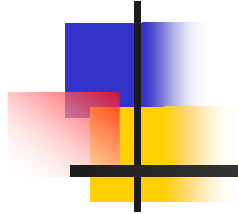


# Asian Energy Security and Japan-China Cooperation



## 12th IEEJ Energy Seminar

**"Trends and Challenges of China's Energy/Environment Measures and Development of  
Japan-China Cooperation including Business Collaboration"**

**February 28 (Thursday), 2008**

**Ken Koyama, PhD**

**Director**

**Institute of Energy Economics, Japan**

# New Risks and Threats to International Energy Market Stability



---

- Rising energy prices
- Rapidly growing energy demand in developing countries and concerns for structural tightening of global supply-demand
- Excessive competition for access to energy resources
- Growing geopolitical risks, emerging resource nationalism, issues of market power
- Emerging concerns for energy supply constraints
  - Investment risks in resource development
  - Importance of stability of energy transportation and sea lane security
- Environmental challenges for sustainability

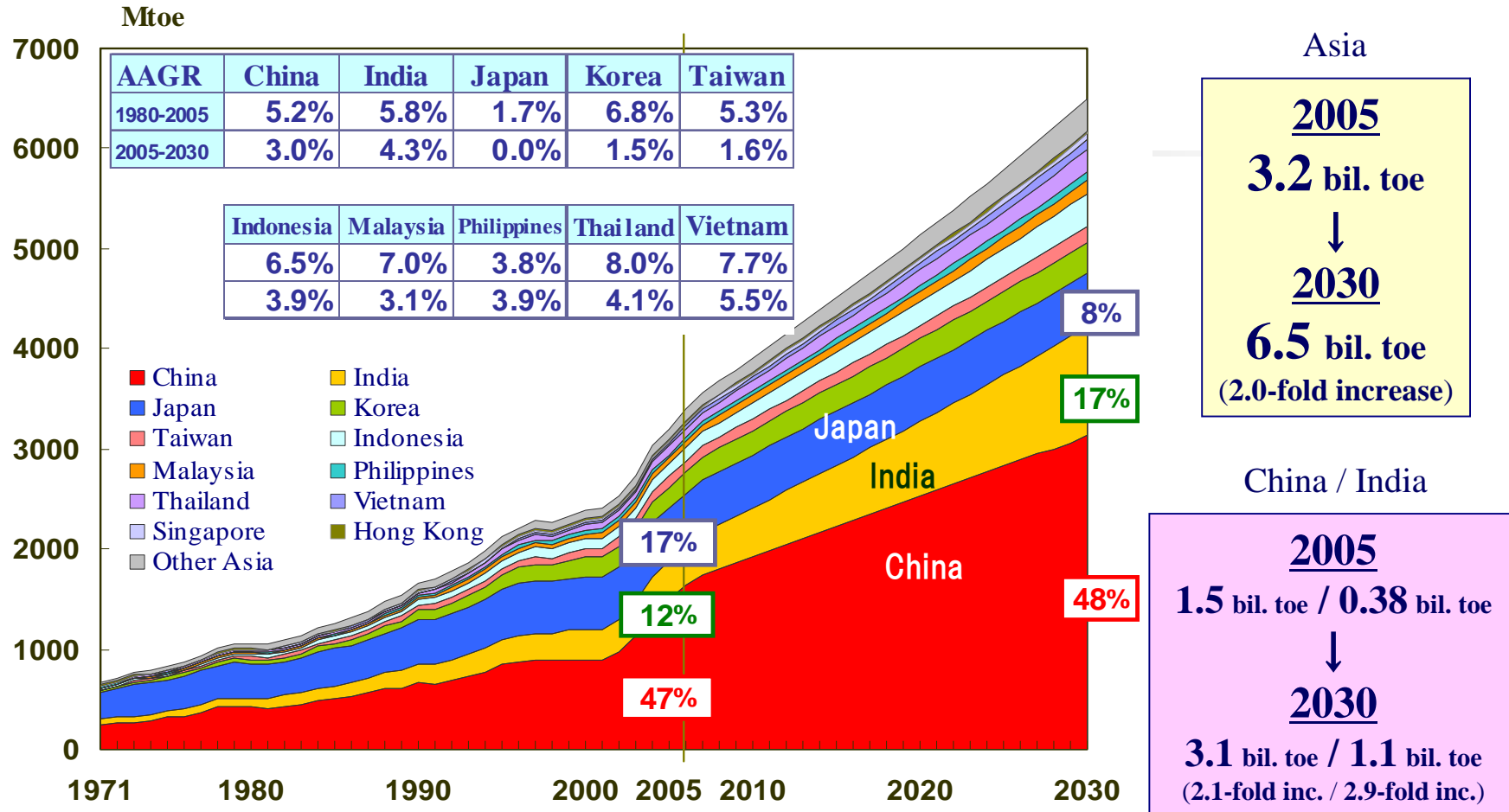
# Challenges regarding global warming and other environmental problems



---

- **Energy and environmental problems are two sides of the same coin**
- **Annex I countries are required to reduce GHG emissions in the first commitment period**
- **Anti-warming measures for the first commitment period and longer-term post-Kyoto goals are urgent challenges in consideration of energy problems.**
- **Environment problems are one of the top priority agenda items for the G-8 Lake Toya Summit in 2008**
- **International negotiations on global warming represent international politics and provide discussions involving national interests**
- **Air pollution and other public hazards are more real and serious problems in developing countries. In this respect, energy problems are closely linked to environmental problems.**

# Asian Primary Energy Demand Outlook

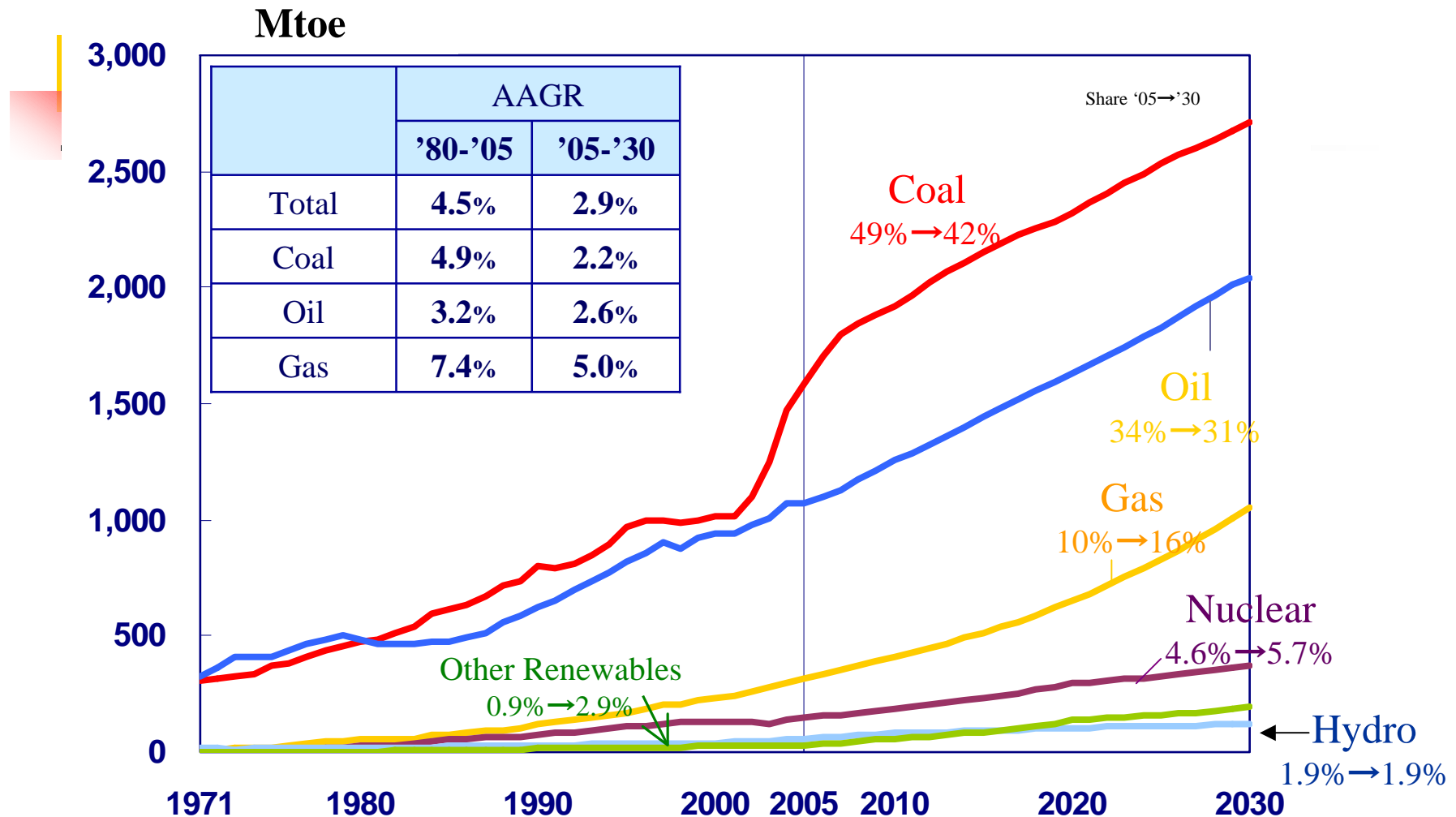


-Based on strong economic growth, China's share of Asian primary energy demand will significantly increase to 48%. The combined share for China and India will rise to 65%.

-Japan's share of Asian primary energy demand will decline from 17% in 2005 to 8% in 2030 in line with progressing energy conservation, the maturing economy and depopulation.

