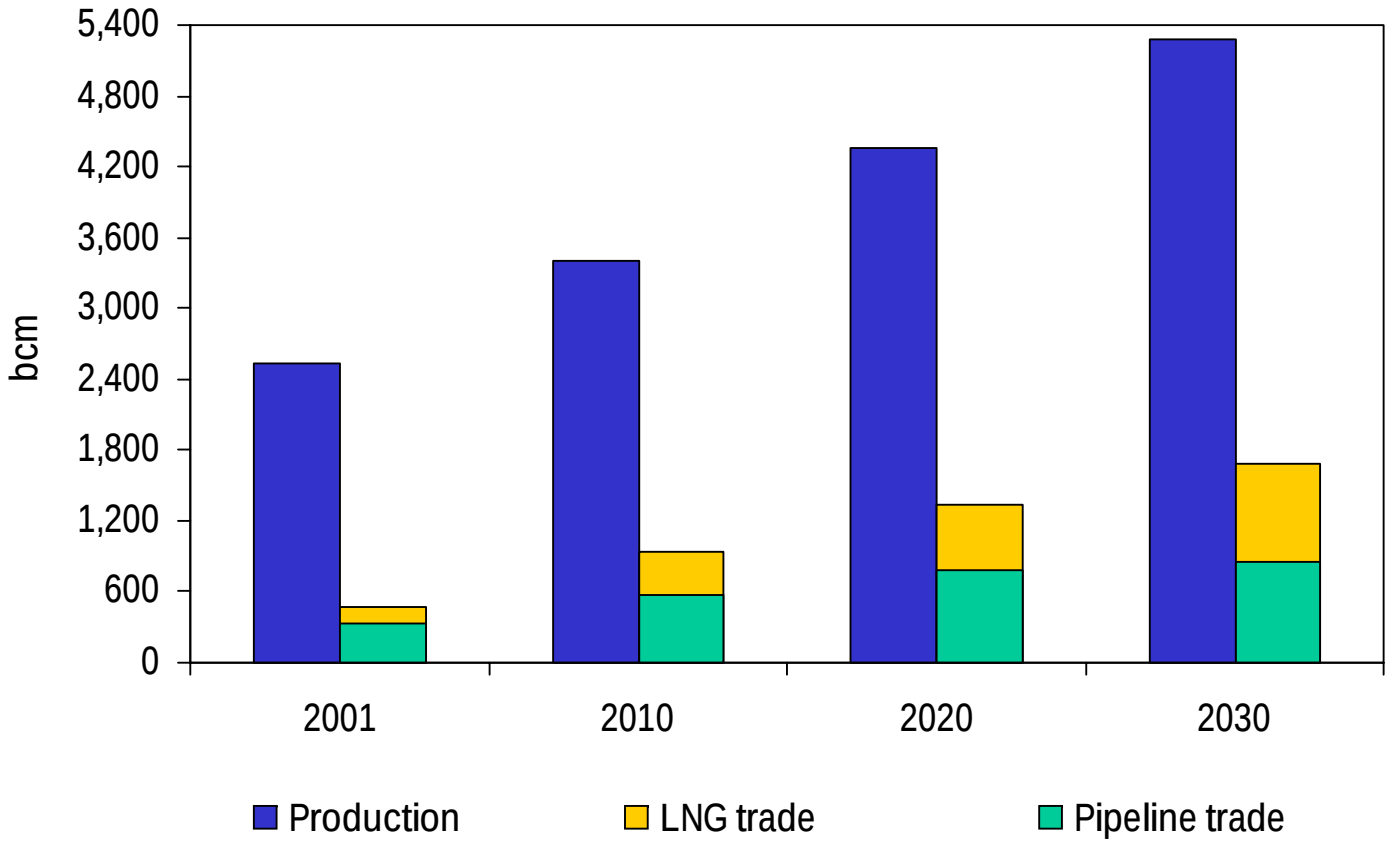
Net Inter-regional Trade & Production



A growing share of gas will be traded between regions, much of it in the form of LNG

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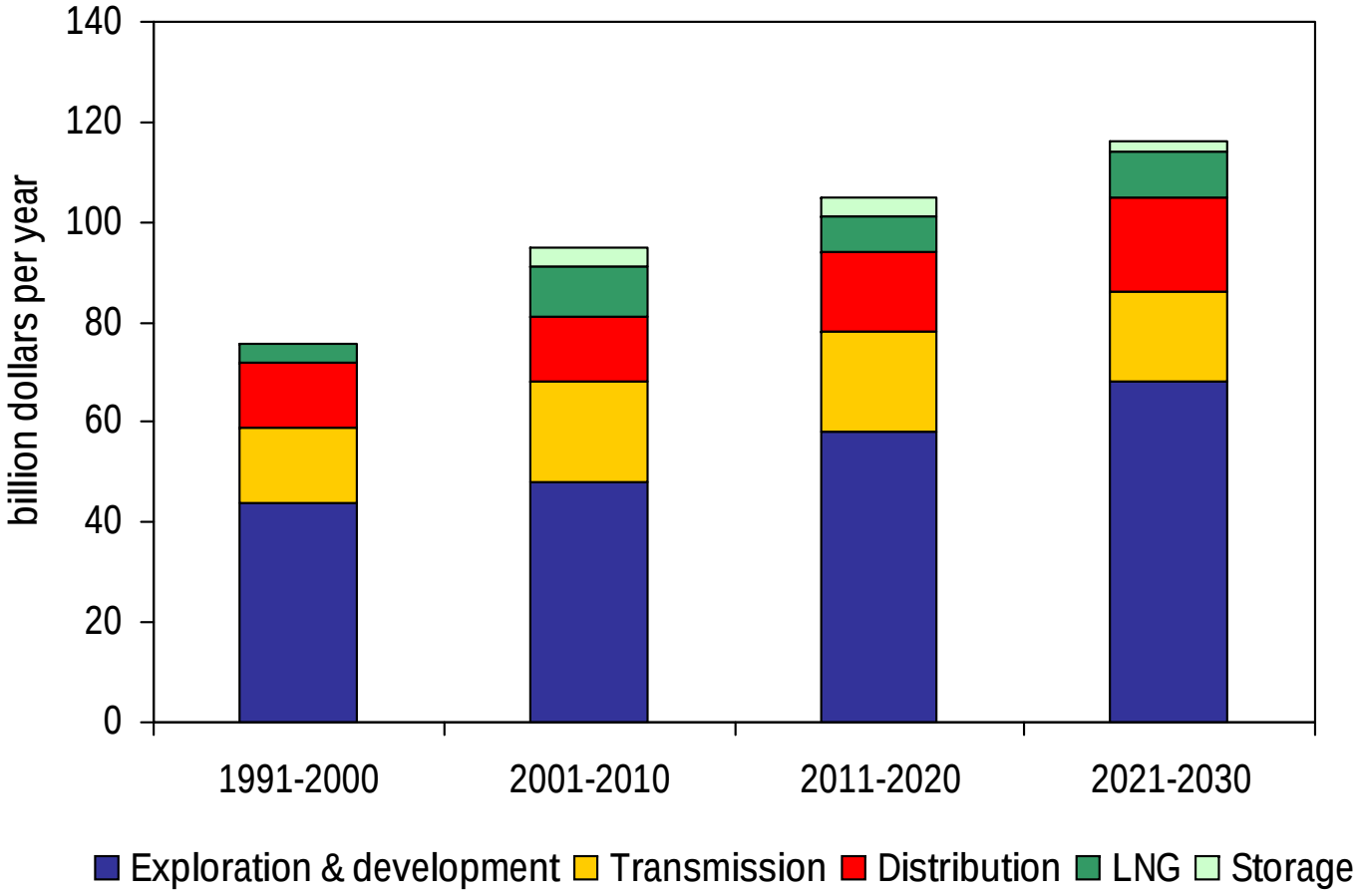
Global Gas Investment

