

*395th Forum on Research Works
21 September 2006 , Tokyo, Japan*

A light gray silhouette of a world map is centered in the background of the slide. The map shows the outlines of all major continents and countries.

ASIA/WORLD ENERGY OUTLOOK 2006

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Projection Outline

- **Objective:** *Attempt to quantitatively simulate realistic energy pictures in a fully logical and consistent way, with elaborate investigation into current status of socio-economic and energy fundamentals, in both world and Asian regions.*

Analysis of Asian region is, in particular, carefully implemented through the exchange of information with numerous agencies specialized in study of Asia.

- **Projection Period:** 2004 ~2030

- **Methodology:** *Macro-Economic Model, Energy Demand and Supply Model, both developed on the basis of econometric model*

- **Scenarios:**

- **Reference**

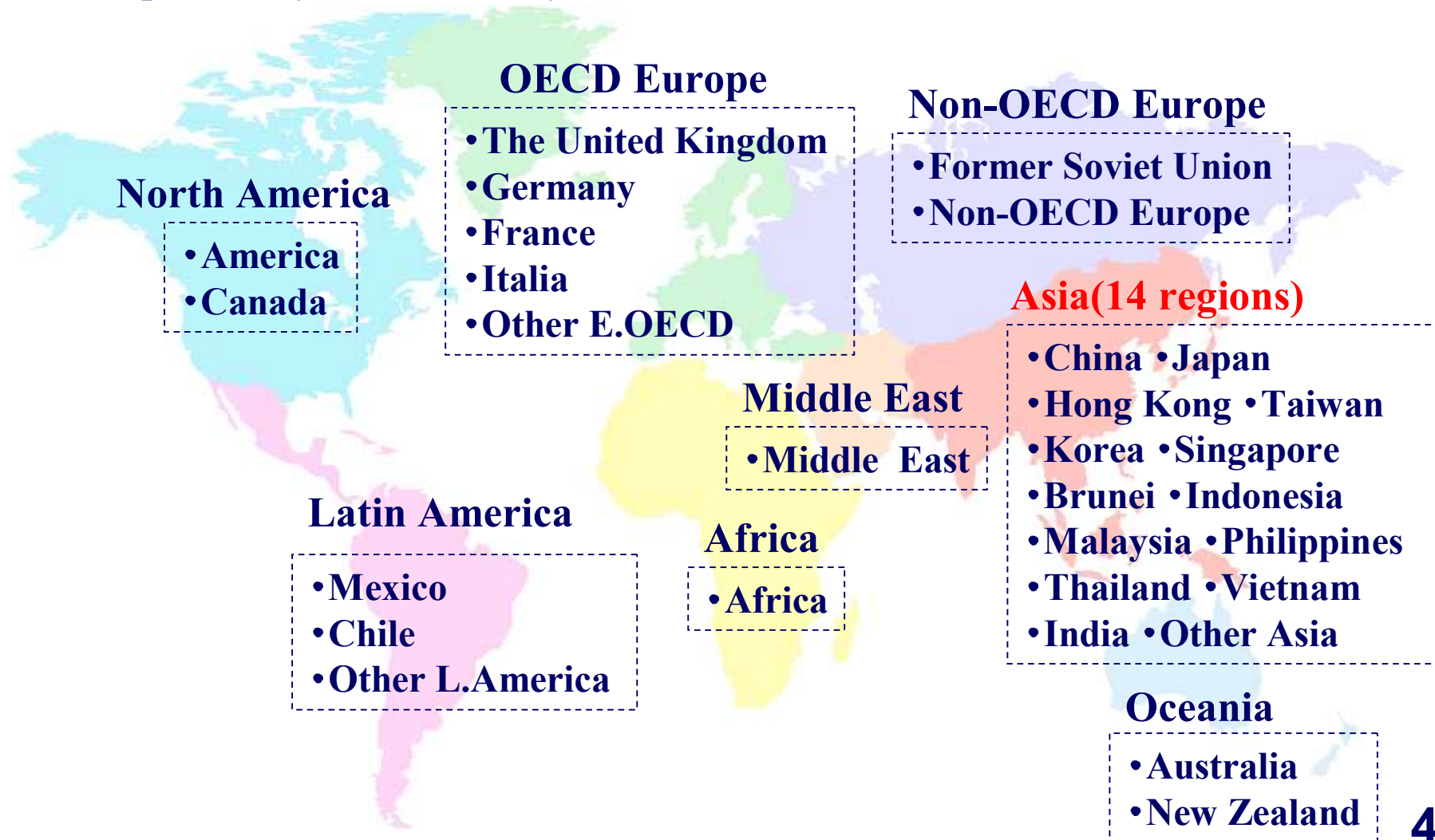
Reference scenario anticipates highly probable assumptions based on current economic and political situations, which yields normative future evolution of energy demand and supply

- **Technological Advanced Scenario**

This scenario develops future picture, in which Asian countries take several technological advanced majors in order to secure energy supply and mitigate environmental problem.

Geographical Coverage

- *The whole world is geographically divided into 30 regions, Asia into 14 regions.*
- *Geopolitically detailed analysis into Asian countries.*



Basic Framework

MACRO Economic Model[†]

- GDP components
- Price/Labor etc.
- Industrial activities
- Transport activities

GDP, Crude oil price, Exchange rate, Population, Power generation outlook, World trade etc.

[†] Development of country-specific macro economic model in China, Korea and ASEAN countries (Indonesia, Malaysia, Philippines, Thailand)

Energy Demand-Supply Model

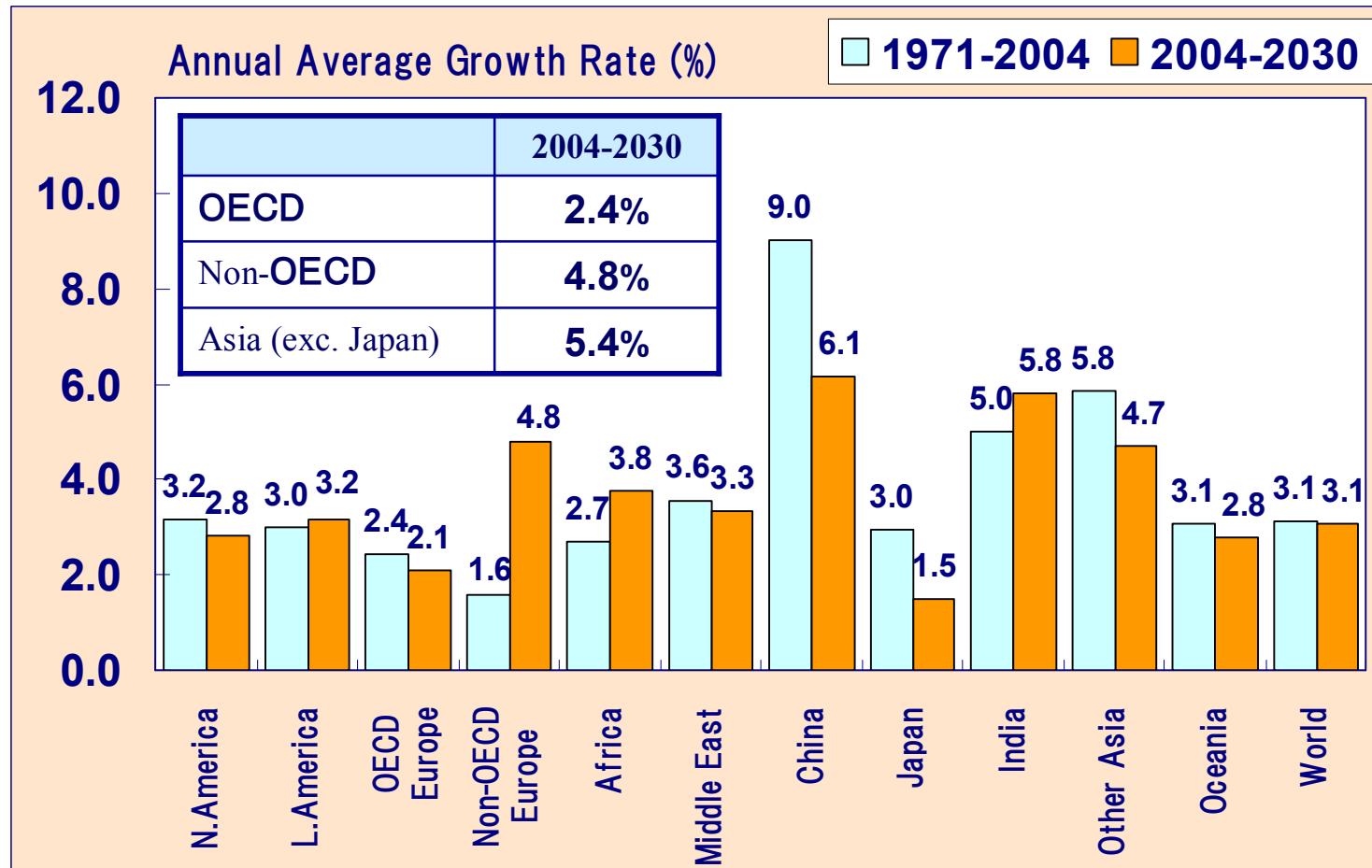
- Energy Demand
- Conversion Sector
- Energy Supply
- CO₂ emissions

World Trading Model of Crude Oil and Petroleum Products (LP Optimization)

- Crude Oil and Petroleum Products Supply
- Crude Oil and Petroleum Products trading

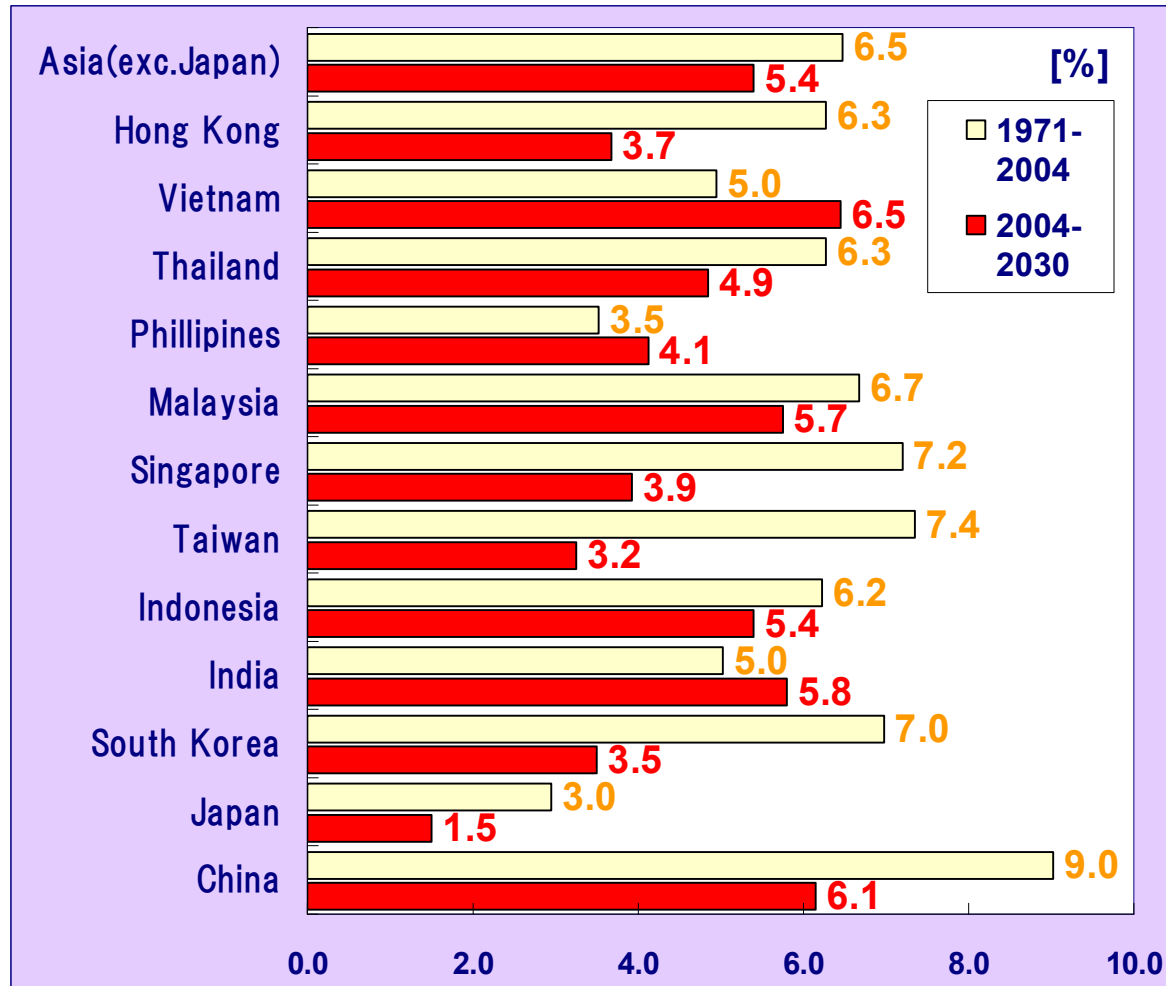
These models allow us to fully understanding the interaction among numerous parameters in a logical and consistent way.