Source: "Asia/World Energy Outlook 2007," IEEJ

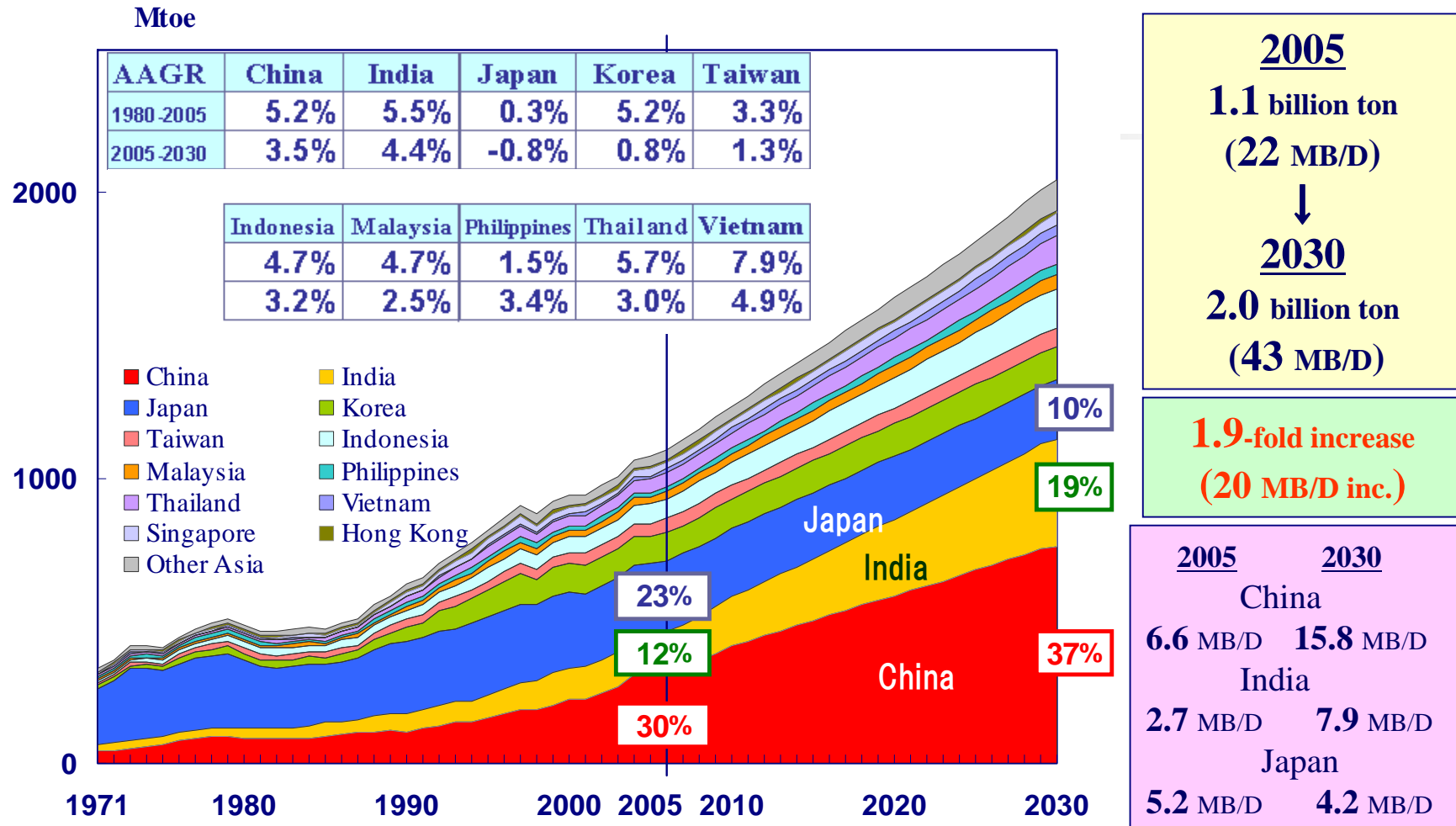
# Asian Primary Energy Demand Breakdown by Source



- Demand will increase for coal and oil as the mainstay energy source until 2030
- The share for natural gas will grow to 16%, driven by power generation

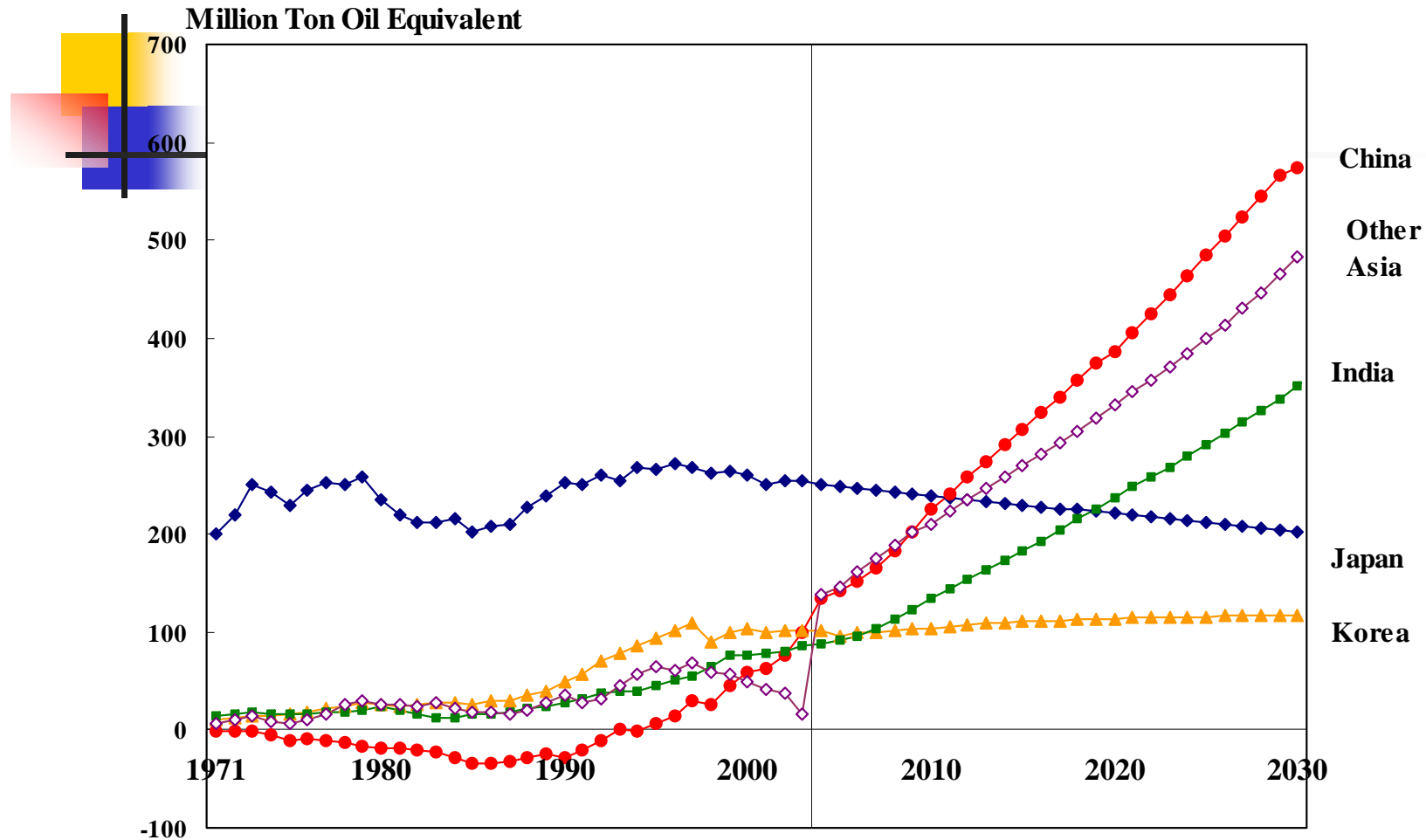
Source: "Asia/World Energy Outlook 2007," IEEJ

# Asian Oil Demand Breakdown by Region



- Asian oil demand will expand 1.9-fold to 20 million B/D on progressing motorization and other developments.
- The combined share for China and India will grow from 42% to 56% while Japan's share will decline.

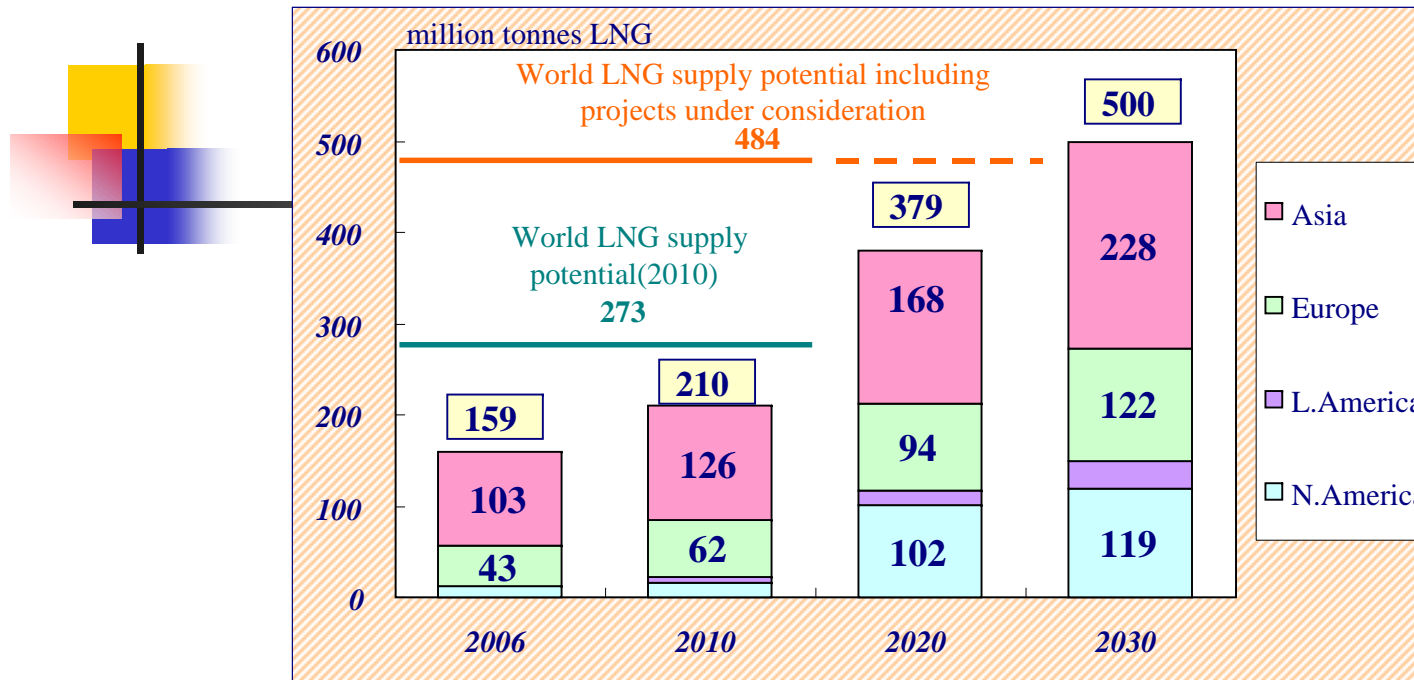
# Outlook for Net Oil Import by Asian Countries



- China's net oil import is projected to expand from 135 million ton in 2004 to 574 million ton in 2030.
- India's net oil import is projected to expand from 88 million ton in 2004 to 351 million ton in 2030.