Annual Average in Each Decade



E&D will continue to account for 55% of gas investment, but the share of LNG jumps in the current decade

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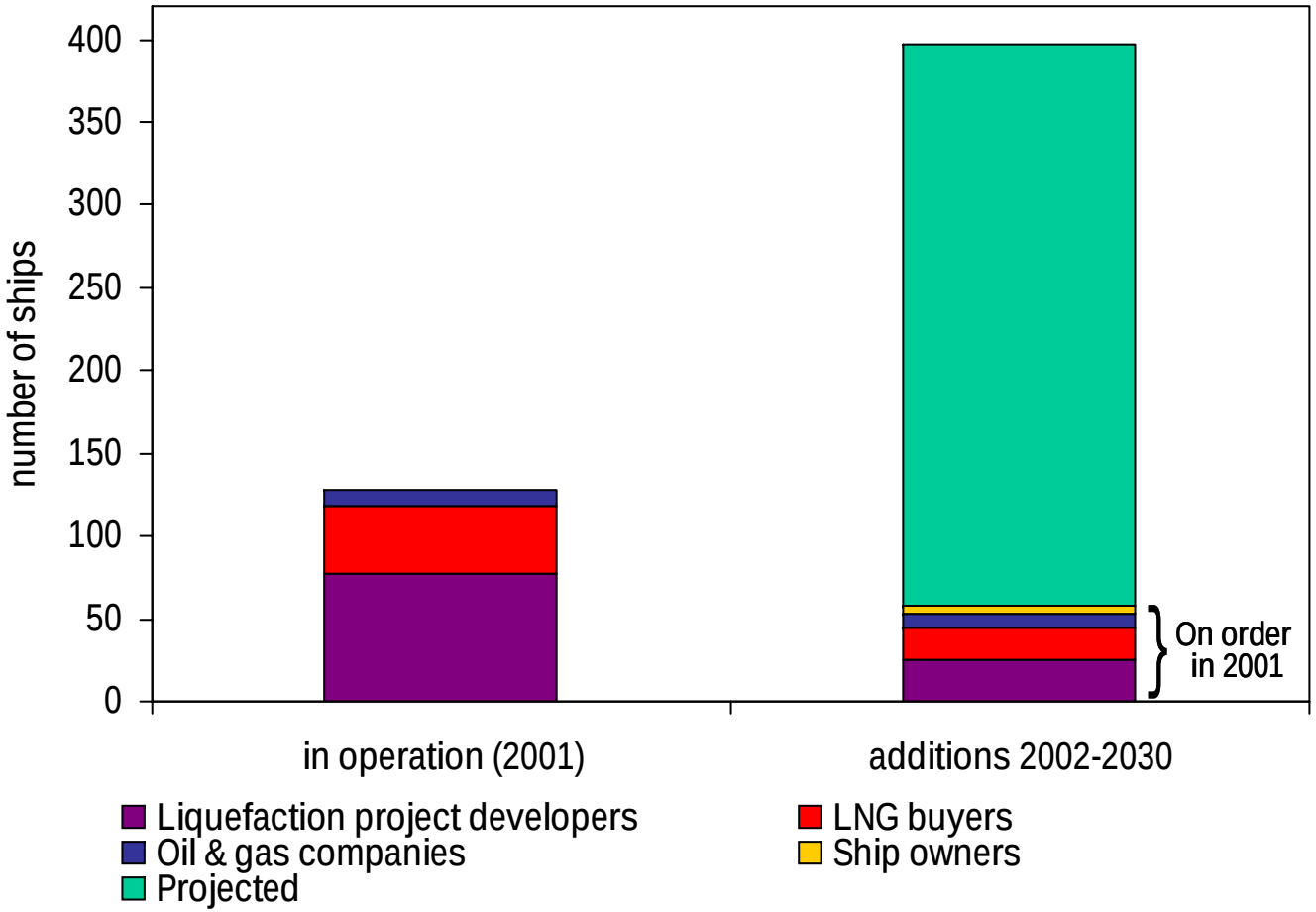
LNG Shipping Fleet



A 6-fold increase in LNG trade between 2002 and 2030 will call for massive investment in new carriers

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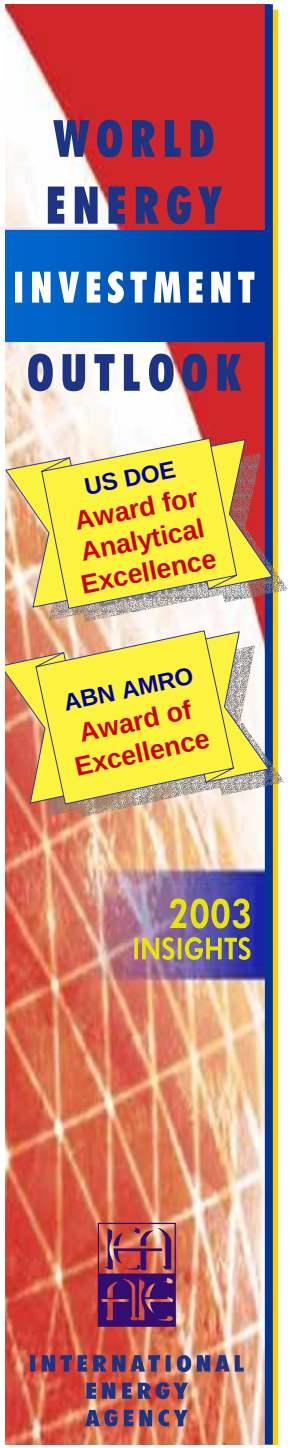
Future Gas Supply Infrastructure in China