GDP (World)



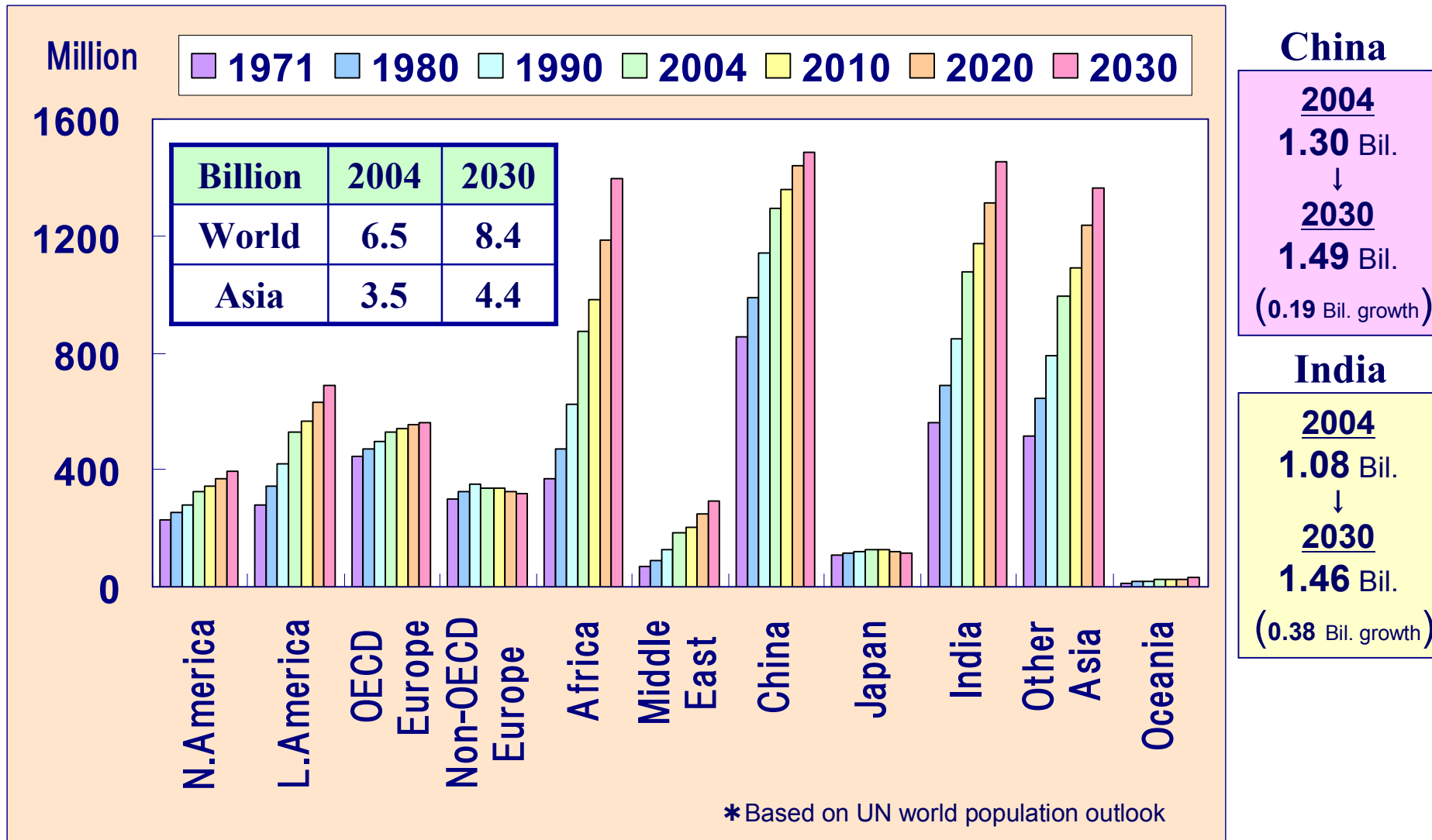
- *World economy is projected to grow at 3.1% per annum, driven mainly by developing countries.*
- *GDP in China continues to achieve relatively high growth, as Chinese economic driver gradually changes from investment and export to domestic private consumption.*
- *GDP in India assumes high growth reflecting on improving economic efficiency by liberalization and direct investment from foreign countries.*

GDP (Asia)



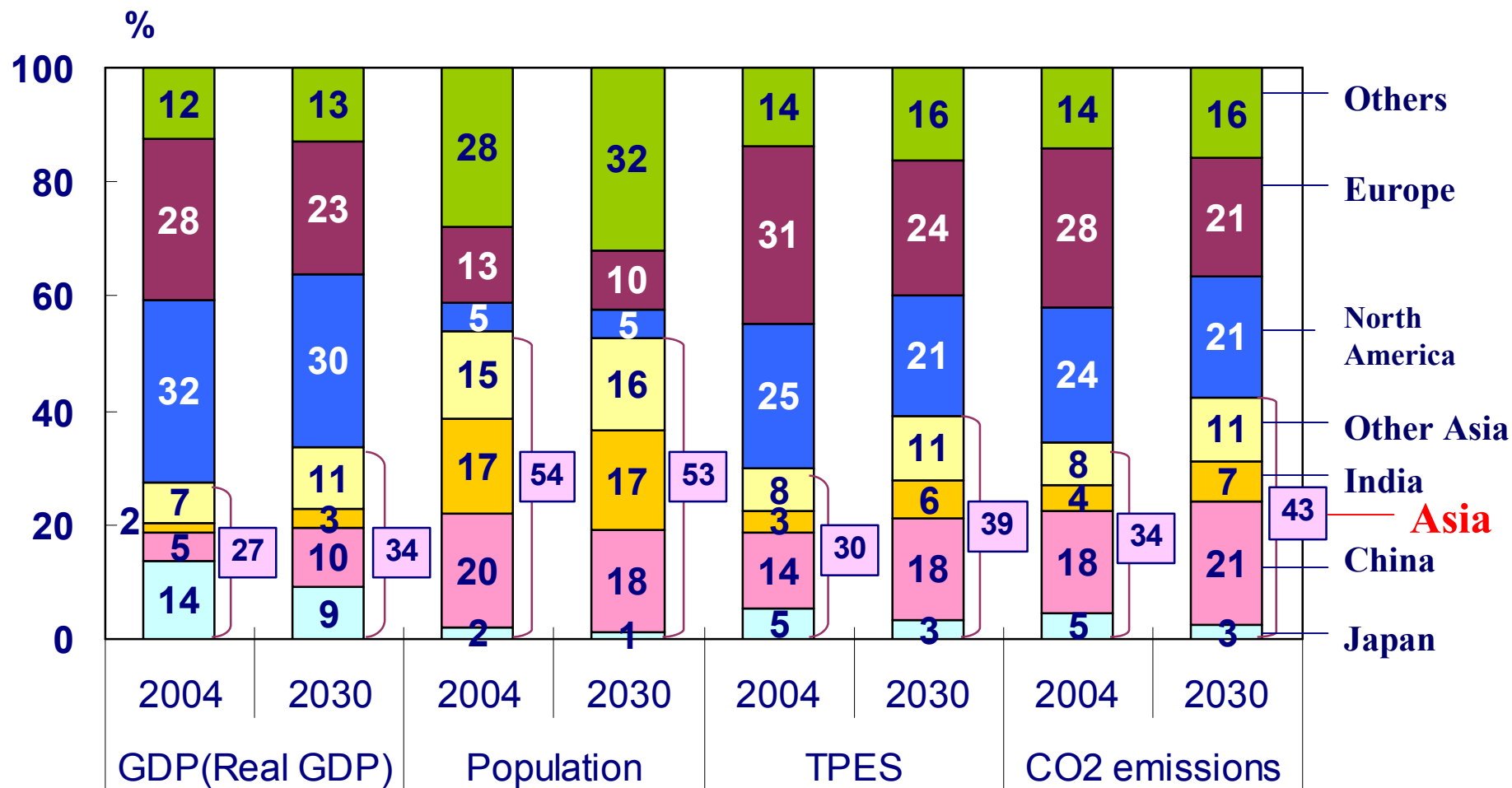
Thailand, Indonesia, Philippines, Vietnam together sustain strong economic growth on the basis of exports, private investment etc. GDP growth of Korea, Taiwan, Singapore, relatively developed countries, experiences gradual slowdown.

Population



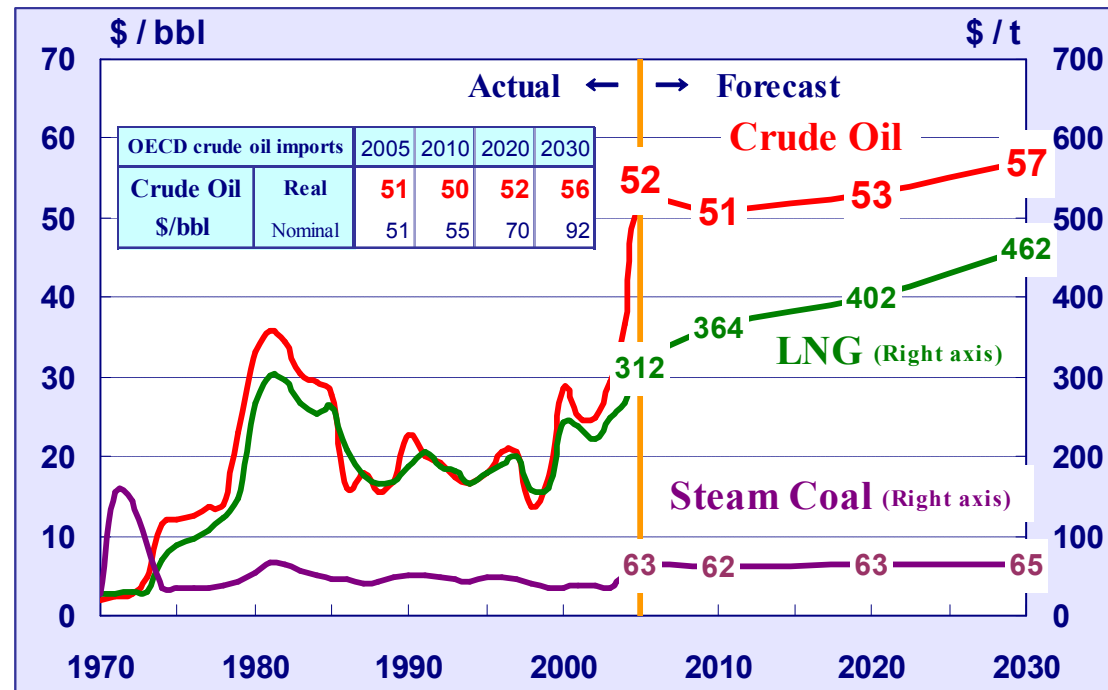
Of the incremental increase in population over the period 2004-2030, roughly 90% derives from Non-OECD.

Economy and Energy Presence of Asia



- Asian share of GDP expands from 27%(2004) to 34% (2030), primary energy demand from 30% (2004) to 39%(2030), and CO2 emissions from 34%(2004) to 43%(2030).
 - Asian population controls about 50% in the world.

Primary Energy Price



Cf. All the prices are calendar year data; future price is based on 2005 real price. ;In the graph, energy prices are explained by Japan's import energy price (CIF base).

- Present high price of crude(import CIF price) exhibits slowdown towards 2010. After 2010, international oil market is forecast to become tightened as a result of oil demand increasing mainly driven by Asia, besides stagnation of investment in upstream sector, boosting oil price higher for 2030
- LNG price is projected to rise in accordance with crude oil price.
- Coal price remains almost unchanged.

※ Energy import prices (Japan)

petroleum :62.4 \$/bbl, LNG :359.3\$/t steam coal :62.6\$/t (average from Jan.2006 to Jun.2006)

petroleum :67.9 \$/bbl, LNG :356.8\$/t steam coal :62.6\$/t (Jul.2006)

Primary Energy Price

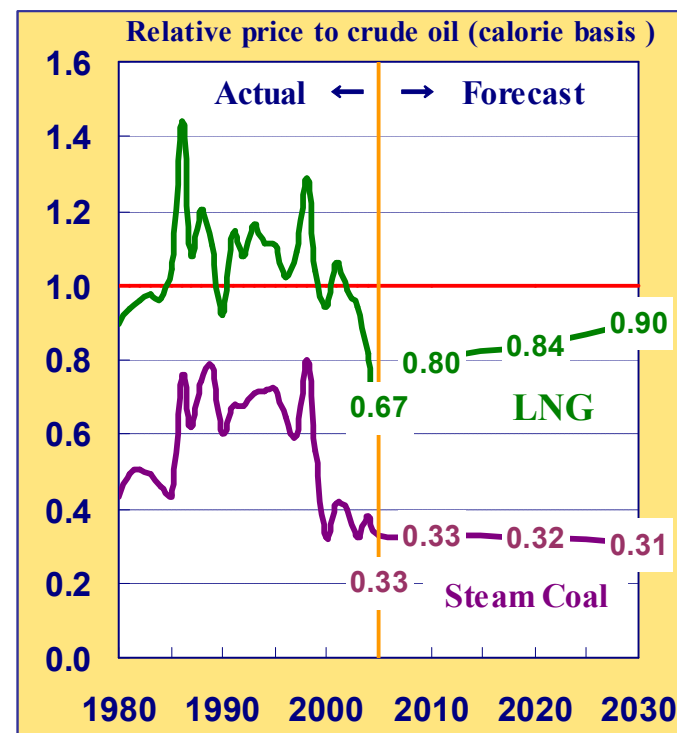
【Real prices and nominal prices】

		2000	2005	2010	2020	2030
OECD crude oil imports	Real	31	51	50	52	56
	Nominal	28	51	55	70	92
Crude oil imports(Japan)	Real	32	52	51	53	57
	Nominal	29	52	56	72	94
LNG imports(Japan)	Real	269	312	364	402	462
	Nominal	243	312	402	541	758
Steam Coal imports(Japan)	Real	38	63	62	63	65
	Nominal	35	63	69	85	106

* Real prices are set in 2005.

* Inflation rates are assumed at 2% annually.