Source: IEEJ (Asia/World Energy Outlook 2007)

# World LNG Outlook



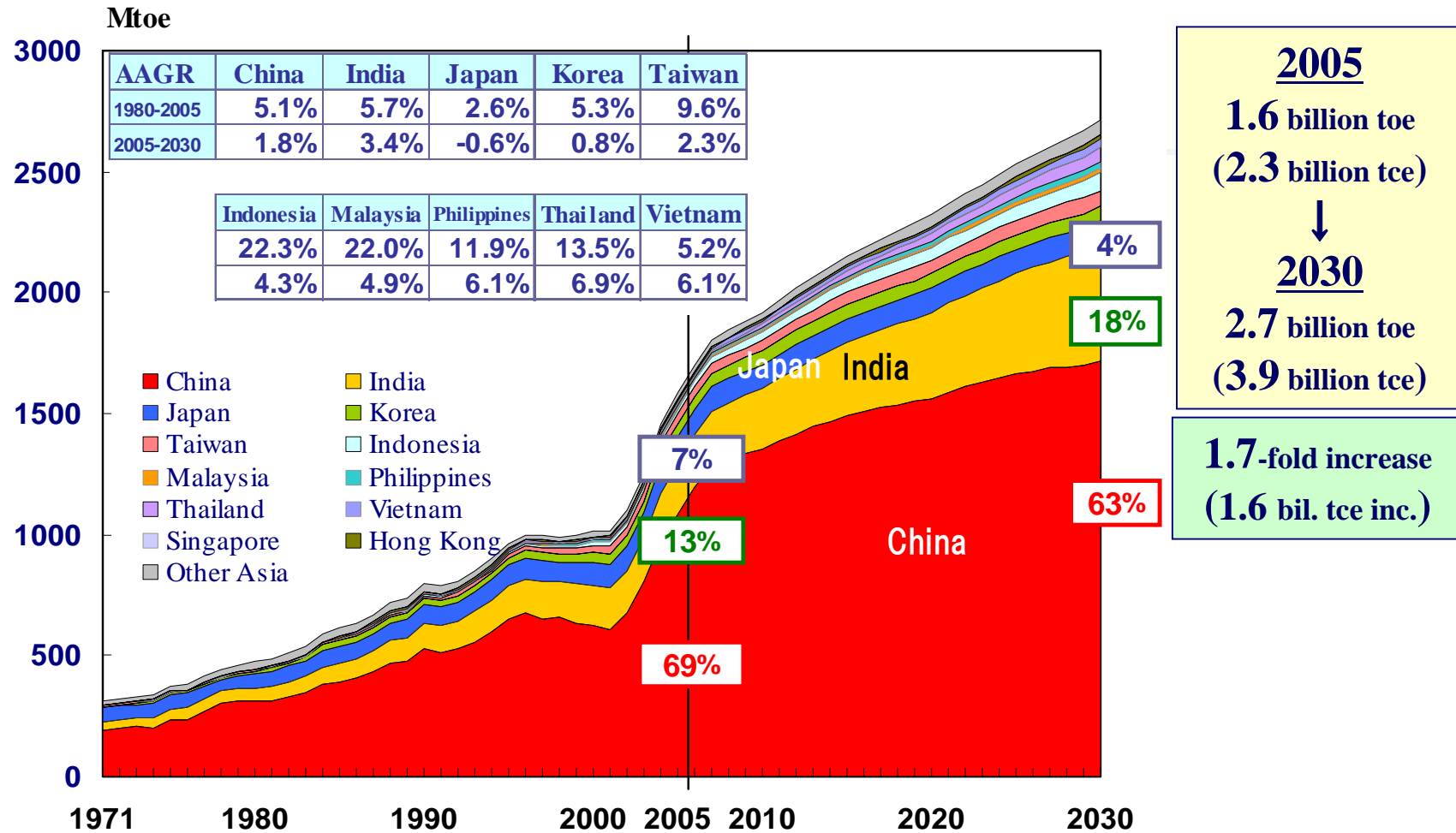
\*“World LNG” supply potential (2010)” includes LNG plants that already exist, are under construction and that are with signed SPA/HOA. “World LNG supply potential including all projects under consideration” combines “World LNG supply potential (2010)” and projects now under consideration for commercialization.

•World LNG demand will expand from 159 million tons in 2006 to 500 million tons in 2030, achieving 3.6-fold growth. European and U.S. LNG demand is projected to increase rapidly, mainly because of growing gas demand in the power generation sector and sluggish local gas production. European and U.S. LNG demand will exceed Asian demand by 2020.

•World LNG supply potential, including projects now under consideration for commercialization, roughly meet projected demand for 2030. If these projects stagnate, the world LNG supply/demand relationship will become tighter in and after 2010. The key point is whether LNG projects under consideration would be implemented steadily.



# Asian Coal Demand Breakdown by Region



*Coal consumption will increase in China and India which are rich with coal resources and depend on coal thermal power generation to meet fast-growing power demand.*


# Significance of Cooperation with China and Asia



- **Growing importance and influence of China and Asia in international energy markets**
  - Accurate and timely data/information collection and analysis on Chinese and Asian energy markets and policies will become more important for Japan and China and for the entire world.
  - Regional optimization in the whole of Asia is important.
- **Energy security and environmental problems, and Cooperation with China and Asia**
  - As energy markets are increasingly interrelated and linked together, resolution of China's and Asia's vulnerability regarding energy and their energy problems should contribute to solving regional and global energy problems.
  - It is important for Japan and China/Asia to acknowledge that they should pursue common interests concerning energy security and environmental problems.
  - Japan should continue and enhance cooperation utilizing its energy policy experiences, know-how and technological capabilities.
  - Japan should develop a "comprehensive" policy toward China and Asia that should not be limited to the area of energy.
- **Chinese energy market featuring a combination of growing size, market opening and uncertainty**
  - Chances and risks for Japanese companies
  - Japan should utilize its relative technological advantages, experiences and existing infrastructure.

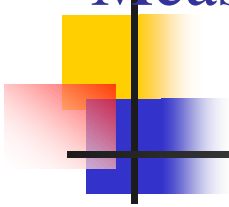
# Measures to be taken toward cooperation (1)

## -- Energy security measures --

- 
- **Development and enhancement of common perceptions toward cooperation**
    - Further promotion of policy dialogue (development of dialogue frameworks)
    - Promotion of information sharing
  - **Cooperation regarding energy demand and reduction of environmental load**
    - Technological cooperation in energy conservation
    - Cooperation regarding clean coal and other technologies for energy supply with less environmental load
    - Cooperation regarding implementation of CDM (clean development mechanism) projects
    - Development of business environments for cooperation in energy conservation and environmental technologies
  - **Cooperation regarding energy supply expansion**
    - Cooperation in efforts to diversify energy sources (including coal, nuclear and natural gas)
    - Supporting Chinese and Asian efforts to expand domestic energy (electricity) supply
    - Effective utilization of existing infrastructures (including surplus energy supply capacity)
  - **Cooperation regarding enhancement of emergency response capacity**
    - Support for and cooperation in development of oil stockpile systems
  - **Cooperation in external energy policies**
    - Cooperative approach in oil-producing countries (including Middle Eastern countries and Russia)
    - Efforts to secure safe passage through key sea lanes

# Measures to be taken toward cooperation (2)

## -- Measures against global warming and other environmental problems --

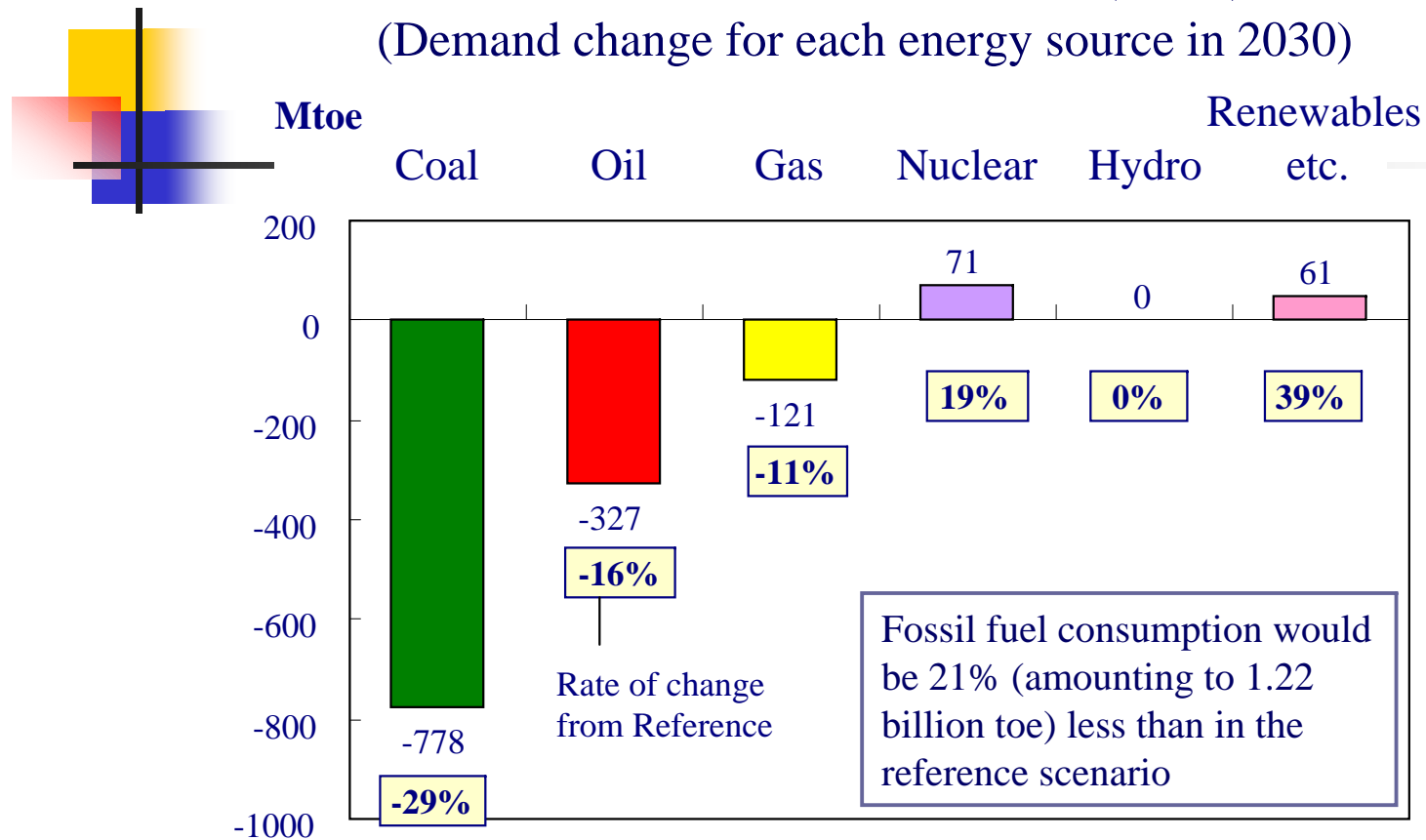


---

- **The above-cited measures and cooperation are effective for addressing global warming and other environmental problems.**
  - Particularly, energy conservation, environment technology cooperation and promotion of low-carbon energy sources are important
- **Promotion of cooperation should be linked to the importance of "environmental adaptation" as well as "mitigation of greenhouse gas emissions."**
- **Dialogue and cooperation for international frameworks to curb greenhouse gas emissions over a long period**
  - Global warming is a threat to the sustainability of the entire world
  - Goal of halving global emissions by 2050
  - China, India and other developing countries should participate in emission-cutting schemes in order to achieve long-term goals.
  - Development of schemes or approaches in which China, India and other developing countries take part will be the key to addressing post-Kyoto Protocol problems.
  - Fairness and efficiency should be secured for developing nations' participation in international schemes.