Gas Investment Challenges

- $3 trillion needed up to 2030 - increasing share of E&D and distribution network investment
- Balance of risk and return – price is key
- Access to reserves and fiscal regime – most new investment will be private
- Complexity of financing very large-scale projects – especially in developing countries
- Impact of market reforms on investment risk
  - Non-OECD countries need to ensure basic principles of good governance are applied and respected
  - Cost-reflective pricing and adequate returns in regulated businesses are critical to attracting capital

These factors could lead to shortfall in investment, supply bottlenecks and higher prices in some cases



Coal Investment Outlook

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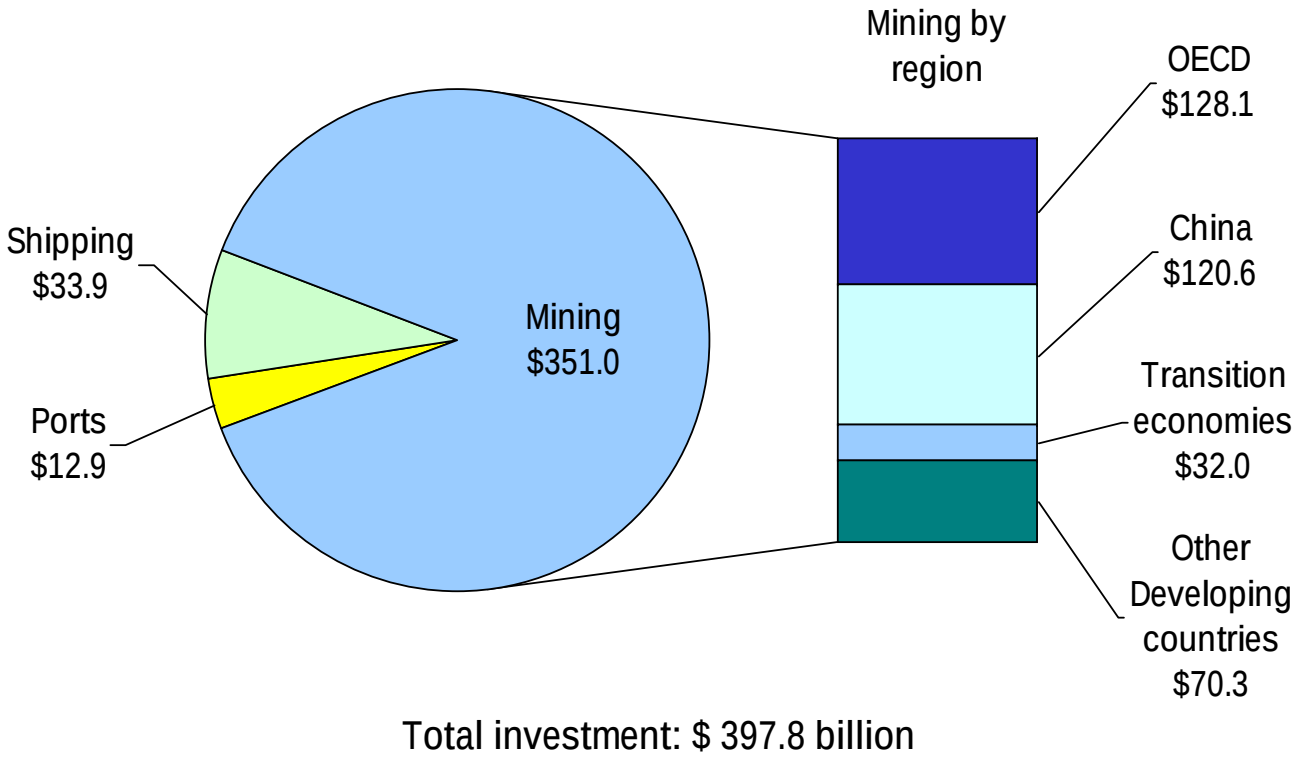
Coal Industry Investment
2001-2030



Almost all coal investment will be for mining – a third of it in China alone

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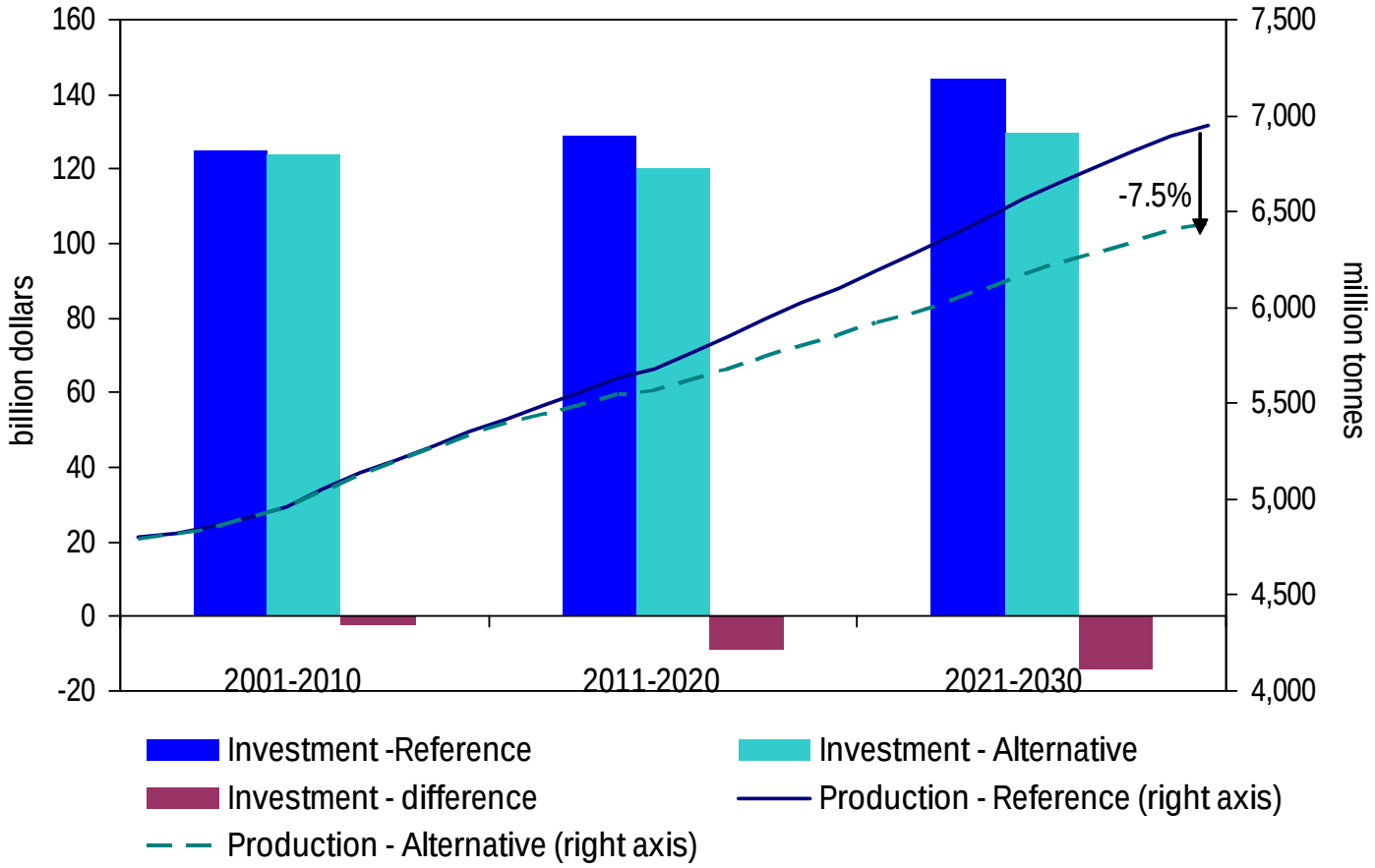
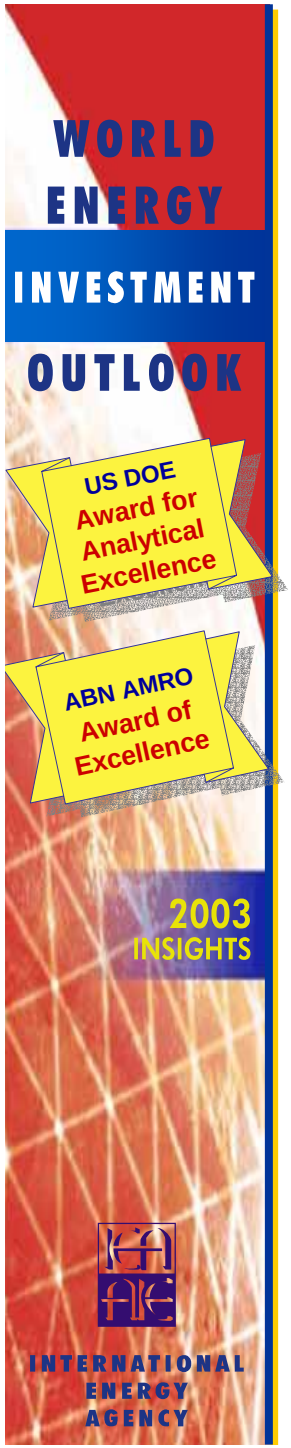
Global Coal Investment & Production