【Relative prices to petroleum】



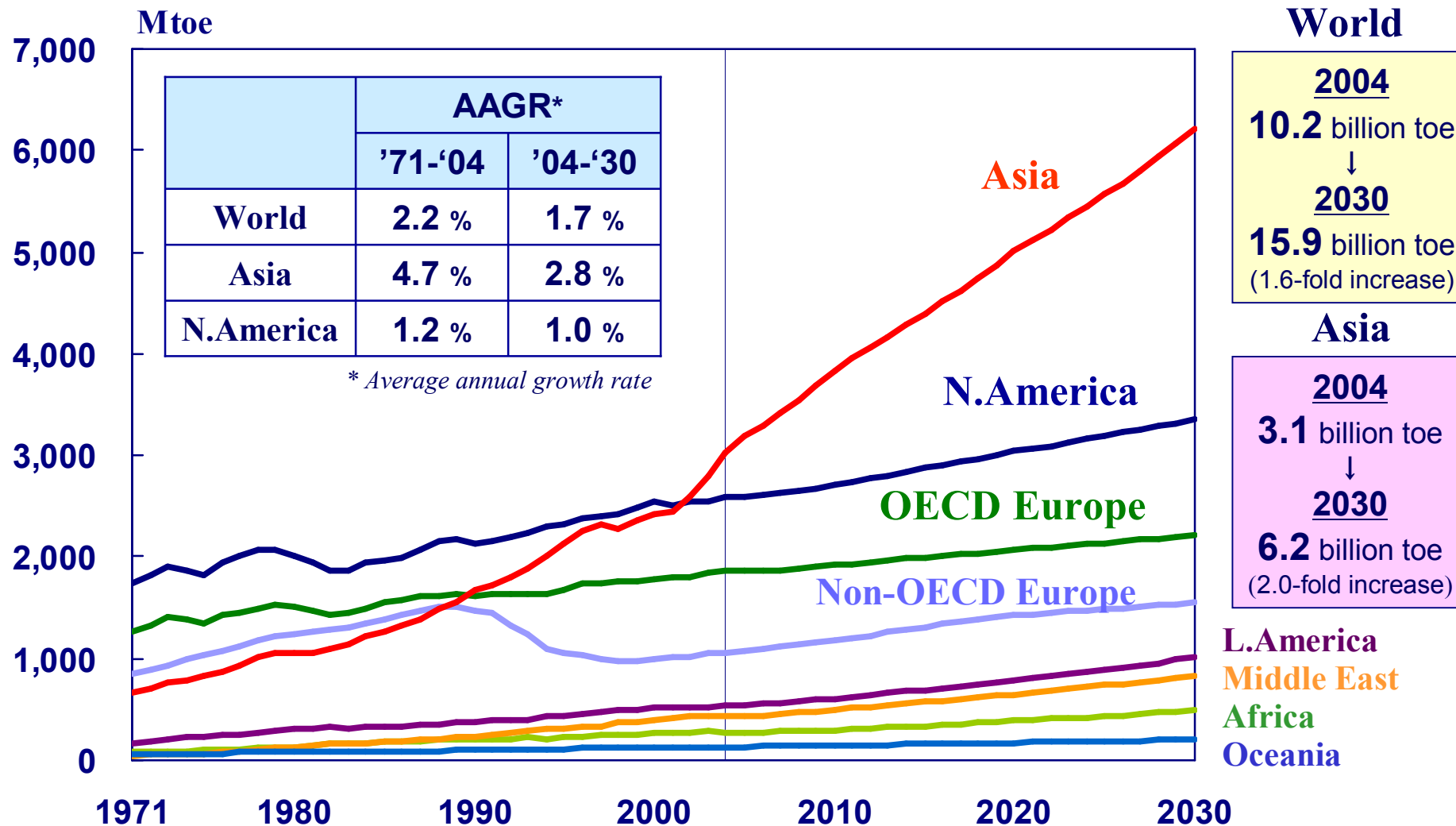
▪Currently, LNG price becomes cheaper compared with sharply rising petroleum price. For the long-term trend, the gap between crude oil and LNG, however, will become smaller.

▪Coal relative price will remain roughly constant for 2030.



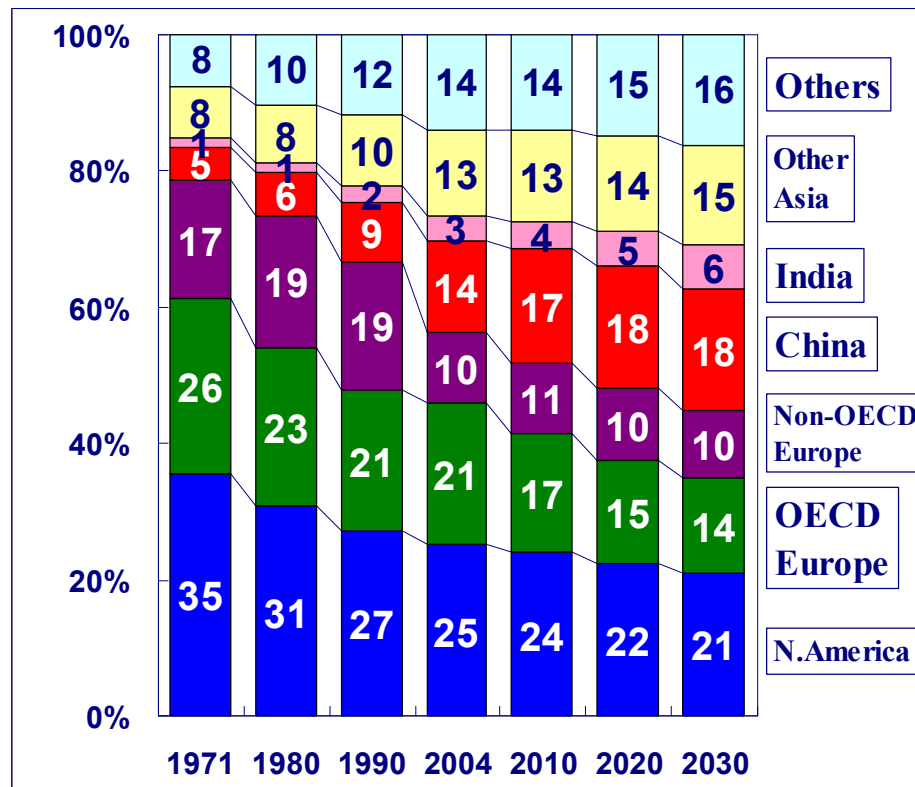
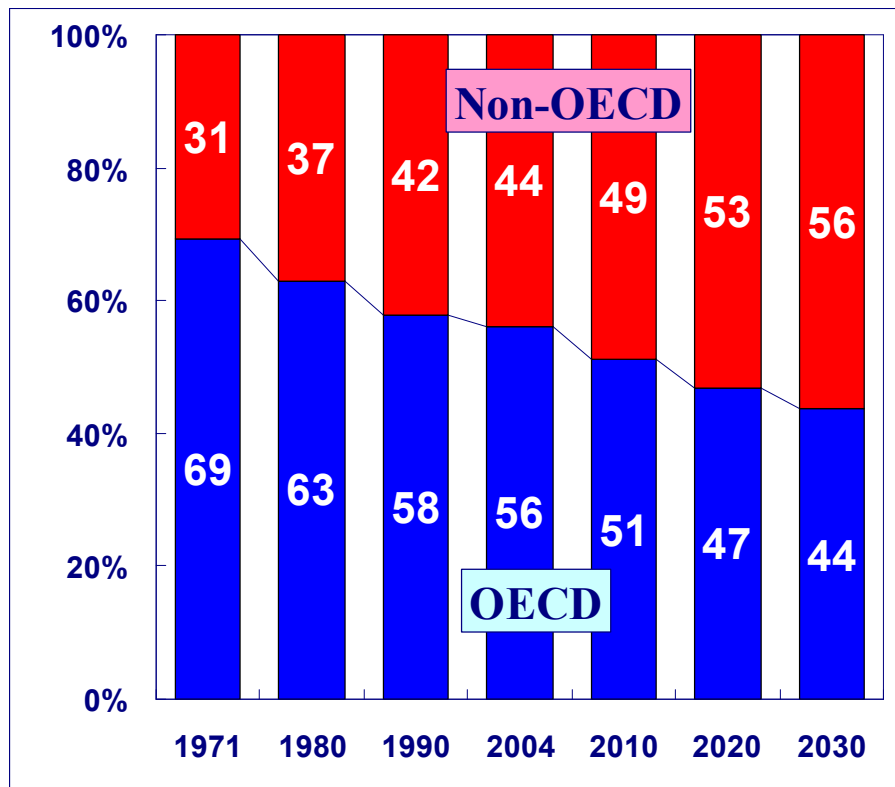
Projection Results Overview: World

Primary Energy Demand by Region ; World



In 2030, primary energy demand of Asia achieves twice as much as current level, reflecting on highly economic growth. 3.1 billion toe(2004) → 6.2 billion toe (2030)

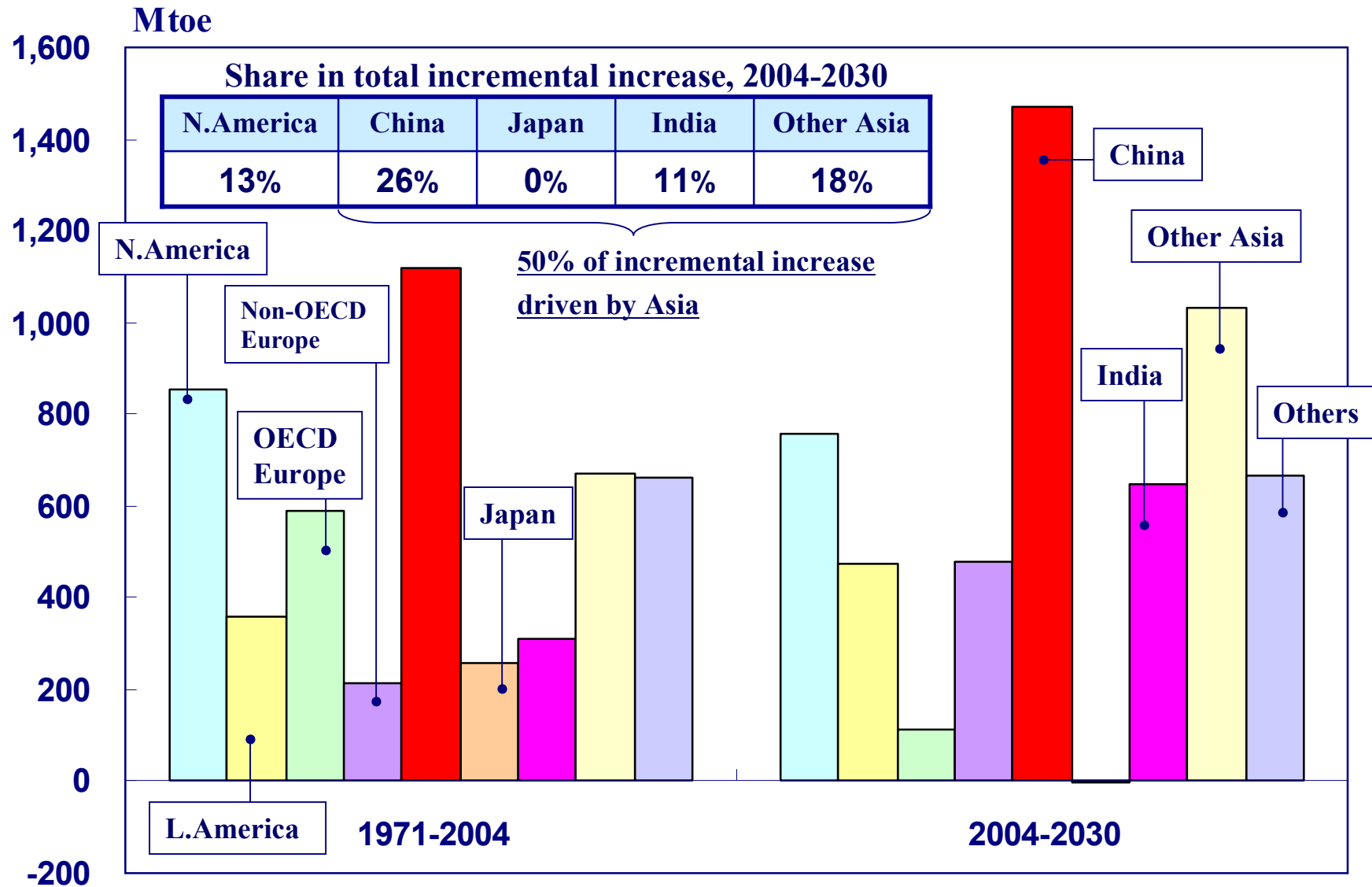
Regional Share (Primary Energy Demand)



▪ Energy demand in Non-OECD and Asian region will exhibit a rapid expansion, with the share of Asian regions in world energy demand extending to around 40% by 2030.