# Change in Energy Demand by Source for Technology Advancement Scenario (Asia)

(Demand change for each energy source in 2030)

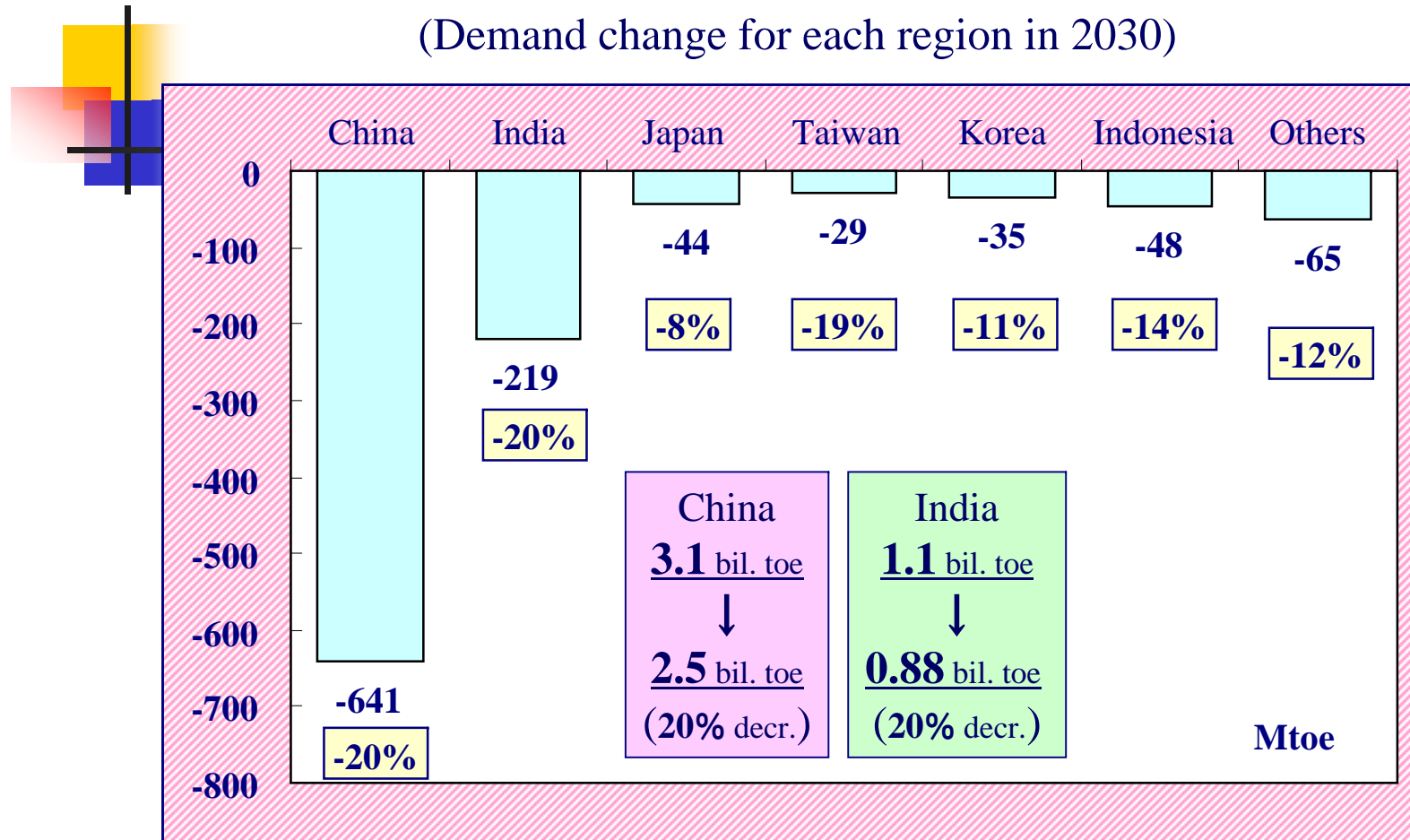


- Coal consumption could be largely reduced. Introduction of technologies for efficient utilization of coal and clean coal technologies would be very significant in Asia.

- Improvement of automobile fuel efficiency and the like will work to reduce oil consumption and greatly contribute to stabilization of the international oil market.

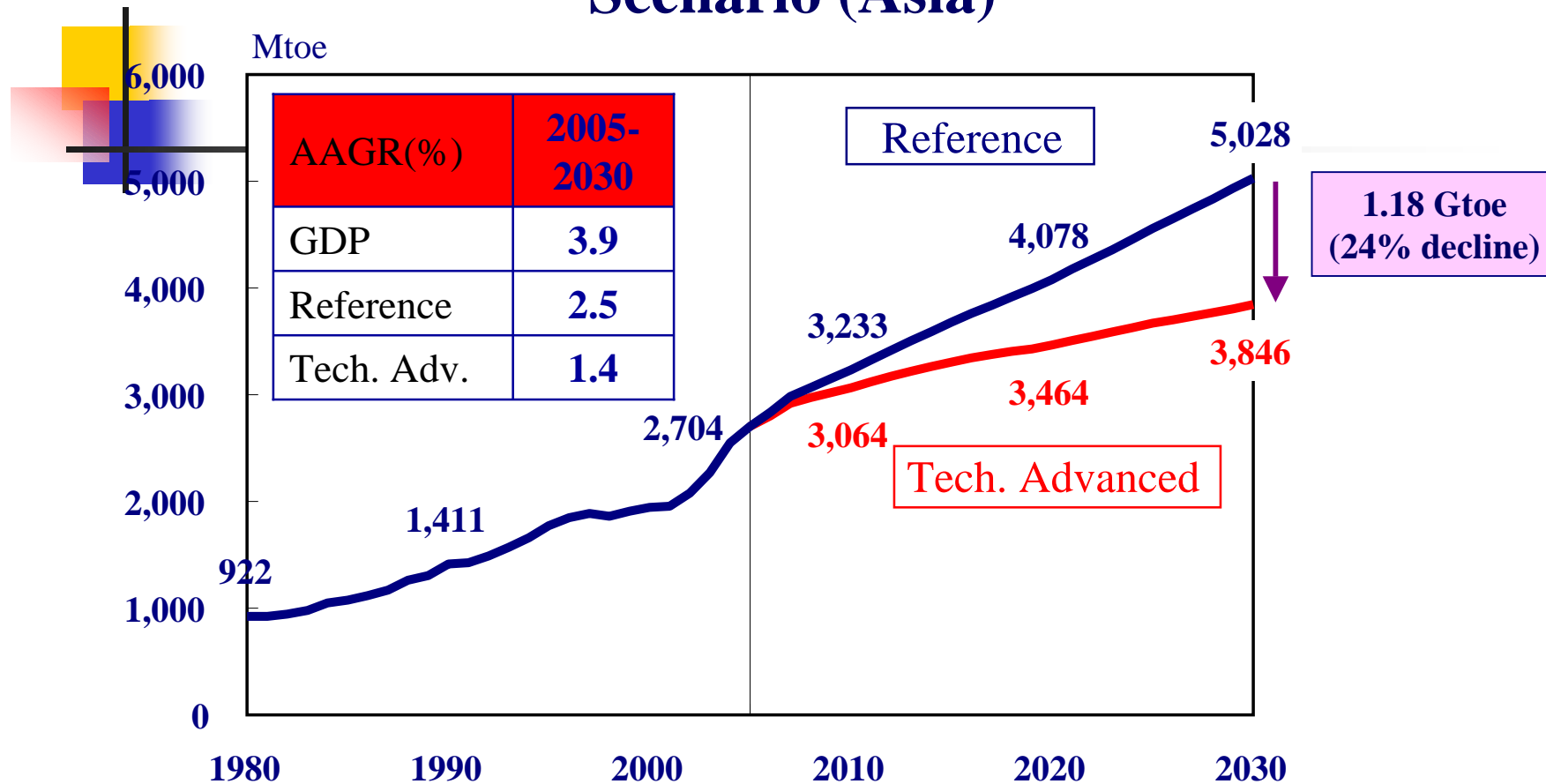
# Change in Energy Demand by Region for Technology Advancement Scenario (Asia)

(Demand change for each region in 2030)



*Potential of energy conservation through introduction of technologies for efficient energy consumption is great in China and India*

# CO<sub>2</sub> Emissions for Technology Advancement Scenario (Asia)



- In the technology advancement scenario, CO<sub>2</sub> emissions in 2030 would be about 23% (1.18 billion tons carbon equivalent) less than in the reference scenario. The gap is some 3.5 times as much as Japan's current CO<sub>2</sub> emissions.
- Potential of CO<sub>2</sub> emission reductions through technology advancement in China is dominantly great. India has the second greatest potential. (China and India account for 950 million tons of the total emission cuts.)

Source: "Asia/World Energy Outlook 2007," IEEJ



# Conclusion

---

- **Key Challenges in International Energy Markets**
  - Existence of new threats and risks in energy security
  - Need for global response to the growing global warming problem
- **Asia's Importance for International Energy Markets**
  - Asia' growing presence and influences backed by its expanding demand and imports
  - Need for major Asian countries or the entire Asian region to address energy problems
- **Expectations for Japan's Cooperation with China and Asia**
  - Japan's enhanced cooperation with Asia should contribute to international energy market stability.
  - Japan and other Asian energy-consuming nations should give priority to addressing common challenges.
  - Japan's strengths and advantages should match the needs of Asian countries
  - Japan should enhance efforts to grasp and solve problems with the promotion of energy cooperation