Reference and Alternative Policy Scenarios



Lower coal production worldwide and lower OECD imports yield a 6% reduction in global coal investment



Electricity Investment Outlook

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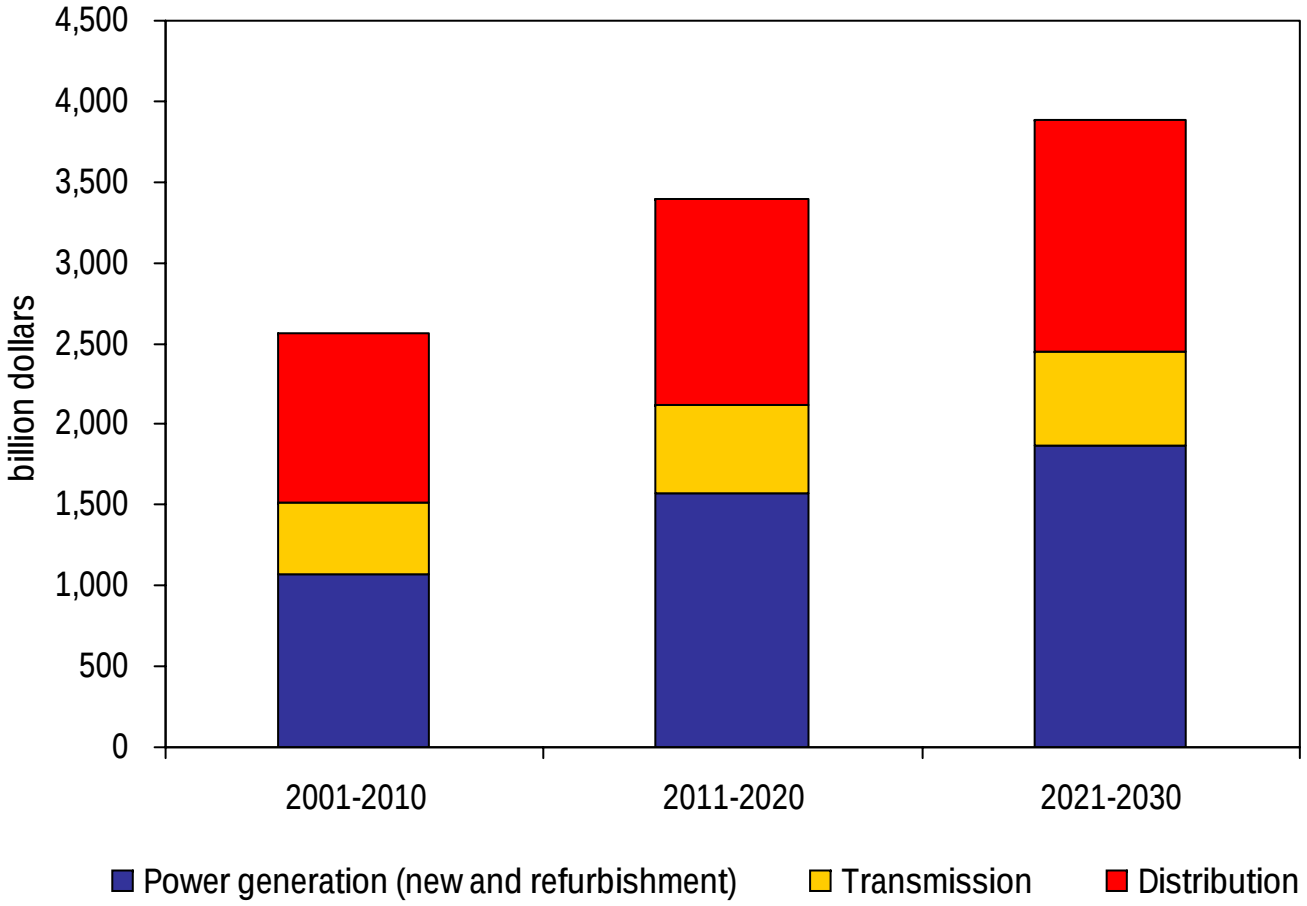
World Electricity Sector Investment
2001-2030



Transmission and distribution networks will account for well over half of electricity-sector investment