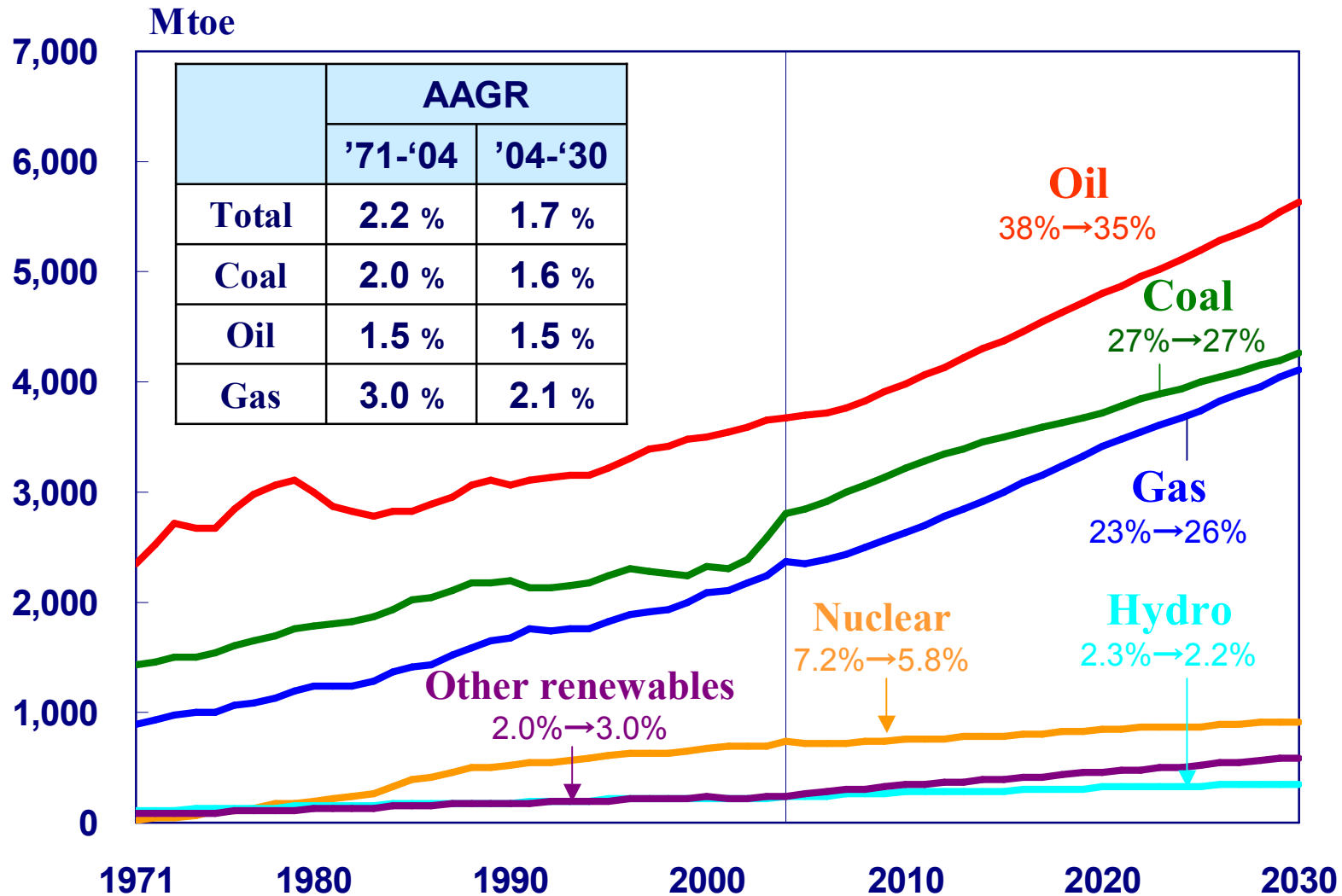
▪ The component ratio of China in world energy demand will increase to 18% , India 6%, both of these countries accounting for 24% by 2030.

Incremental Increase in World Primary Energy Demand by Region, 2004-2030



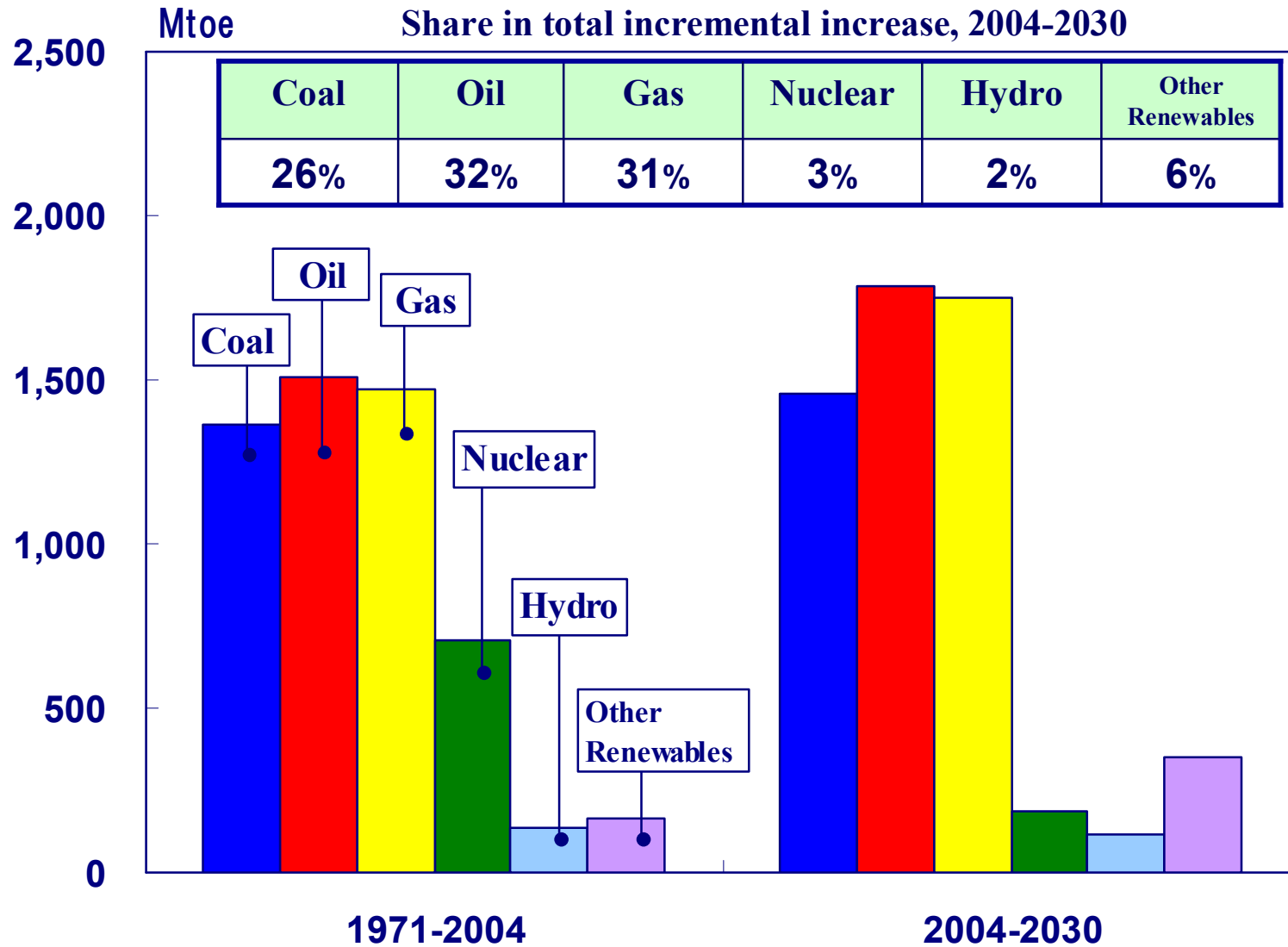
Approximately 50% of incremental increase is derived from Asia.

Primary Energy Demand by Fuel ; World



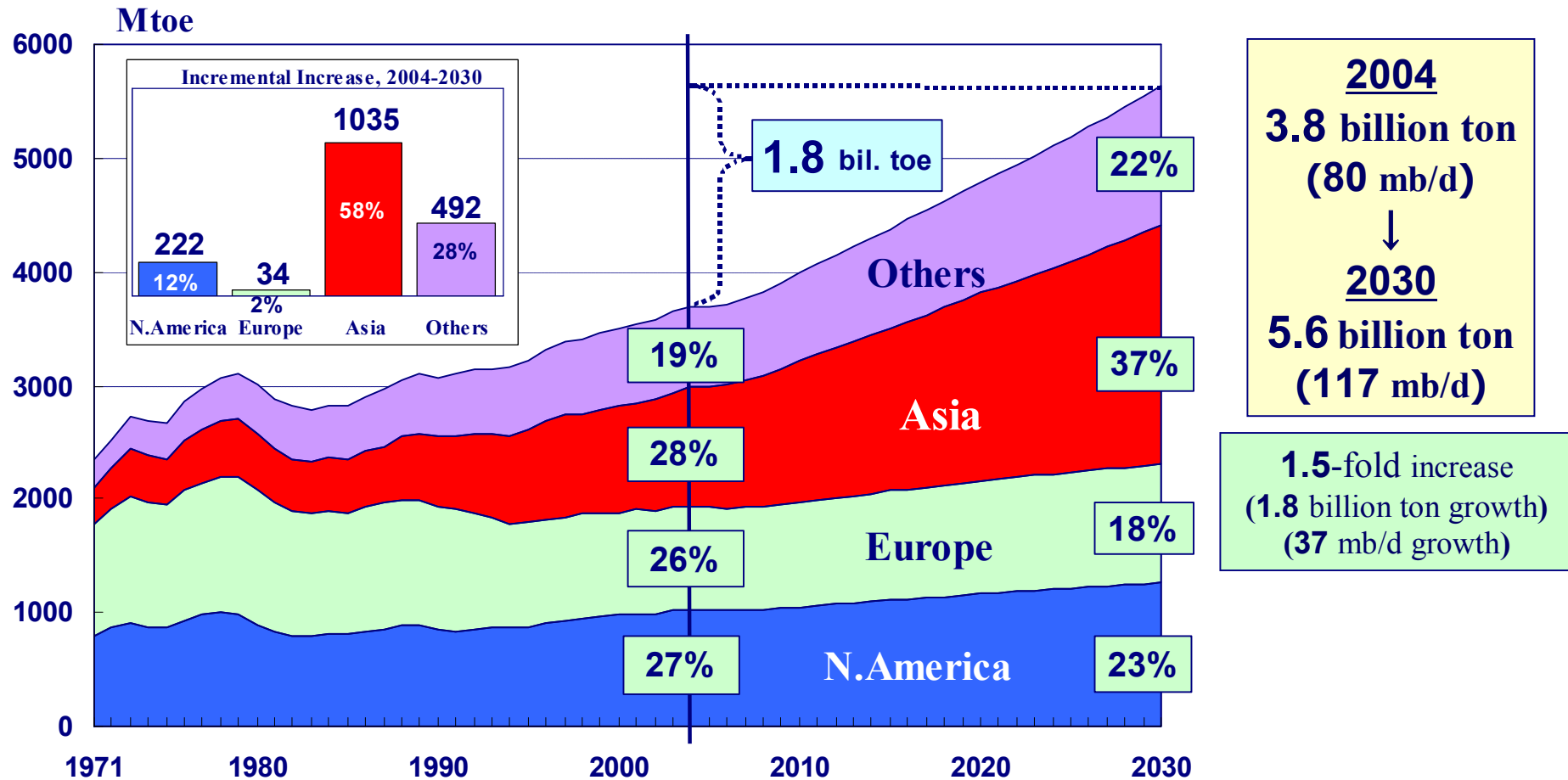
- Oil will remain the largest energy source in primary energy mix by 2030
- Natural gas is expected to grow with its future extensive use in various sectors, eventually catching up with coal around 2030.

Incremental Increase in World Primary Energy Demand by Fuel



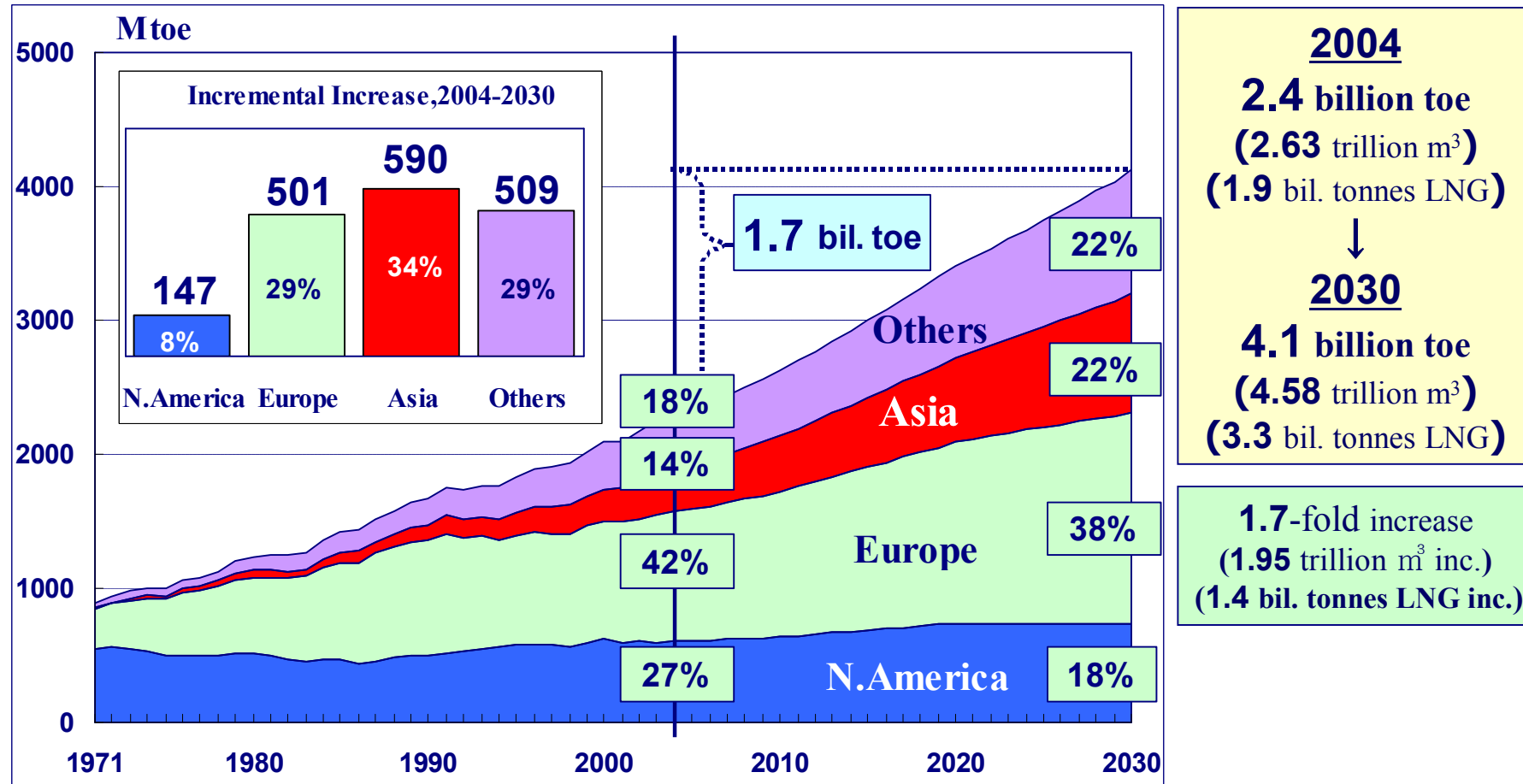
Approximately 90% of incremental increase will become concentrated on fossil fuels