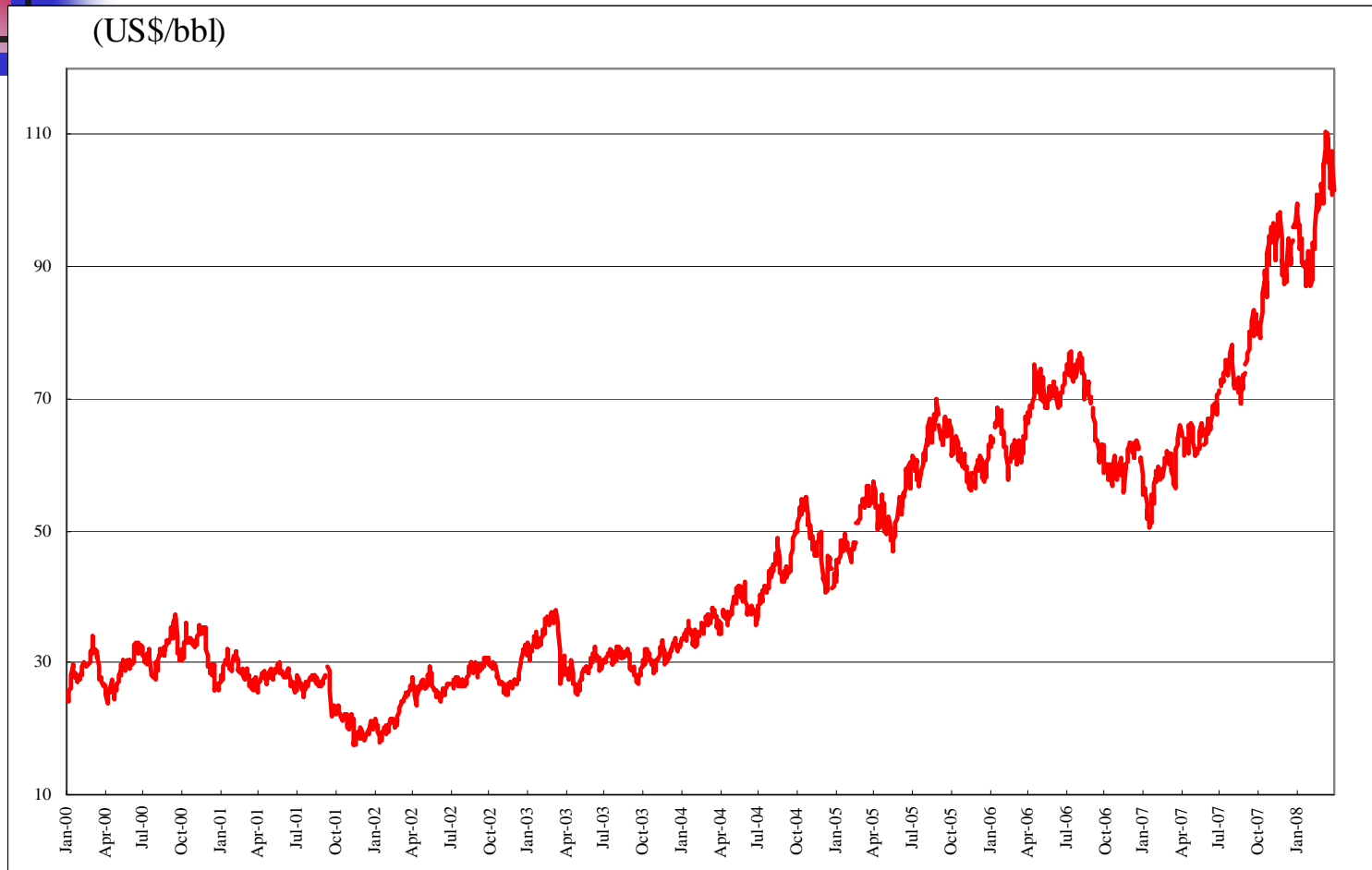




# Appendix

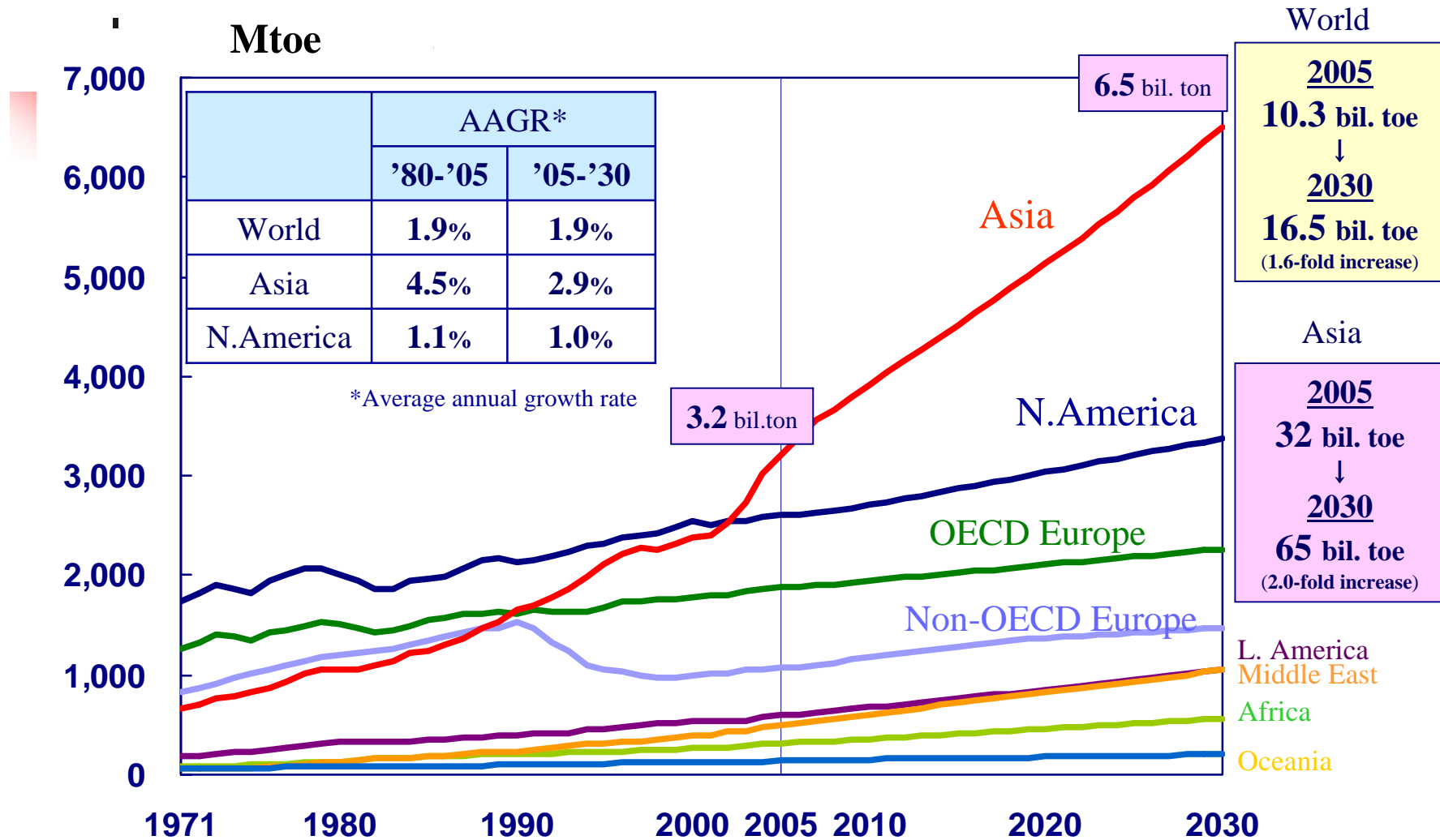
# Fast-rising WTI Crude Oil Futures Price

WTI price exceeded \$110 per barrel in March 2008 for the first time ever



(Source) NYMEX data

# World Primary Energy Demand Outlook by Region

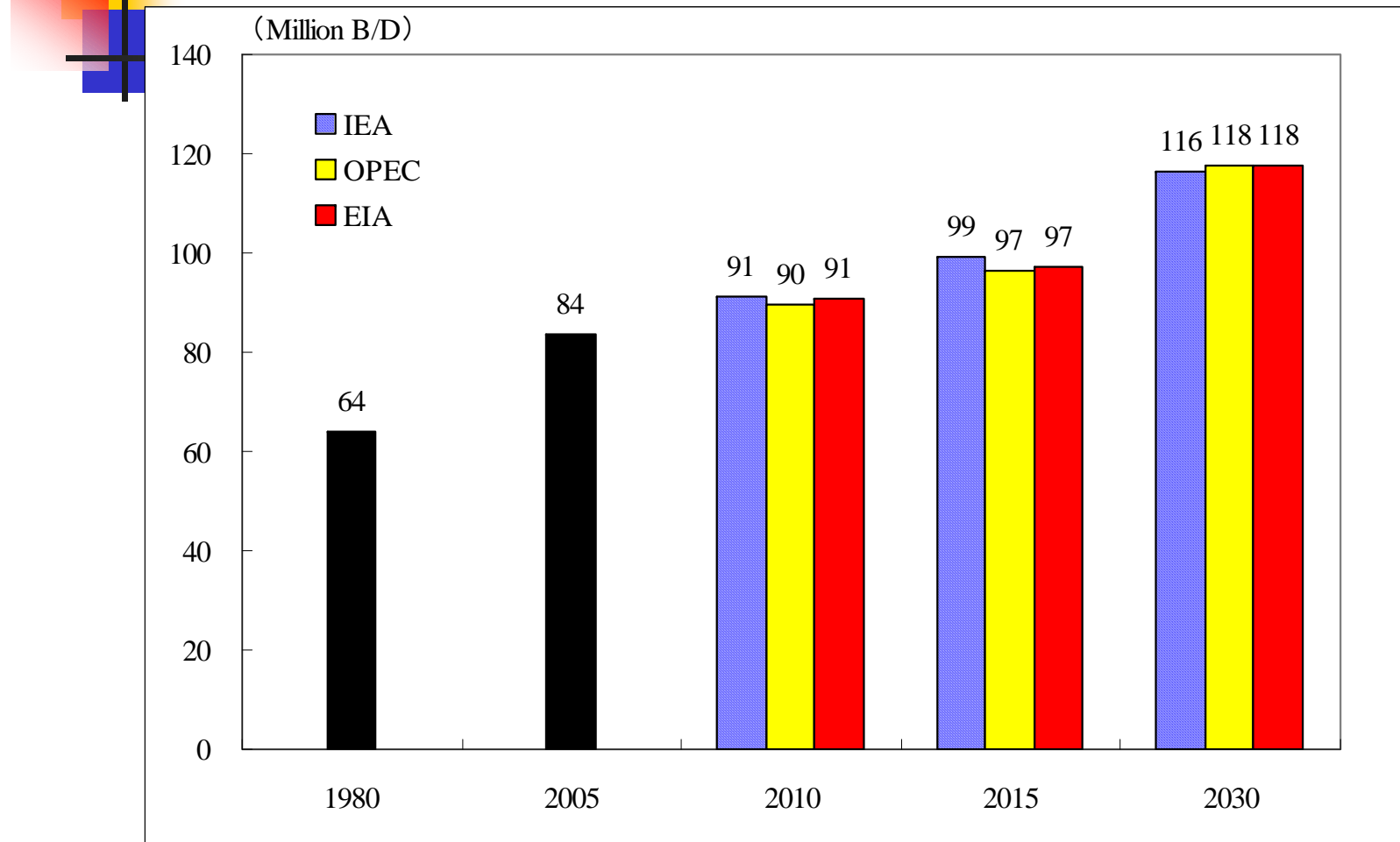


*In 2030, primary energy demand in Asia will almost double from the present level on steady economic growth (from 3.2 billion toe in 2005 to 6.5 billion toe in 2030).*