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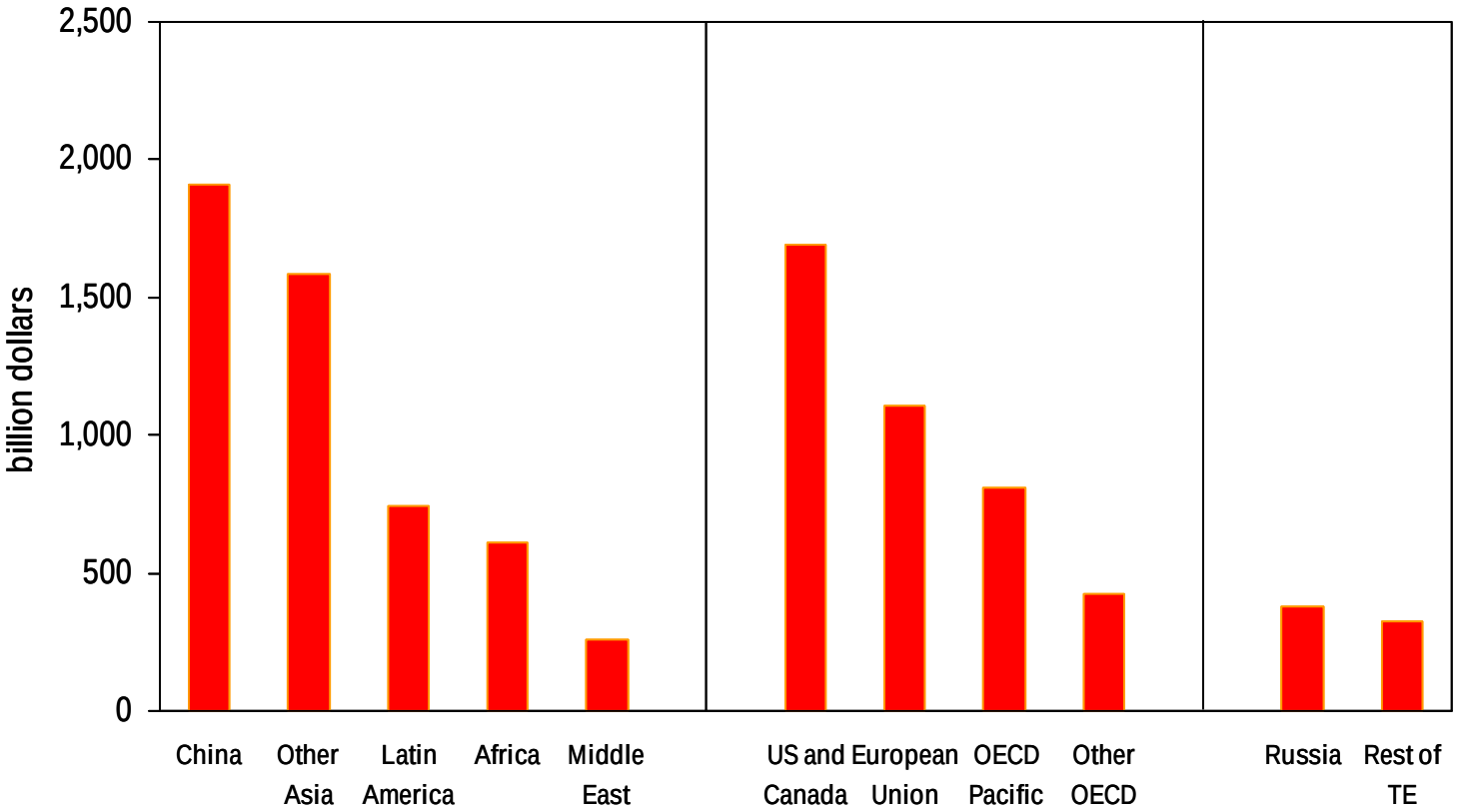
Electricity Sector Investment by Region
2001-2030



China will need more electricity investment than any other country or region

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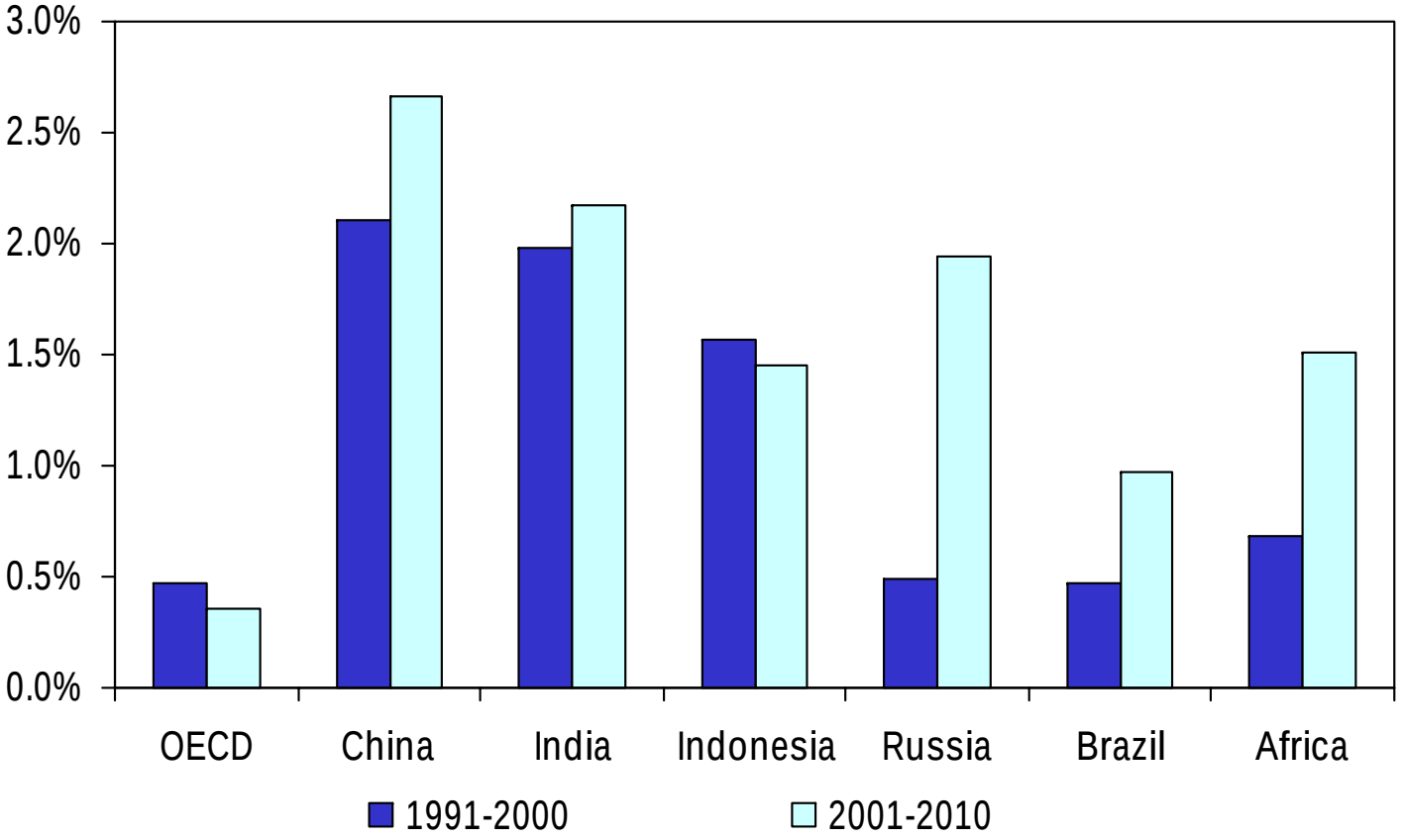
Electricity Investment as Share of GDP