Oil Demand by Region ; World



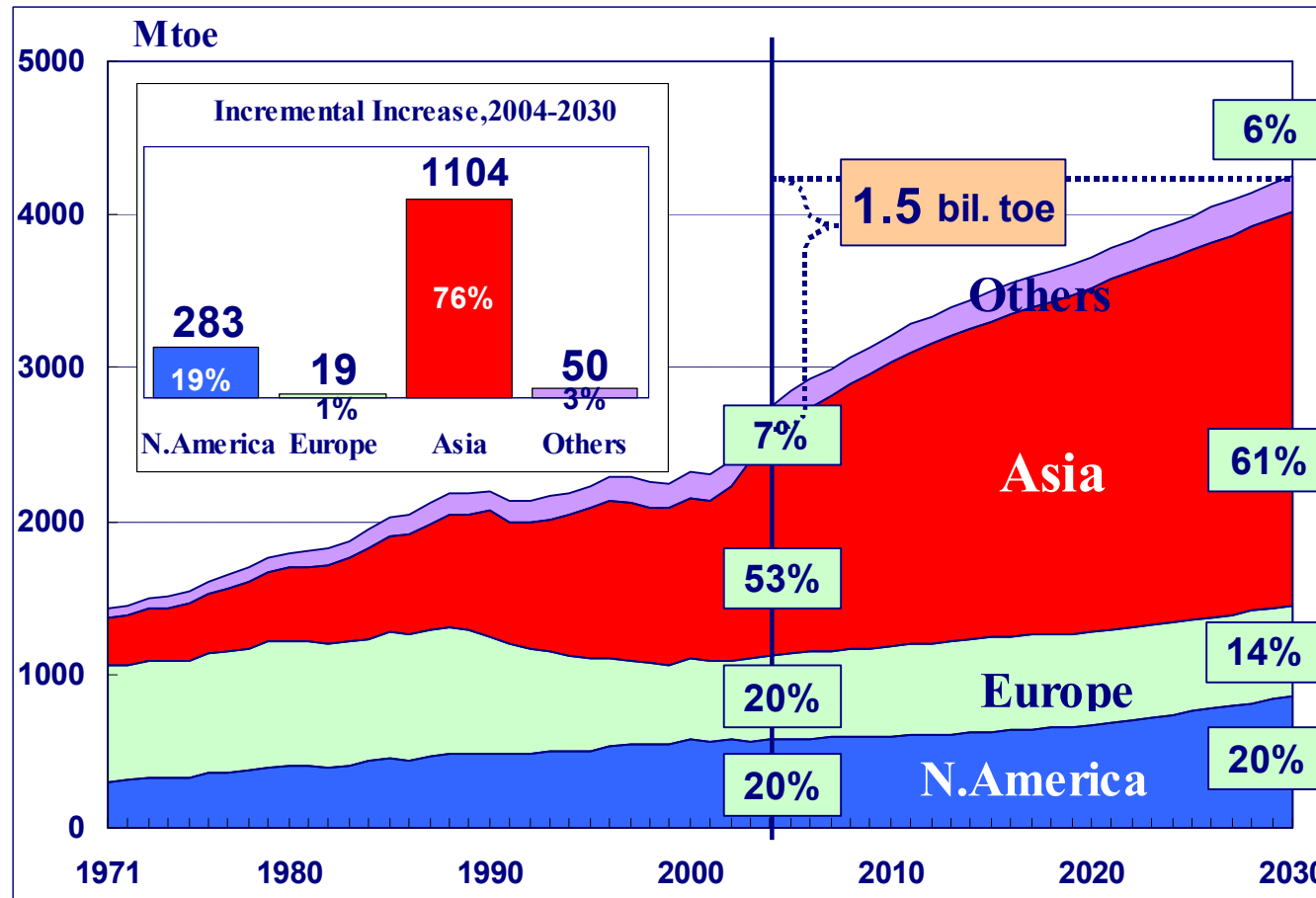
Approximately 60% of incremental increase will be derived from Asia; Asia become centre of oil demand for 2030.

Gas Demand by Region ; World



World gas demand is expected to increase from 2,630 bcm in 2004 to 4,580 bcm in 2030, representing 1.7 times increase

Coal Demand by Region ; World



2004
 2.8 billion toe
 (4.0 bil. tce*)

↓

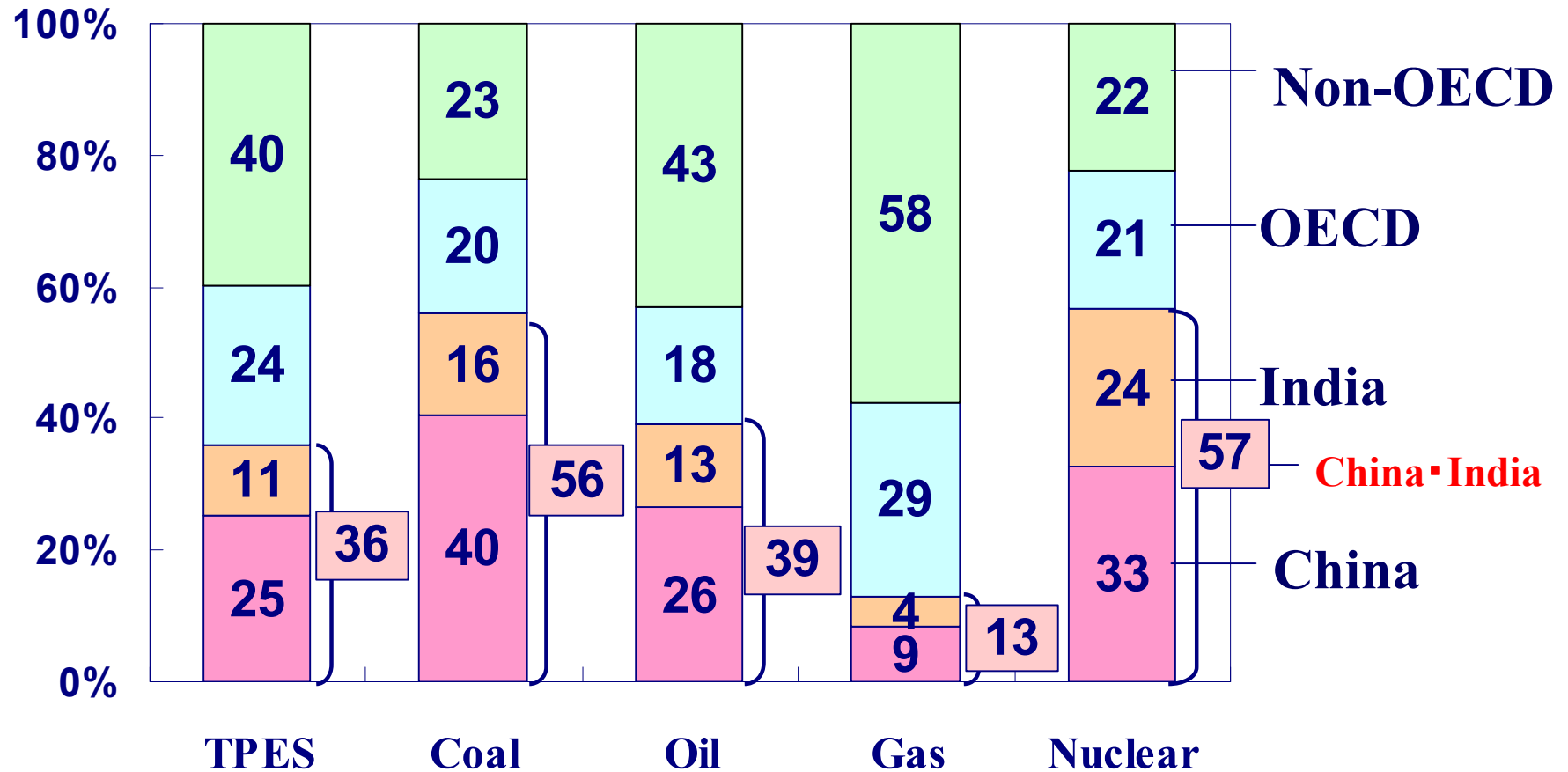
2030
 4.3 billion toe
 (6.1 bil. tce)

1.5-fold growth
 (2.1 bil. tce growth)

* Ton of coal equivalent

About 80% of incremental increase stems from Asia, which share in total coal demand eventually expands to 60% and still remain a centre of coal demand in 2030.

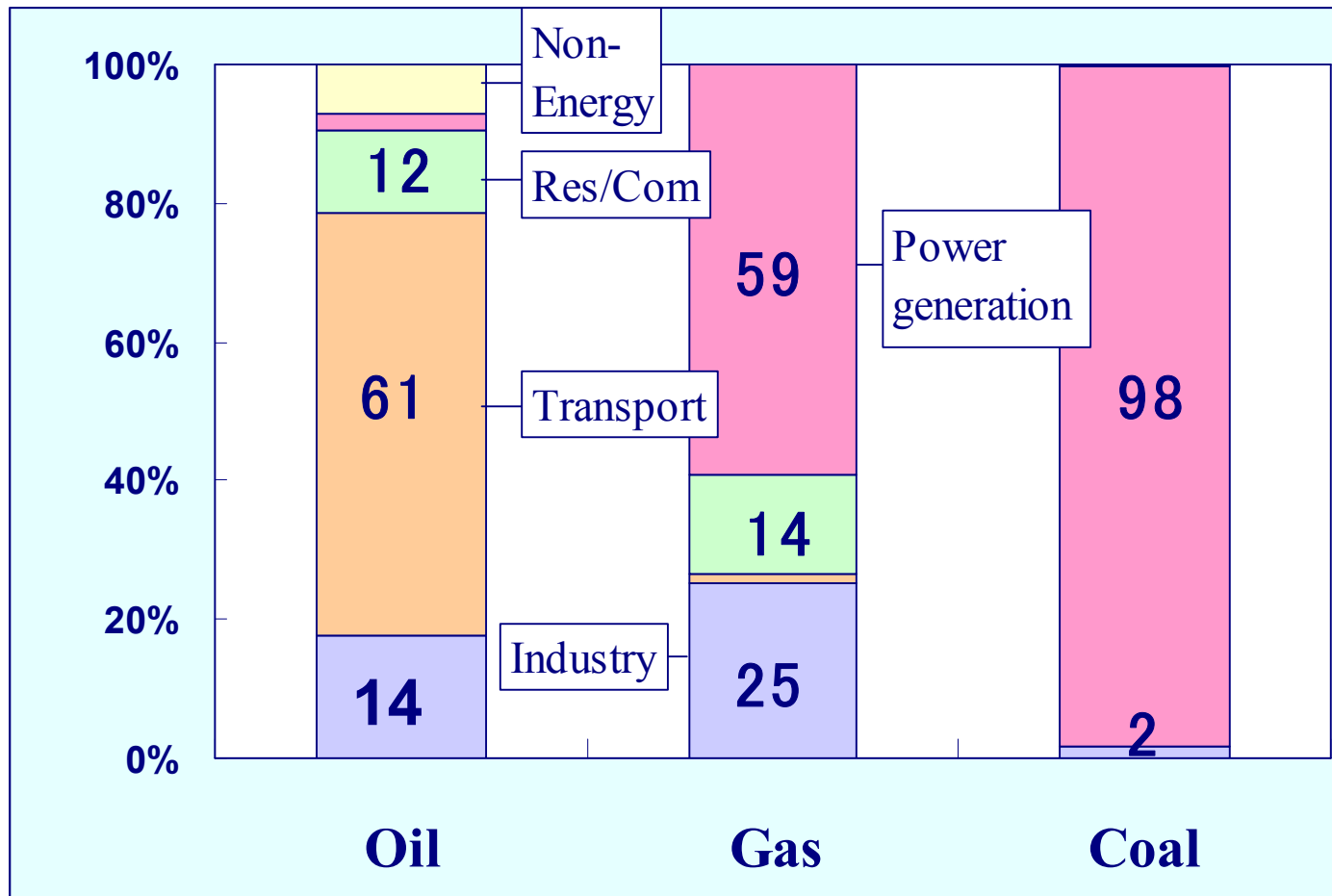
Incremental Increase in World Primary Energy Demand by Fuel and Region - China, India, the Center of Demand Growth



- *Share of China in incremental increase: TPES 25%, Coal 40%, Oil 26%, Nuclear 33%*
- *Share of China and India in incremental increase: TPES 36%, Coal 56%, Oil 39%, Nuclear 57% (Coal and Nuclear are over 50%)*

Incremental Increase in World Fossil Fuel by Sector

【Incremental increase by sector, 2004-2030】



- Globally, of the increase in oil demand, almost 60% comes from transportation sector.
- About 60% of gas and most of coal increase will concentrate on power generation.