Source: "Asia/World Energy Outlook 2007," IEEJ

# Long-term World Oil Demand Outlook

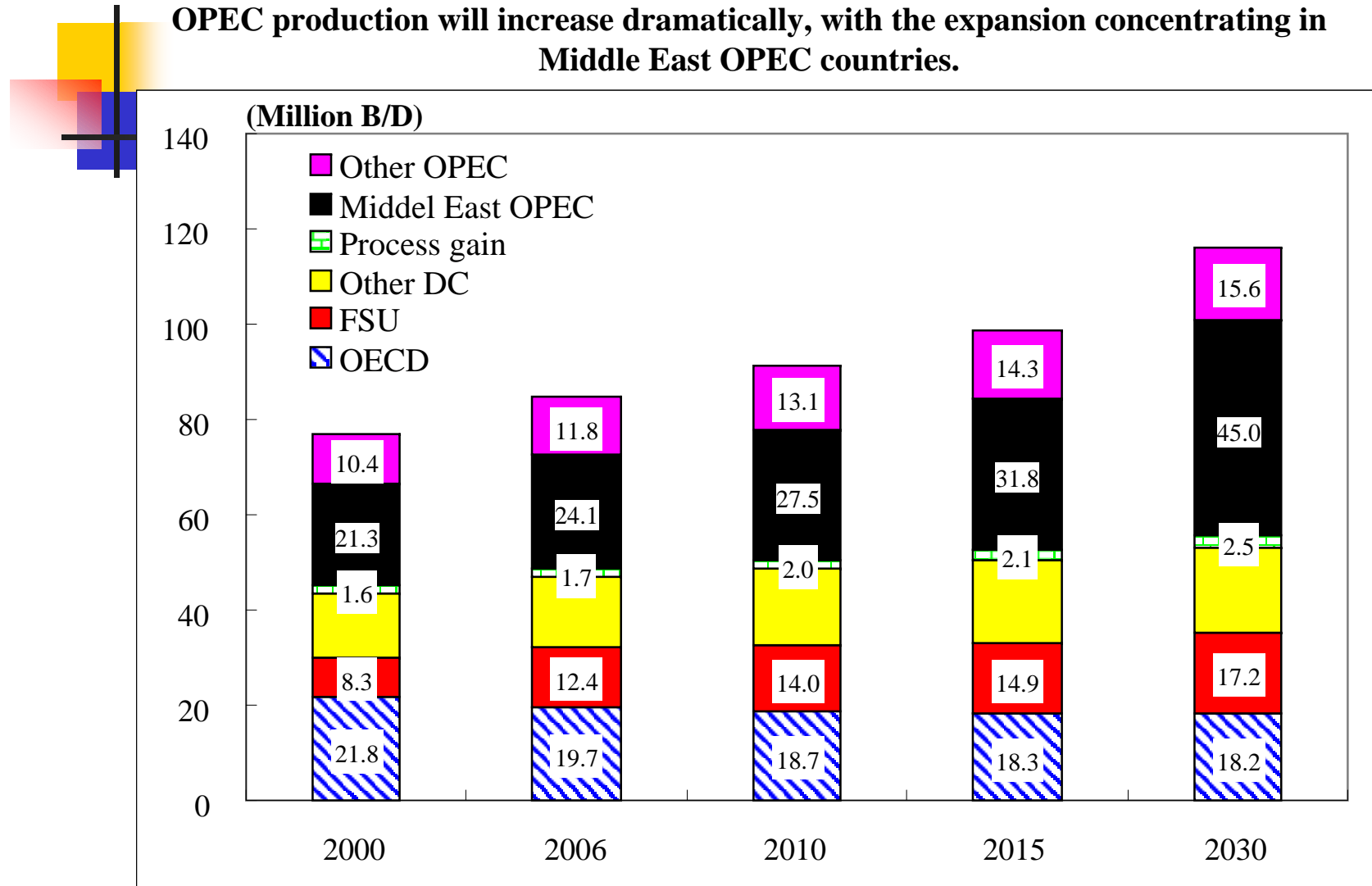
**World oil demand expected to rise to about 120 MBD in 2030, with expansion seen mainly in developing countries**



(Sources) "IEA World Energy Outlook 2007," "US DOE/EIA International Energy Outlook 2007", "OPEC World Oil Outlook (2007)"

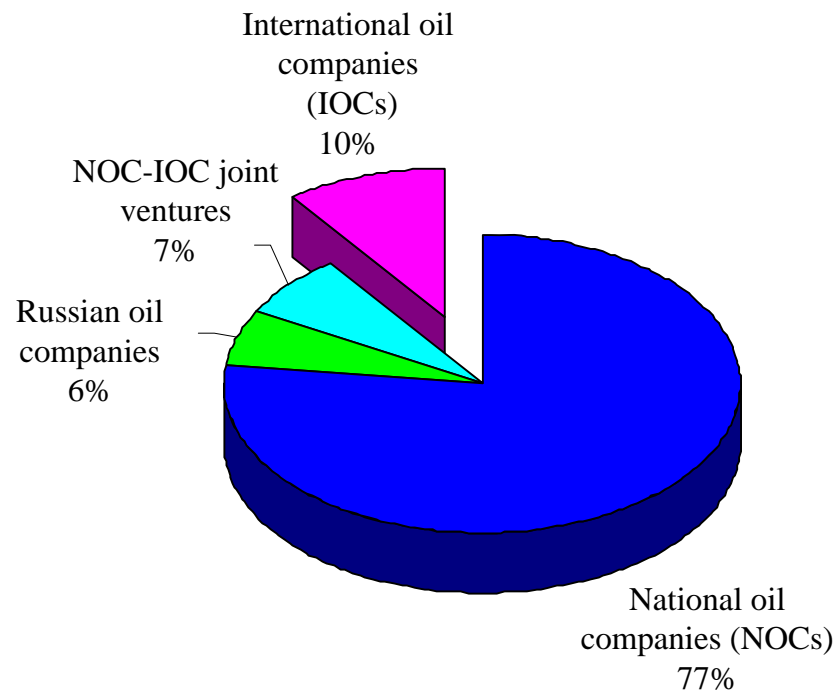
# Long-term World Oil Production Outlook by Region (IEA)

**OPEC production will increase dramatically, with the expansion concentrating in Middle East OPEC countries.**



(Source) "IEA World Energy Outlook 2007"

# National Oil Companies Have Advantage in Access to Resources



- Saudi Arabia : SAUDI ARAMCO
- Iran : NIOC
- Kuwait : KPC
- Abu Dhabi : ADNOC
- Qatar : QP
- Venezuela : PDVSA
- Nigeria : NNPC
- Algeria : SONATRAC
- Libya : NOC
- Indonesia : PERTAMINA
- Russia : ROSNEFT
- Mexico : PEMEX
- China : CNPC, SINOPEC, CNOOC
- Malaysia : PETRONSA
- India : ONGC, IOC, etc.

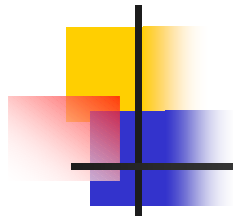
(Source) A. Jaffe (2007.3.) "The Changing Role of National Oil Companies in International Energy Markets"; Rice University.

# Russia Enhancing Government Control of Energy Sector

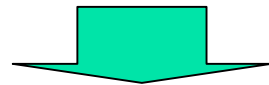


- **Great oil and gas supply potential**
- **Russia has enhanced its presence as an energy supplier in international markets through substantial expansion of oil production since 2000**
- **Enhancement of oil industry management and control by state and their impact**
- **Rise of government-run oil and gas companies (including Gazprom)**
- **Russia's utilization of energy from national interest and strategic perspectives**
- **Foreign energy policy developed from strategic perspectives**
- **Russia is significant for Japan's (and East Asia's) efforts to secure new energy supply sources and diversify energy supply sources.**
- **Russian energy future as a major power will become a global matter of concern.**

# Linkage between Financial Markets and Energy Problems



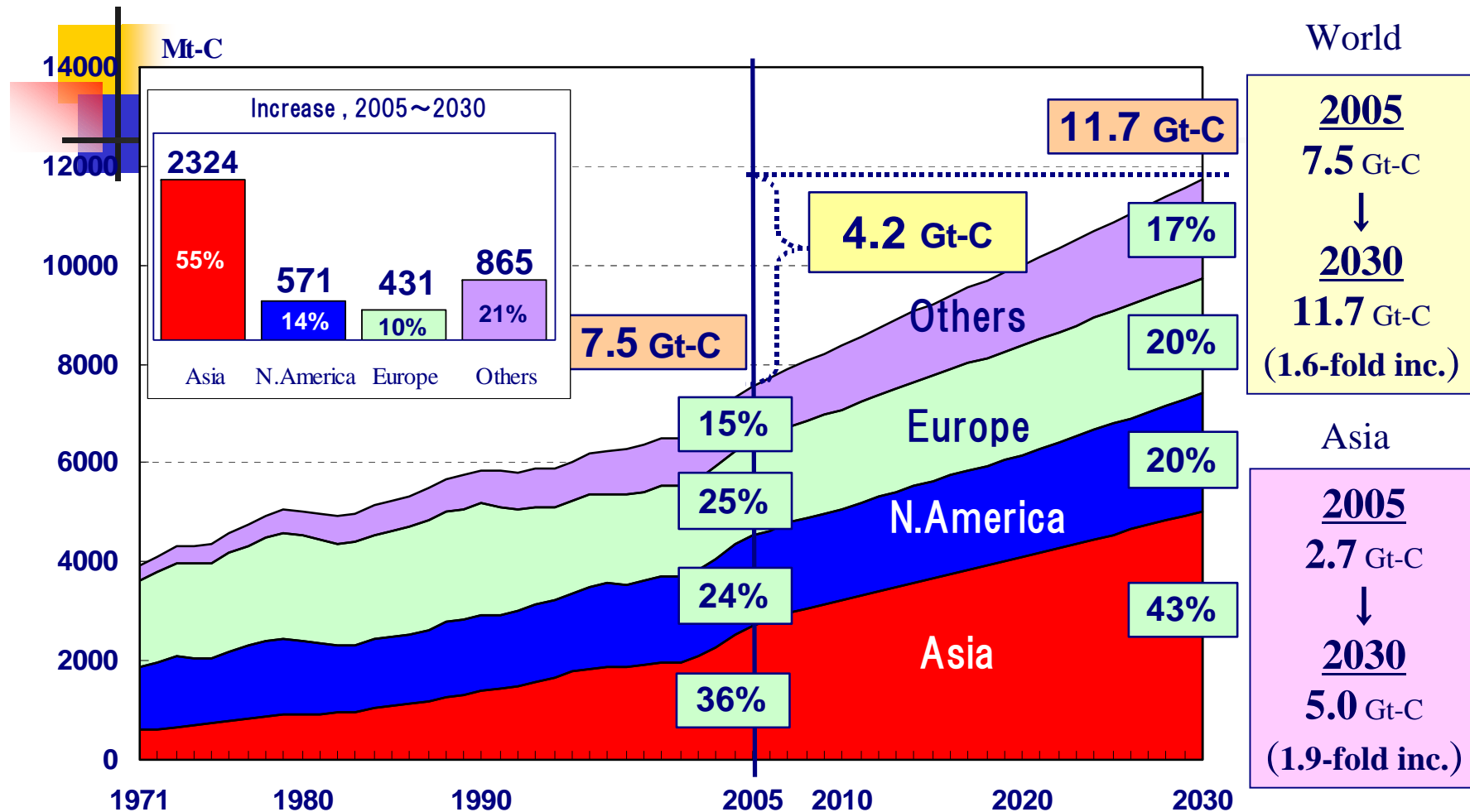
- **Amid worldwide excess liquidity, massive money is flowing into crude oil and other energy markets**
- **Speculative funds, investment funds (including pension and sovereign wealth funds) and other various factors exist behind the massive money inflow into energy markets.**
- **Linkage between energy and financial markets will be enhanced through the U.S. subprime mortgage crisis and the dollar's depreciation**