Medium-term electricity sector investment needs will increase relative to GDP in almost all non-OECD regions

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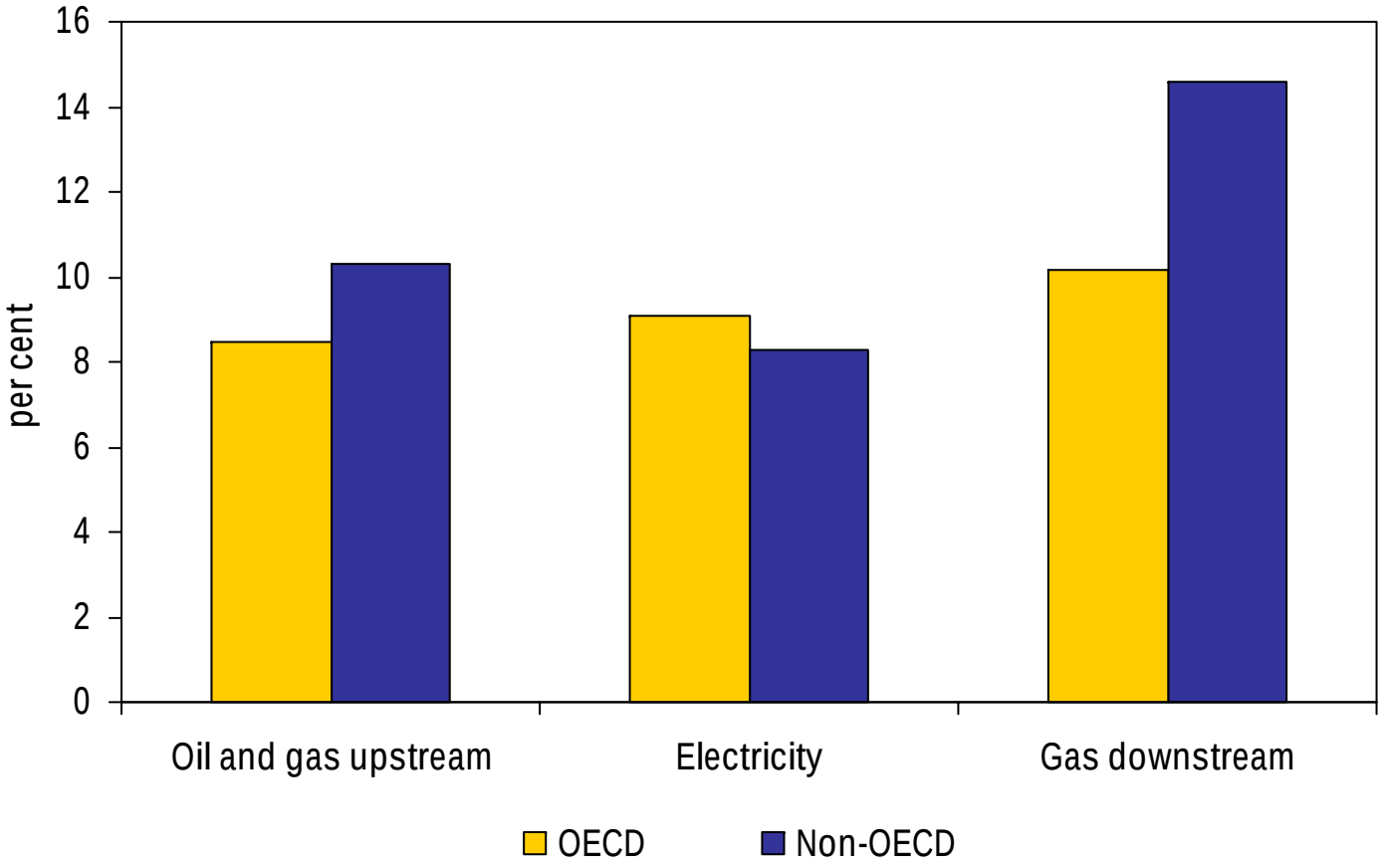
Return on Energy Investment
1993-2002



Higher returns generally in non-OECD countries reflect higher risks – but not the case for electricity