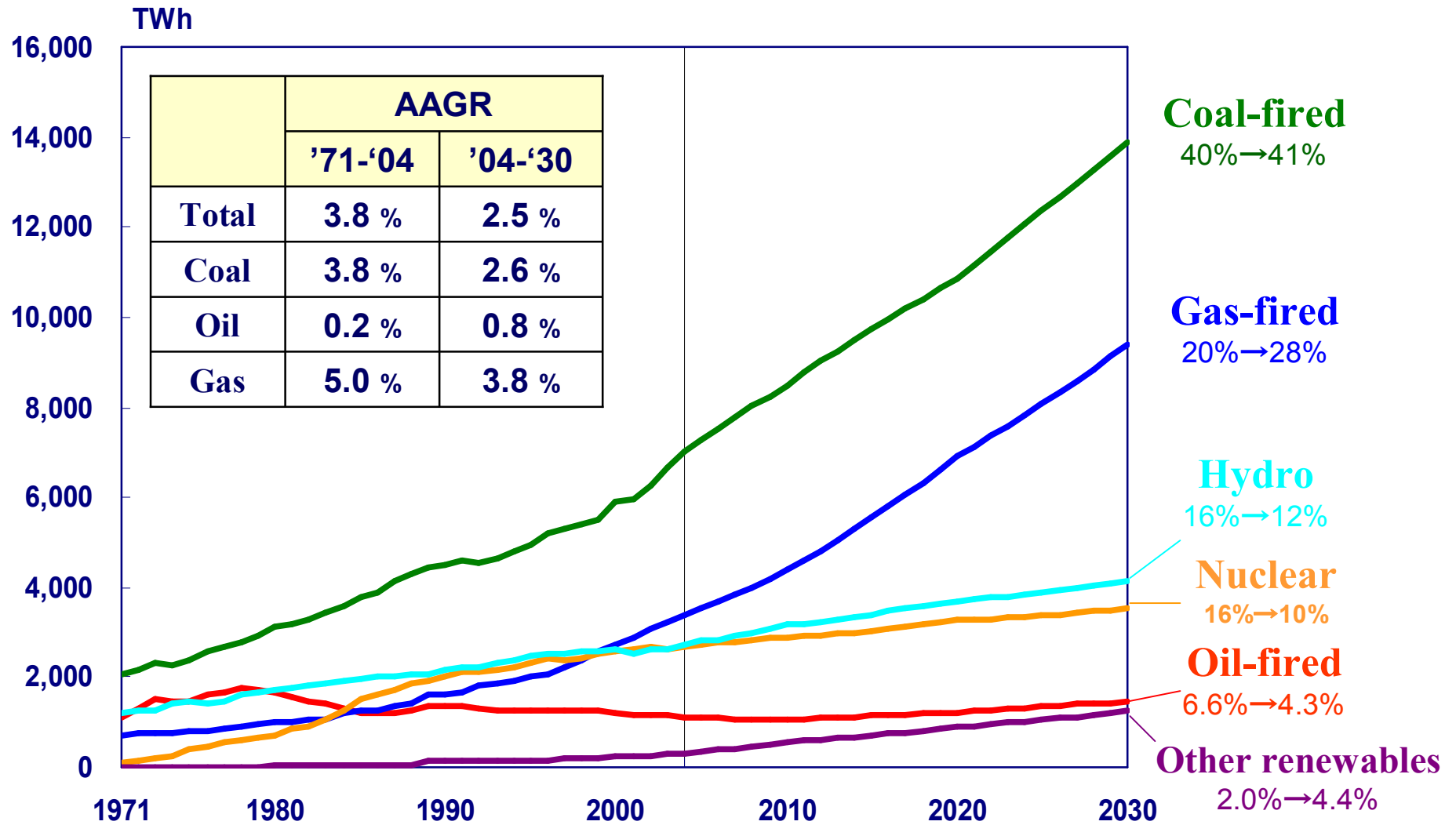
Final Energy Demand ; World

(Mtoe)

		Actual		Forecast			AAGR(%)	
		1971	2004	2010	2020	2030	2004 /1971	2030 /2004
S e c t o r	Industry	1,464 (40.0)	2,425 (35.4)	2,581 (35.4)	3,078 (34.9)	3,554 (34.3)	1.5	1.5
	Res/Com	1,207 (33.0)	2,188 (32.0)	2,301 (31.6)	2,786 (31.6)	3,317 (32.0)	1.8	1.6
	Transport	860 (23.5)	2,009 (29.3)	2,155 (29.6)	2,647 (30.0)	3,130 (30.2)	2.6	1.7
	Non energy etc.	125 (3.4)	225 (3.3)	261 (3.6)	314 (3.6)	362 (3.5)	1.8	1.8
E n e r g y	Coal	614 (16.8)	643 (9.4)	612 (8.4)	611 (6.9)	579 (5.6)	0.1	-0.4
	Oil	1,892 (51.7)	3,288 (48.0)	3,461 (47.5)	4,203 (47.7)	4,972 (48.0)	1.7	1.6
	Gas	604 (16.5)	1,263 (18.5)	1,345 (18.5)	1,639 (18.6)	1,920 (18.6)	2.3	1.6
	Electricity	377 (10.3)	1,260 (18.4)	1,440 (19.8)	1,880 (21.3)	2,357 (22.8)	3.7	2.4
	Heat	68 (1.9)	257 (3.8)	275 (3.8)	307 (3.5)	335 (3.2)	4.1	1.0
	Renewables	73 (2.0)	135 (2.0)	146 (2.0)	166 (1.9)	180 (1.7)	1.9	1.1
World		3,657 (100.0)	6,846 (100.0)	7,286 (100.0)	8,814 (100.0)	10,350 (100.0)	1.9	1.6

Electricity consumption steadily increase , which expanding share in total extends to highly proportion of 23% in 2030. Electrification gradually continues all over the world.

Power Generation Mix by Fuel ; World

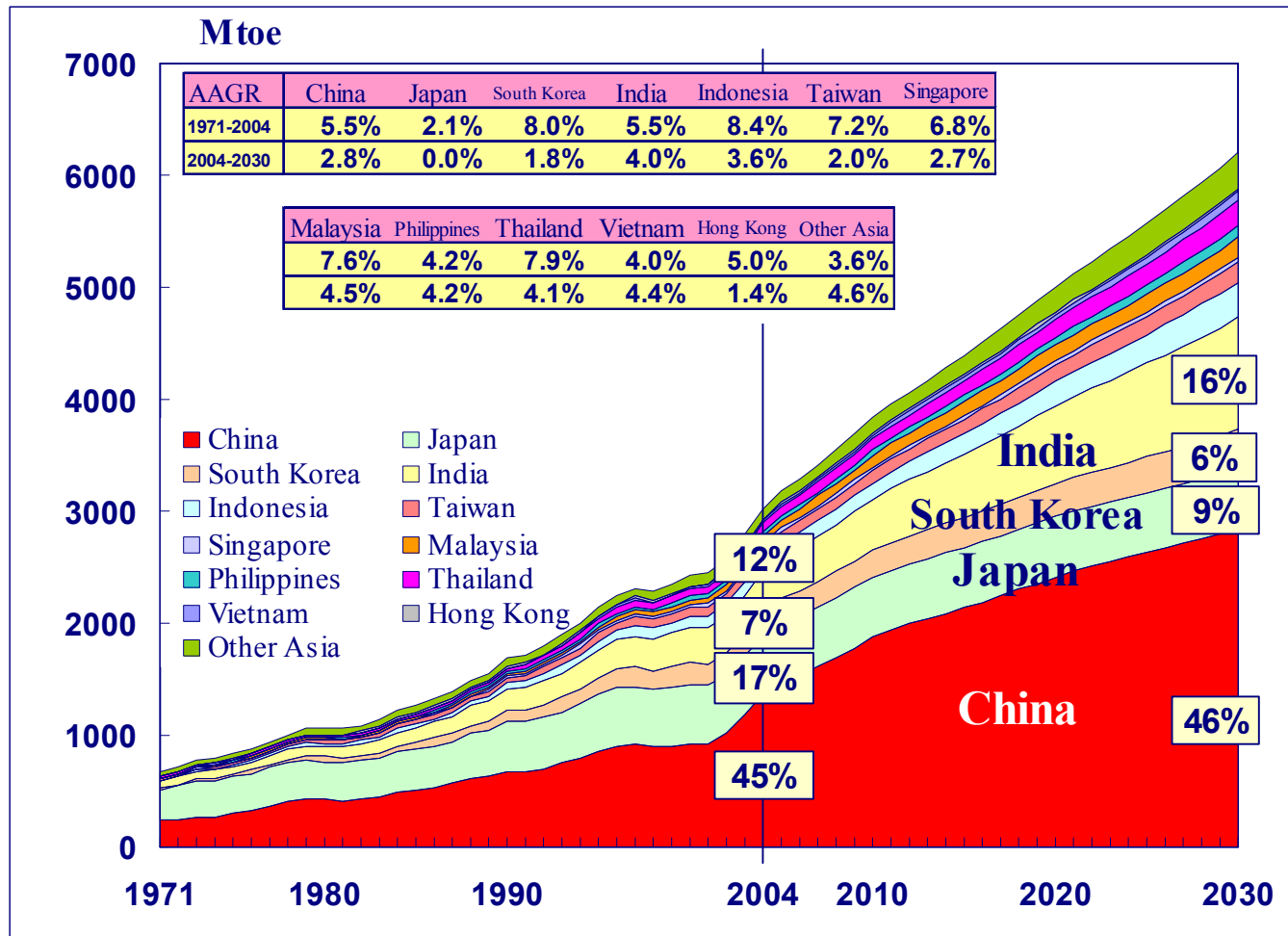


Natural gas-fired is projected to increase significantly worldwide at the highest rate of fossil fuels, through the installation of gas-fired combined cycle gas turbines as preferred option.



Projection Results Overview: Asia

Primary Energy Demand by Region ; Asia



Asia

2004
3.1 billion toe

↓

2030
6.2 billion toe
(2.0-fold increase)

China / India

2004
1.4 bil. toe 0.4 bil. toe

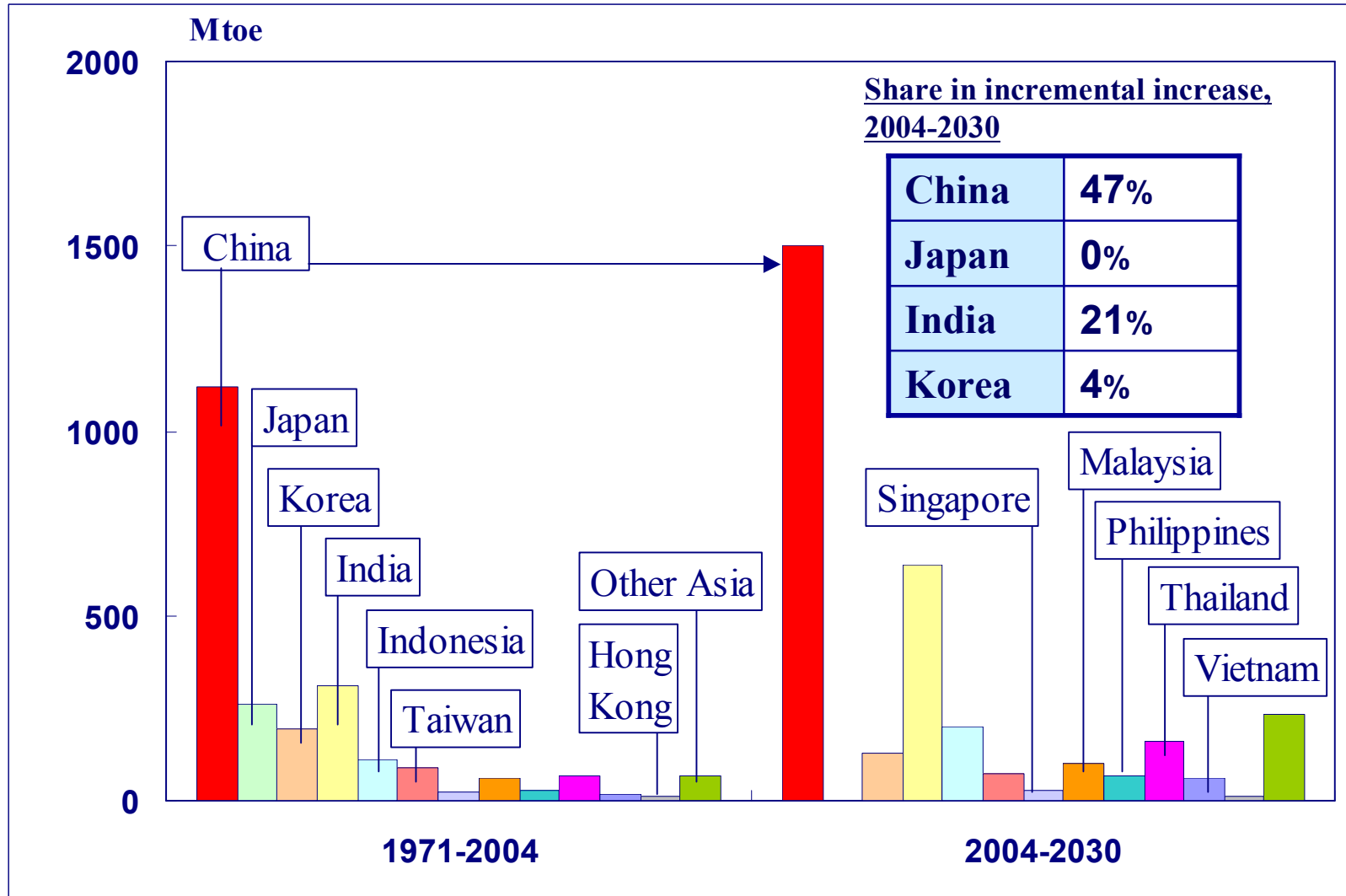
↓

2030
2.9 bil. toe 1.0 bil. toe
(2.1-fold inc.) (2.8-fold inc.)

-Based on strong economic growth, share of China in Asia significantly increases to 46%, China and India 62%.