- **Some impacts are expected on energy prices and volatility**
- **Energy and financial markets and world economy instability will be linked together**
- **Greater volatility and future uncertainties will affect energy investment which requires long lead times.**



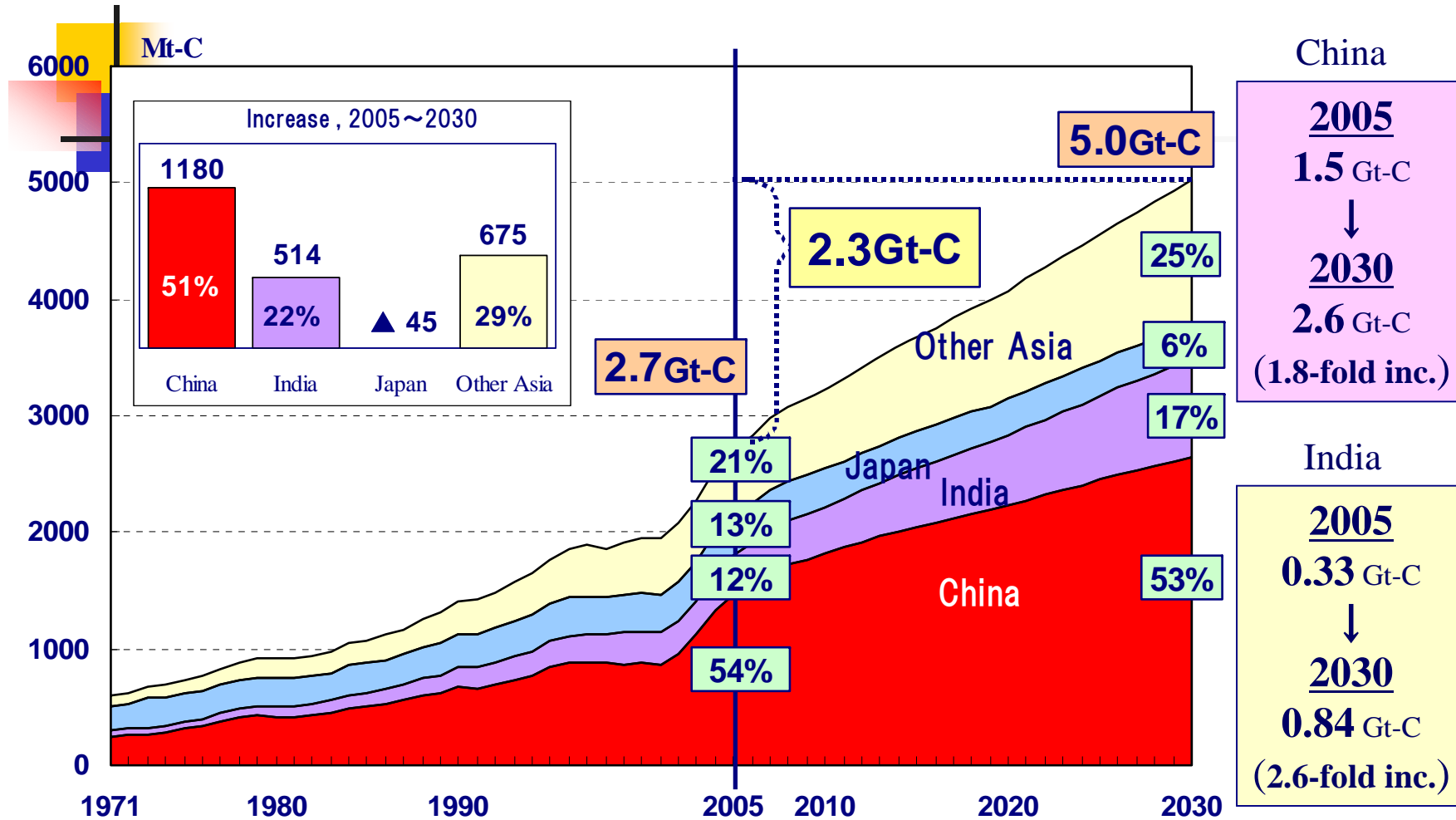
# Projected CO<sub>2</sub> Emissions by Region



Asia will account for more than 50% of a global CO<sub>2</sub> emission increase. North America and Europe will account for some 20%.

(Source) "IEA World Energy Outlook 2007"

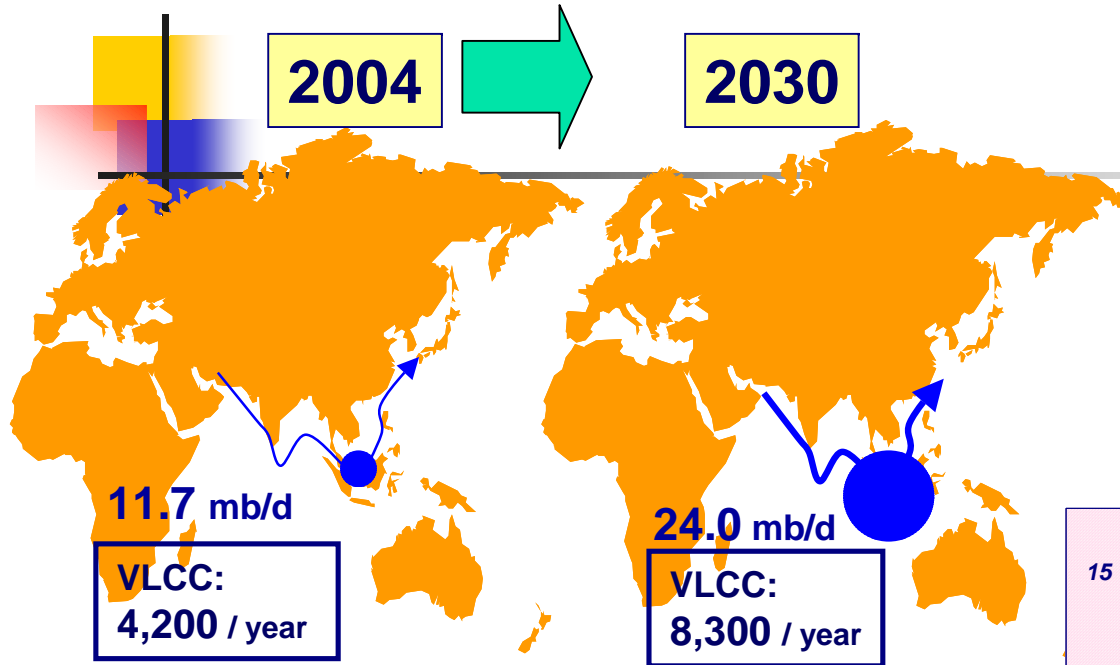
# Projected Asian CO<sub>2</sub> Emissions by Region



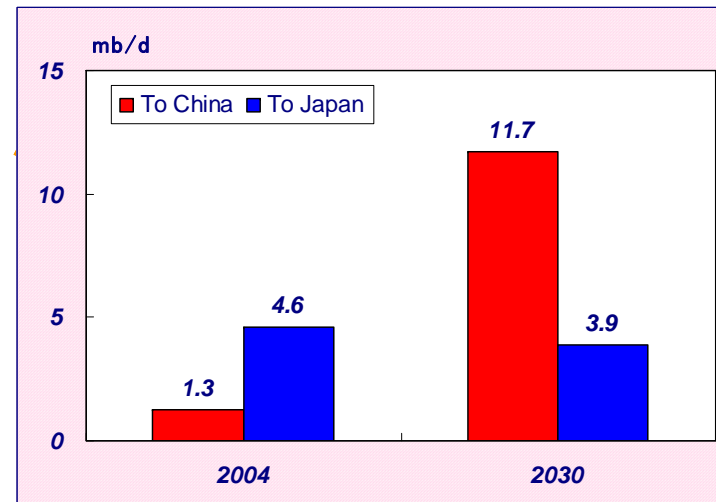
*CO<sub>2</sub> emissions of China and India will dramatically increase, driven by their growing coal consumption, accounting for 70% of Asia's total emissions.*

(Source) "IEA World Energy Outlook 2007"