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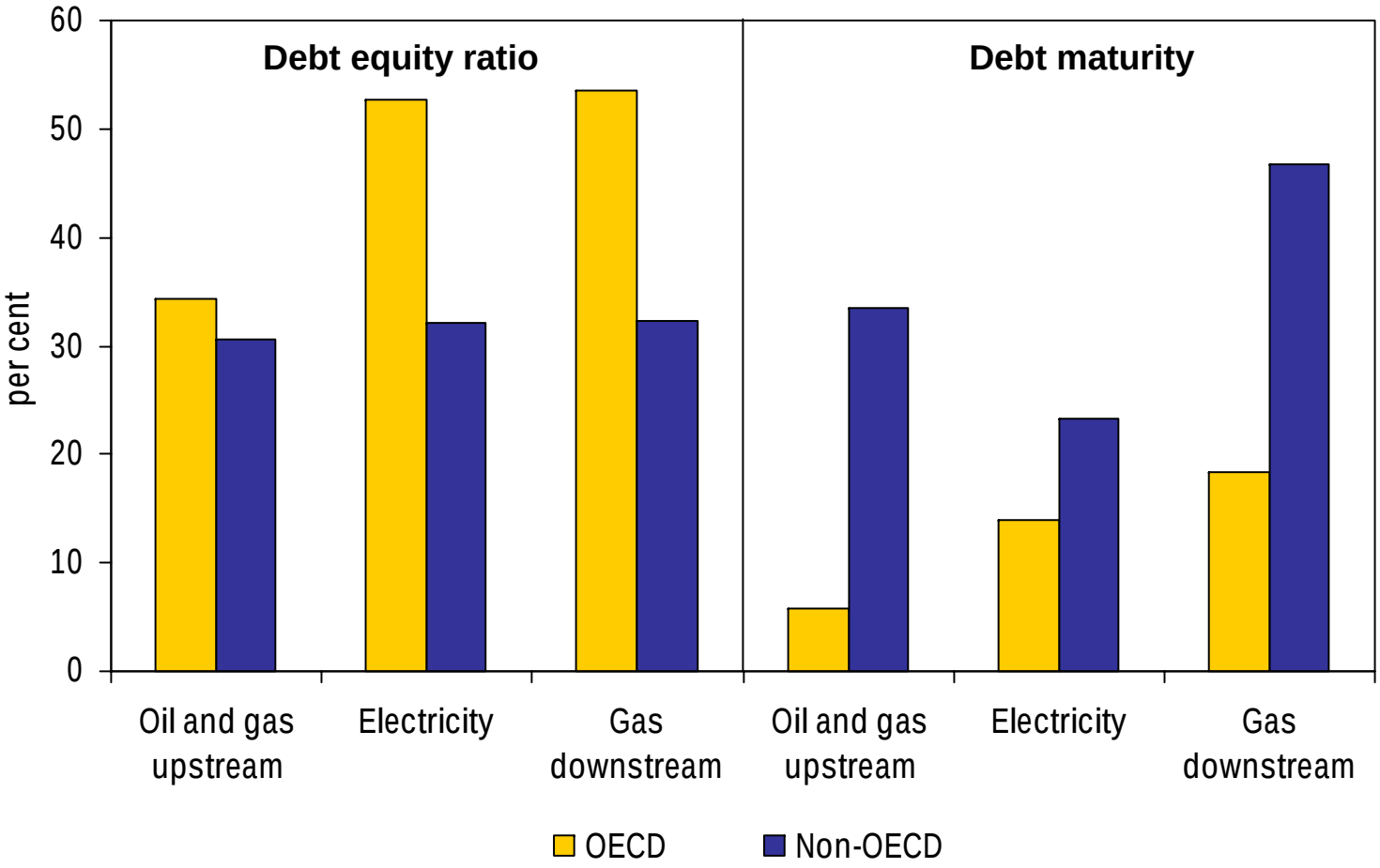
Energy Company Capital Structure
1993-2001



Lower leverage and shorter debt maturity in non-OECD countries reflects their more limited borrowing capability – especially long-term debt

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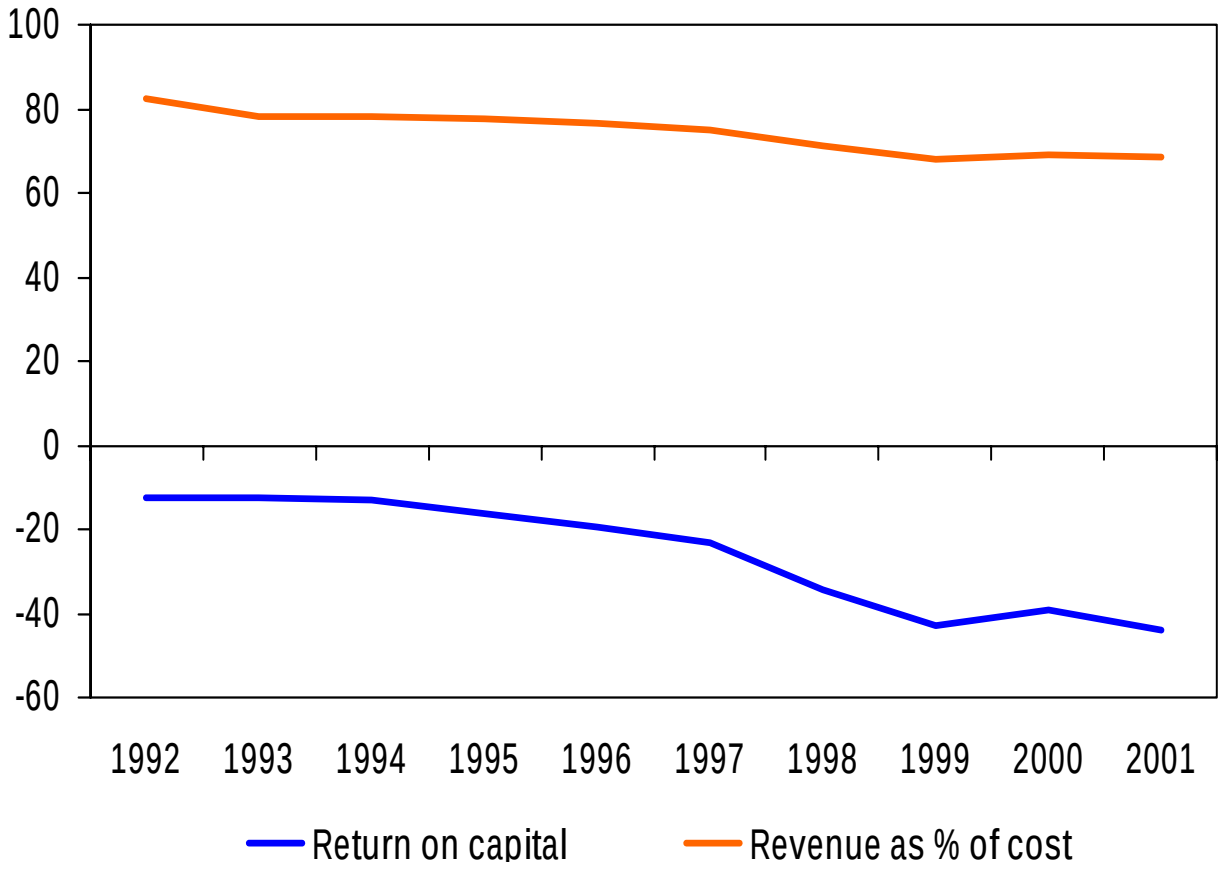
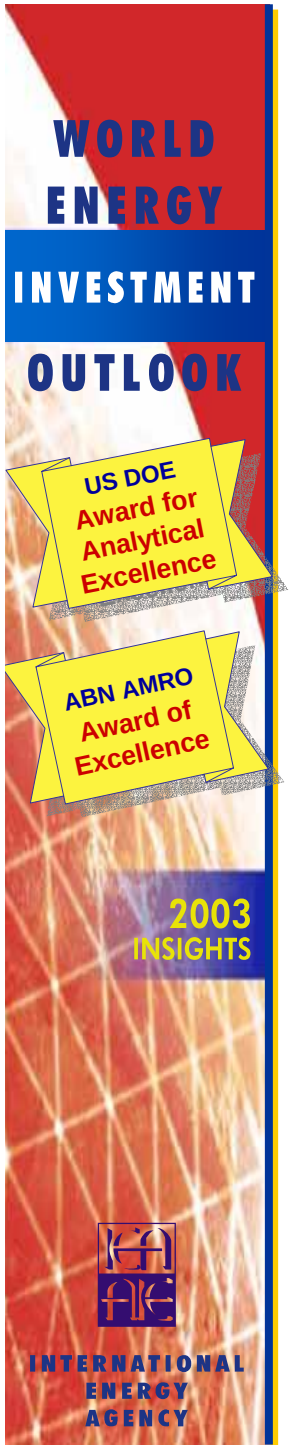
Electricity Revenue and Return on Capital of Indian SEBs