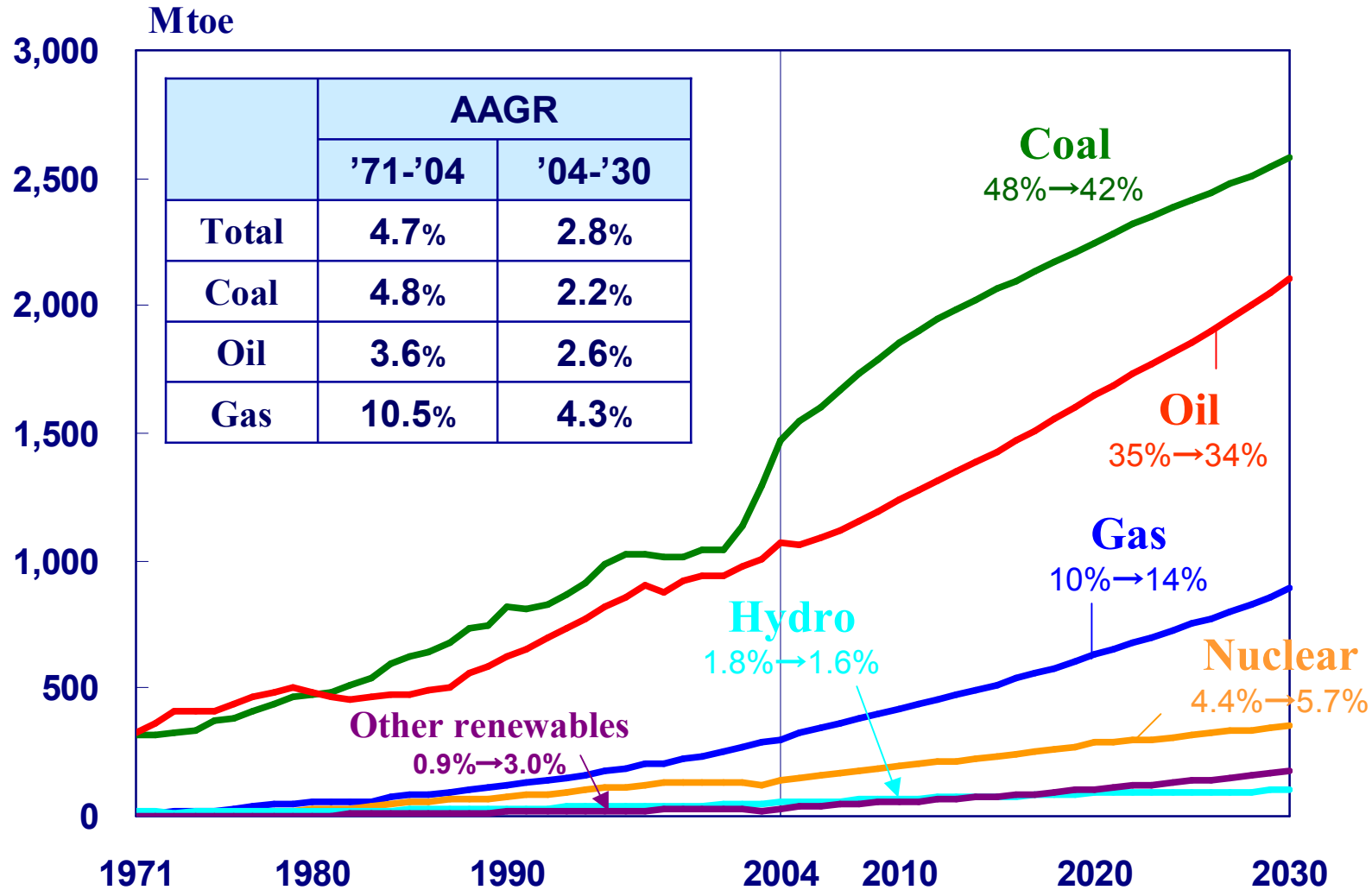
-Japan's energy share in Asia, with its slower-paced economic growth and depopulation, will decline from 17% in 2004 to 9% in 2030.

Incremental Increase in Asian Primary Energy Demand by Region, 2004-2030



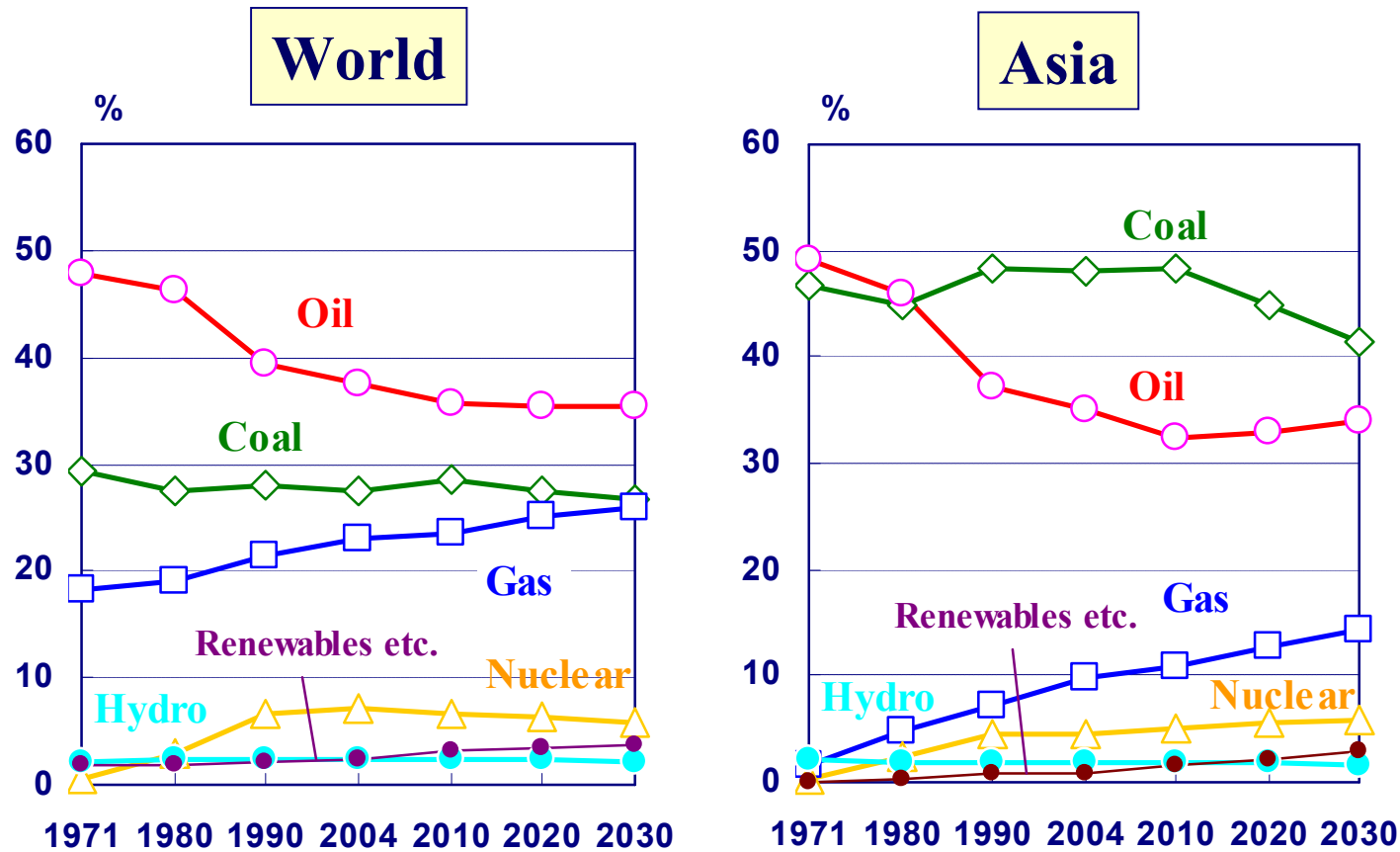
Of total incremental increase in Asia, China and India, as prominent consumers, will account for approximately 70%.

Primary Energy Demand by Fuel ; Asia



- Coal and Oil will continue to maintain its centrality over Asian energy demand by 2030
- The share of natural gas is forecast to grow substantially, driven mainly by power generation

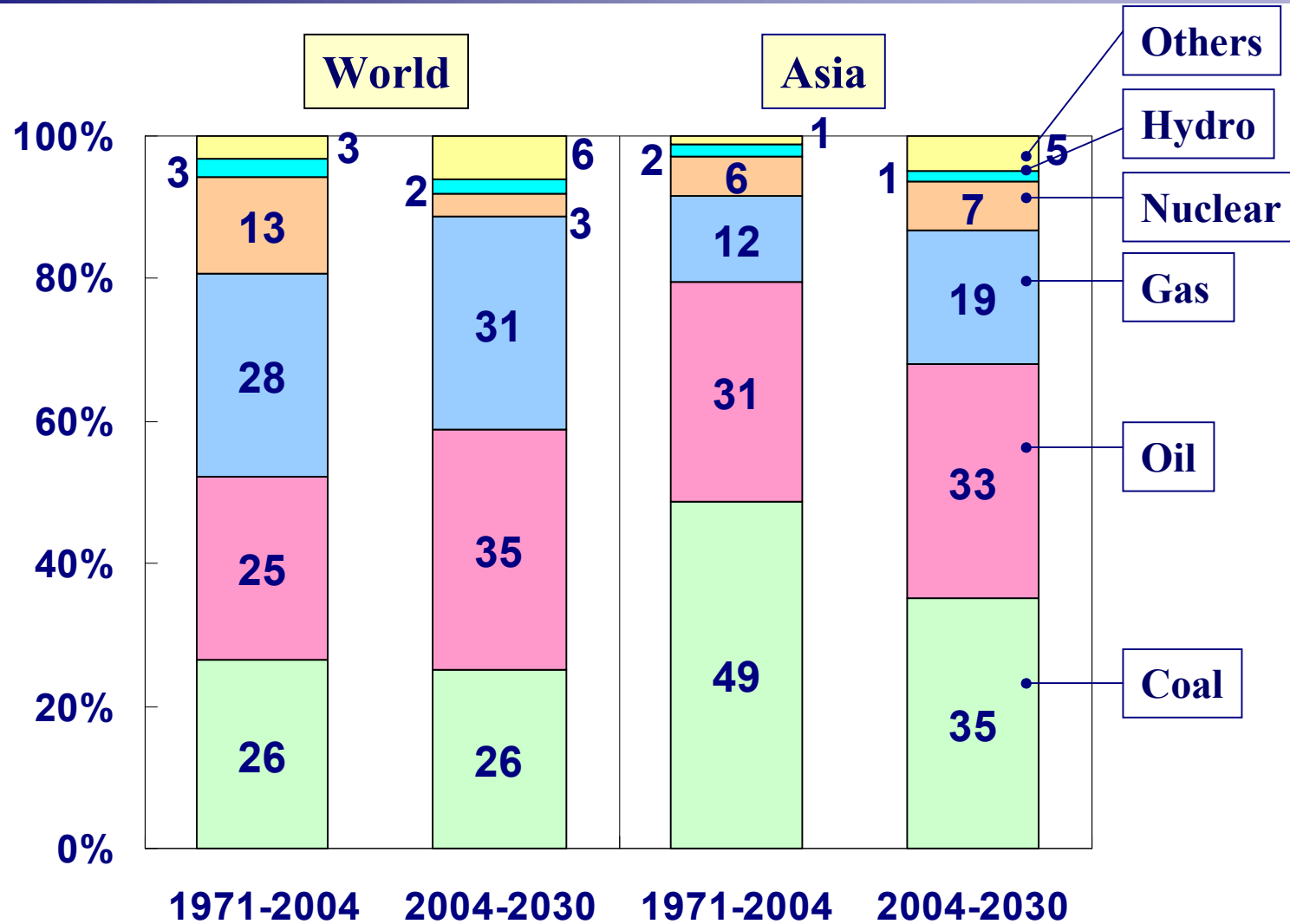
Primary Energy Mix by Fuel; World, Asia



- In Asia, coal remains the largest of primary energy due to electrical power demand increasing for 2030. (Coal share in Asia: 2004:48% → 2030:42%)

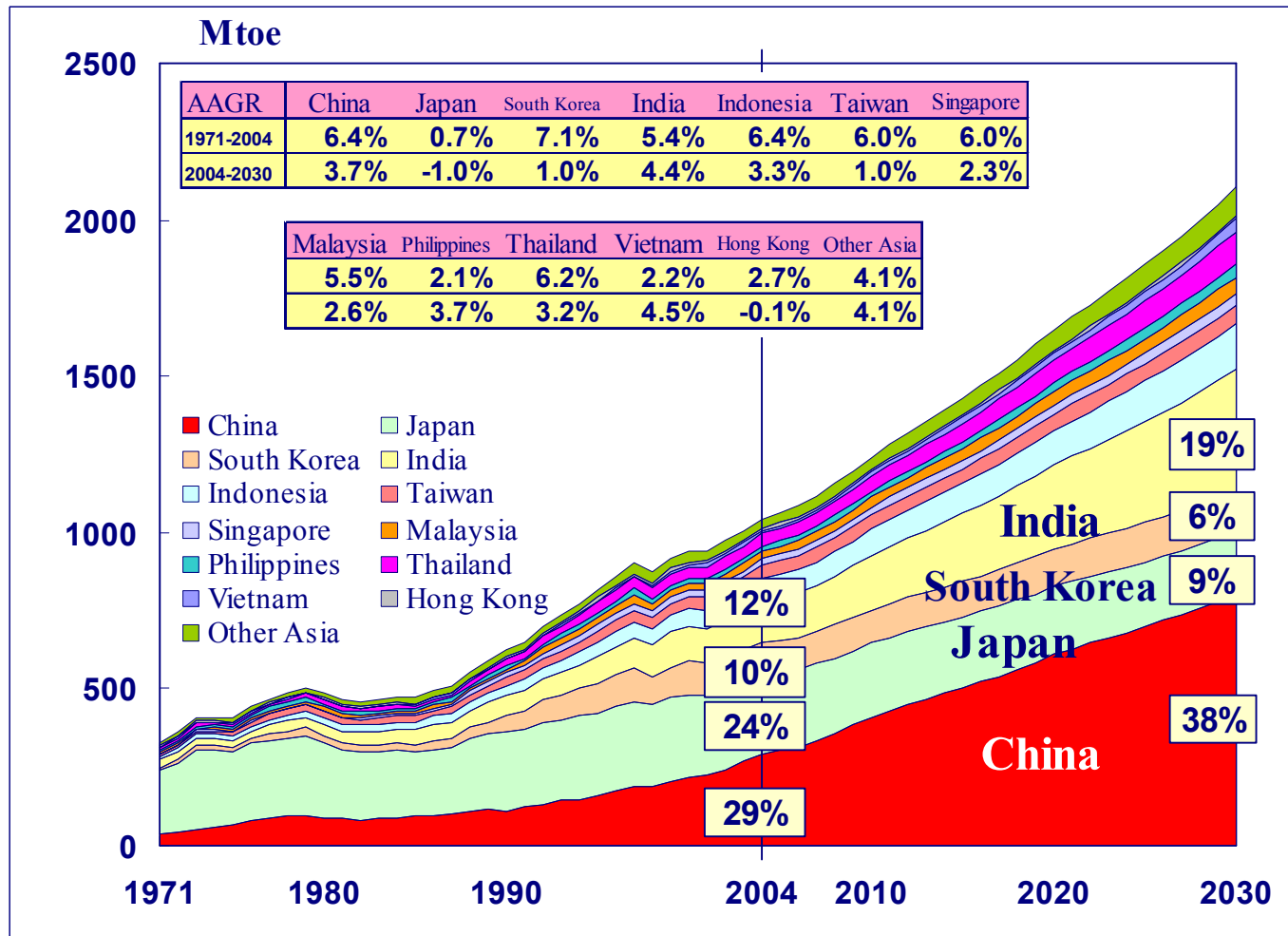
- Nuclear share in Asia gradually increases with active building-up of nuclear power plants in China, India, Japan and South Korea.