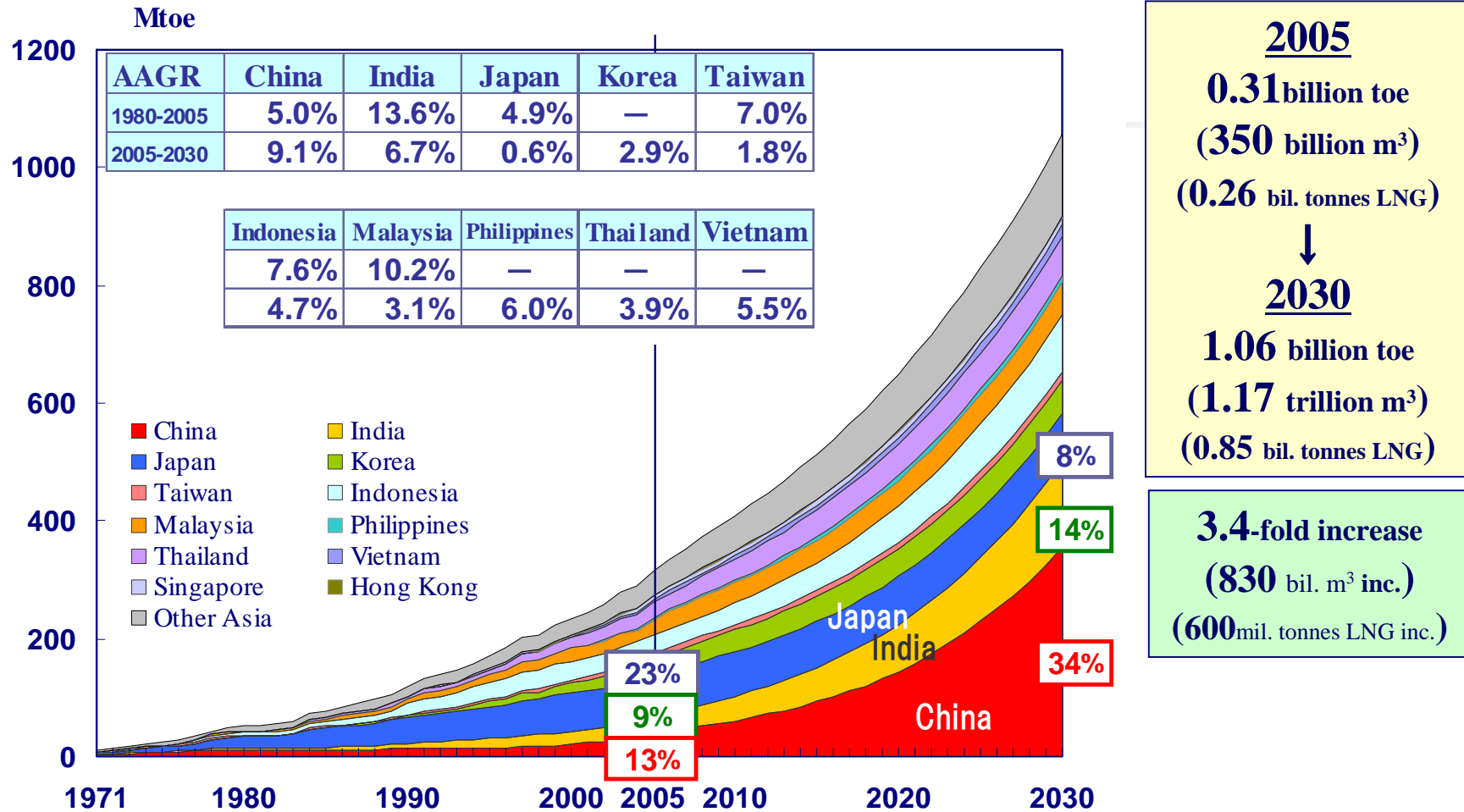
# VLCC traffic at Straits of Malacca



China Oil traffic at Straits of Malacca



# Asian Gas Demand by Region



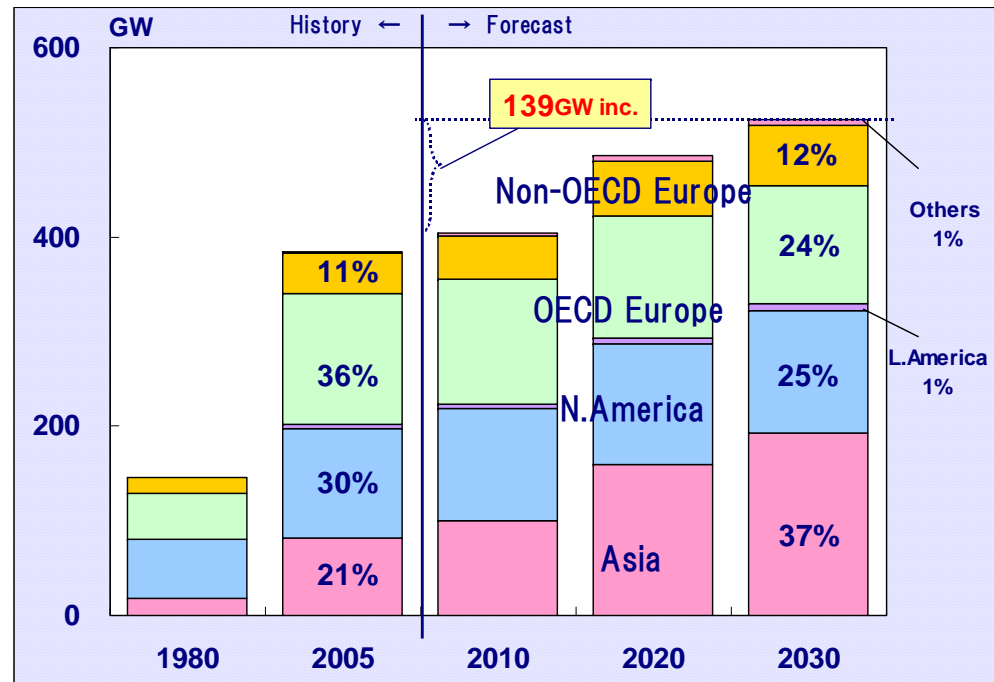
*Gas demand in China will increase substantially, reflecting rising demand for gas for power generation and urban consumers, as well as enhancement of environmental conservation measures.*

(Source) "IEA World Energy Outlook 2007"

# Challenges for Nuclear Power

- **Emerging “Nuclear Renaissance”**
- **Still many challenges remain for further nuclear power promotion**
  - Safety issue
  - Competitiveness in power market
  - Spent fuel disposal
  - Public acceptance, etc
- **Terrorism, an emerging threat**
- **Growing international attentions and discussion on non-proliferation issue and control on nuclear fuel cycle**

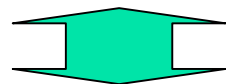
Outlook for Nuclear power capacity



Source: IEEJ (Asia/World Energy Outlook 2007)

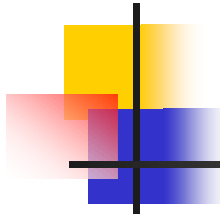
# Challenges for Energy Conservation and Renewable Energy

- Priority given to energy conservation and renewable energy
- Multiple advantage expected: Improve energy security and global warming, strengthen economic competitiveness, promote domestic industries and economy
  - Important domestic policy option
  - Centerpiece for international cooperation



- Problems related to technology transfer/cooperation (IPR, etc.)
- Need for harmonization with food security and environmental protection (deforestation, etc,)
- Importance of further R&D&D

# Basic Predictions and Concepts for Technology Advancement Scenario



In the technology development scenario, a series of energy and environmental policies would be adopted to secure more stable energy supply and enhance measures against global warming.

In the technology development scenario, various energy policies and technology transfers from industrial nations to developing countries are presumed to improve energy efficiency faster than in the reference scenario.

## [Demand-side Technologies]

### ■ Industrial sector

Highly efficient motors, highly efficient boilers, adjustable/variable-speed drives, high-performance industrial furnaces, coke dry quenching equipment, top-pressure recovery turbines for power generation, new kilns, vertical mills, co-generation systems, waste heat power generation, etc.

### ■ Transportation sector

Fuel-efficient vehicles, hybrid vehicles, ITS, etc.

### ■ Consumer sector

Solar water heaters, highly efficient lights, highly efficiency stoves, IT-based energy controls, highly efficient heat pumps, enhanced insulation, highly efficient irrigation pumps, etc.

## [Supply-side Technologies]

### ■ Promotion of new/renewable energy introduction

Wind-power, solar and biomass power generation, biofuels for vehicles, etc.

### ■ Promotion of nuclear energy introduction

Acceleration of nuclear plant construction, technologies for stabilization of operating ratios and safety for light-water reactors, etc.

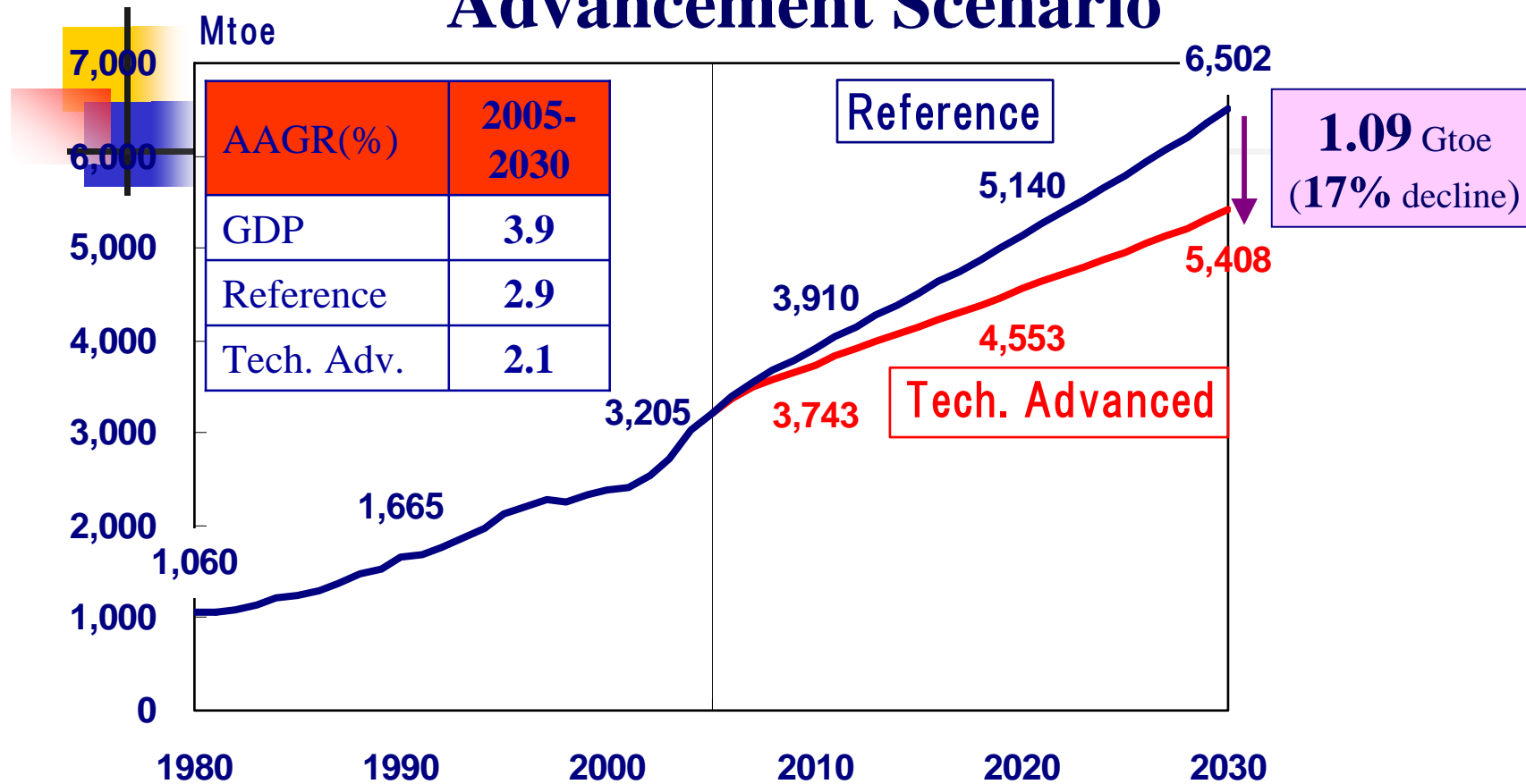
### ■ Greater power generation efficiency and reduction of electricity losses on transmission/distribution

Ultra-super critical coal generation, coal IGCC (integrated gasification combined cycle) systems, natural gas MACC (more-advanced combined cycle) systems, UHV (ultra-high voltage) transmission, etc.

## [Institutional Reforms]

Improvement of energy price systems; promotion of DSM/ESCO (demand-side management and energy service companies); requirements for large energy consumers' energy control; introduction of multiple time zones; introduction of benchmarks for the industrial sector, hotels, hospitals and buildings; promotion of urban public transportation systems; a transportation modal shift from trucking to railway and maritime transportation; and others.

# Primary Energy Demand (Asia) in Technology Advancement Scenario



As the effects of advanced technologies begin to gradually emerge in 2010 in the technology advancement scenario, energy demand in 2030 will be some 17% (1.09 billion toe equivalent, twice as much as Japan's primary energy demand) less than in the reference scenario.