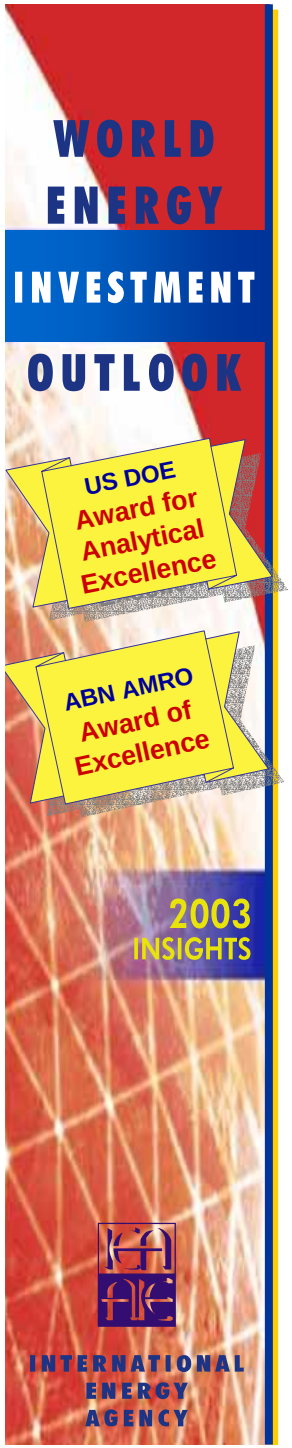


The desperate financial straits of Indian state electricity boards underlines the urgent need for pricing reform



Electricity Investment Challenges

- In *OECD countries*, there are increasing uncertainties about impacts of market reforms on investment
  - $4 trillion needed (2001-2030)
  - Blackouts have underscored reliability needs
  - Concerns are growing over whether electricity prices adequately remunerate investment in peak capacity
  - Distributed generation will help
  - Competition is changing investment
- In *Non-OECD countries*, financing will be the greatest challenge
  - Almost $6 trillion needed (2001-2030) – far more than in past 3 decades
  - Local financial markets are not deep enough
  - Access to international capital is more limited due to non-tradable nature of electricity than fossil fuel sectors
  - Poor sector governance including inefficient pricing and collection undermines viability of investment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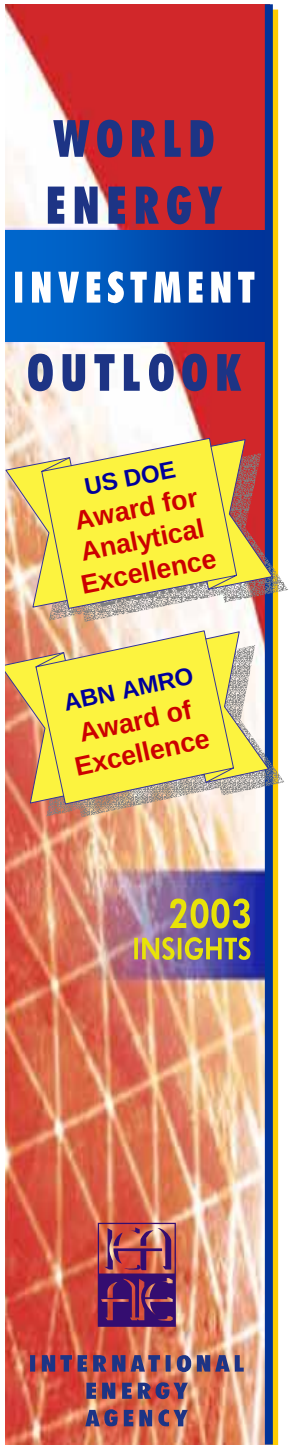
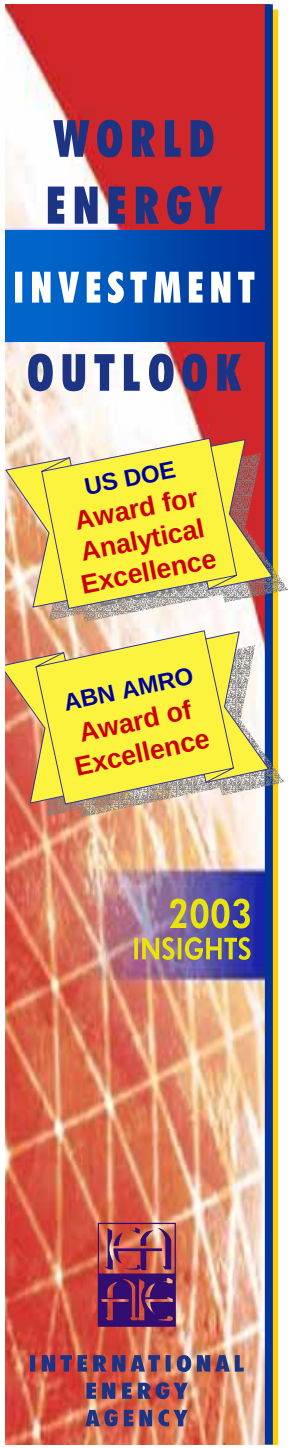
In Summary



Summary on Energy Investment

- Energy investment will shift toward developing countries, particularly China and other Asia
- Capital requirements are largest for electricity
- Investment opportunities and decline rates are key uncertainties for oil and gas upstream investment
- Financial resources are sufficient, but financing electricity-sector investment is biggest challenge for developing Asian countries
- Realising this investment will call for:
  - Development of domestic financial markets
  - More rigorous sector reforms – notably more cost-reflective pricing and improved collection
  - More stable and predictable investment regimes
  - Better corporate governance



World Energy Outlook 2004

- Long-term projections of energy market development up to 2030
  - Global trends
  - Outlook for each fuel
  - Regional outlook
- 20 regions including Japan/Korea, China, Indonesia and other East Asia
- *World Alternative Policy Scenario* to be developed to evaluate impacts of policies to address energy efficiency, climate change and energy security on energy demand and on CO_2 emissions
  - BOTH OECD and non-OECD countries to be analyzed (WEO2002 focused on OECD countries)
- To be released in fall, 2004