Share of incremental increase in World and Asian Primary Energy Demand by Fuel, 2004-2030



- Almost 90% of incremental increase will come from fossil fuels in both world and Asia.
- Of incremental increase in Asia, coal will account for more than 30% for 2030

Oil Demand by Region ; Asia



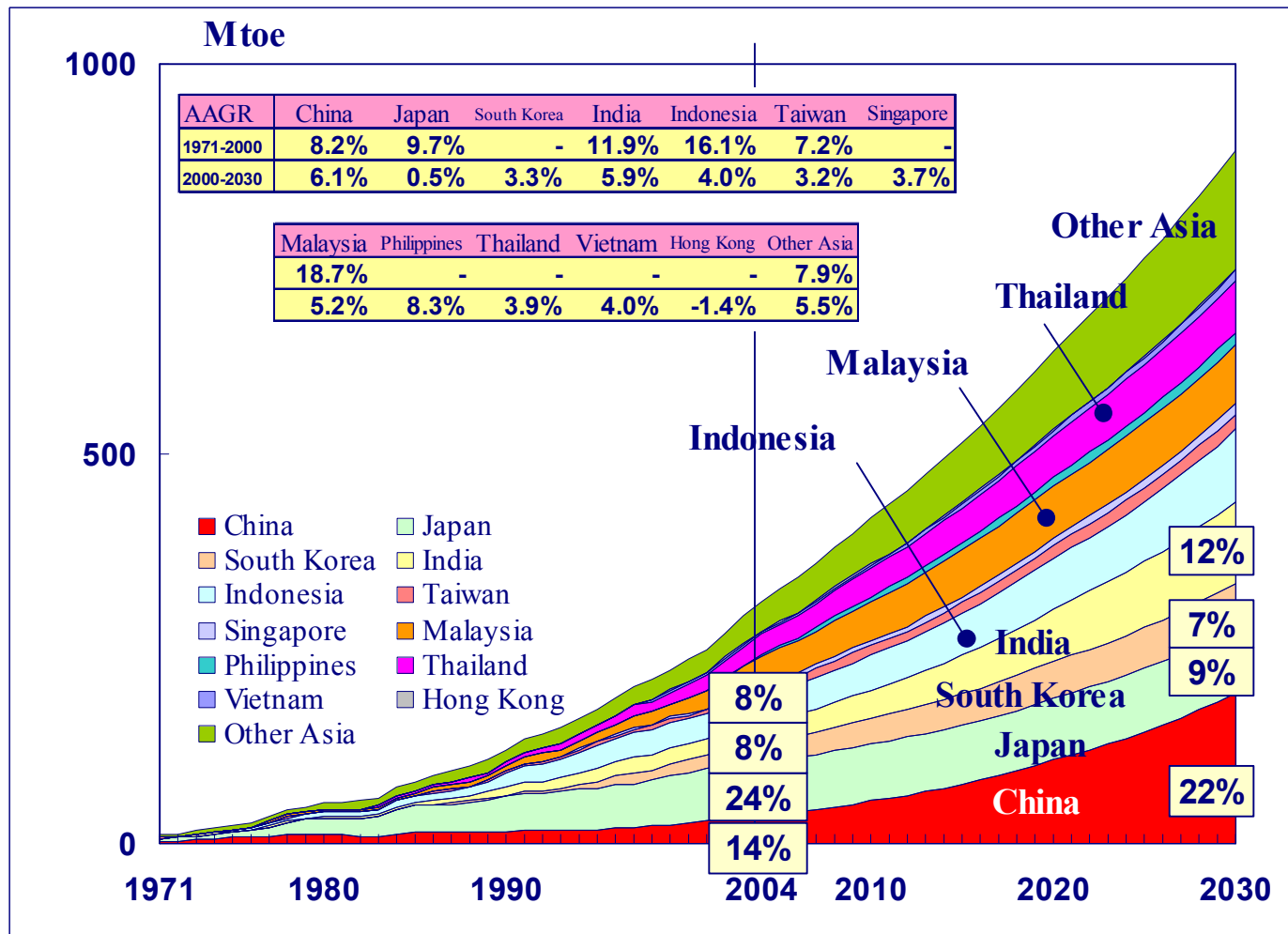
2004
 1.07 billion ton
 (22 mb/d)
 ↓
2030
 2.11 billion ton
 (44 mb/d)

2.0-fold growth
 (22 mb/d growth)

2004	2030
China	China
6.5 mb/d	16.7 mb/d
Japan	Japan
5.3 mb/d	4.1 mb/d
India	India
2.6 mb/d	8.1 mb/d

- Oil demand in China will boost from 6.5 million B/D in 2004 to 16.7 million B/D in 2030, due mainly to its escalating vehicle ownership
- The share of China and India will grow from 41% to 57%

Gas Demand by Region ; Asia



2004
300 Mtoe
 (330 billion m³)
 (240 mil. tonnes LNG)

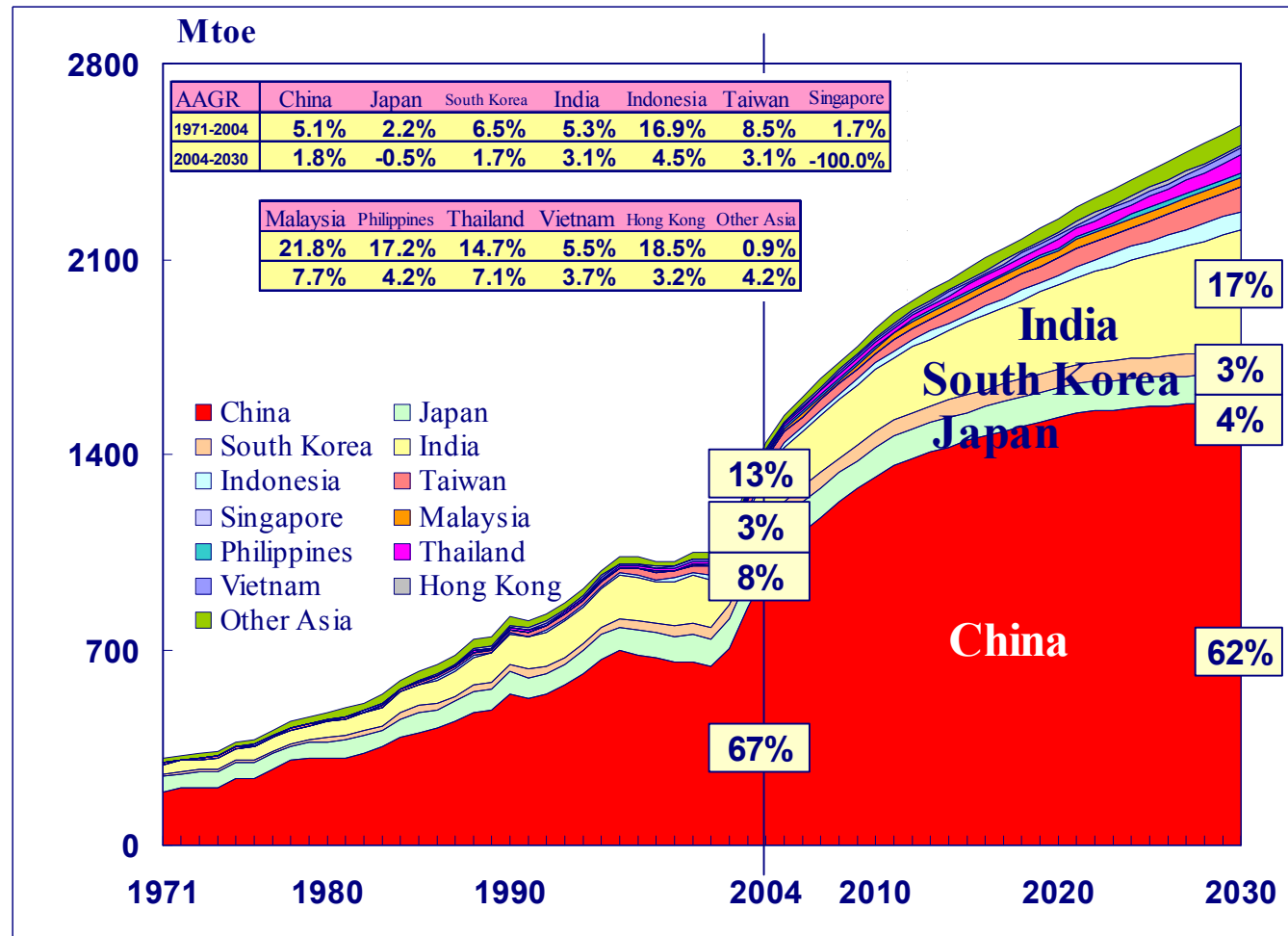
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2030
890 Mtoe
 (990 billion m³)
 (720 mil. tonnes LNG)

3.0-fold growth
 (660 billion m³ growth)
 (480 mil. tonnes LNG)

Gas demand in China will increase substantially, reflecting on increasing demand for power generation, municipal gas use and its environmental advantages

Coal Demand by Region ; Asia



2004
 1.5 billion toe
 (2.1 billion tce)

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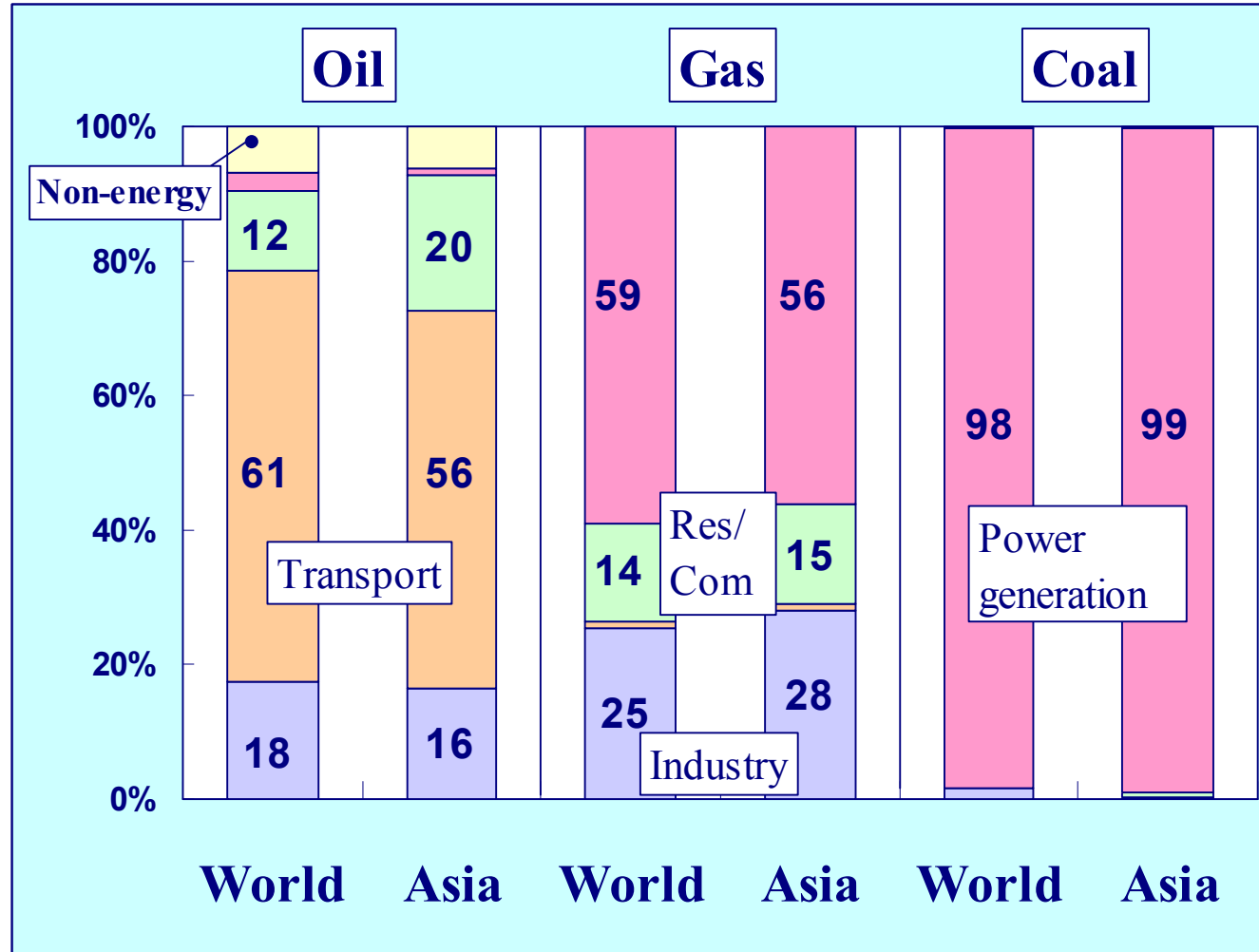
2030
 2.6 billion toe
 (3.7 billion tce)

1.7-fold growth
 (1.6 bil. tce growth)

Coal will become concentrated on power sector, particularly in China, India with abundant availability of domestic reserves, in order to meet growing electricity requirements

Incremental Increase of fossil fuels by Sector in World and Asia

【Incremental Increase in Fossil Fuel by Sector 2004-2030】



Majority of oil will concentrate on transportation, with gas and coal consumed mainly on power generation in both World and Asia

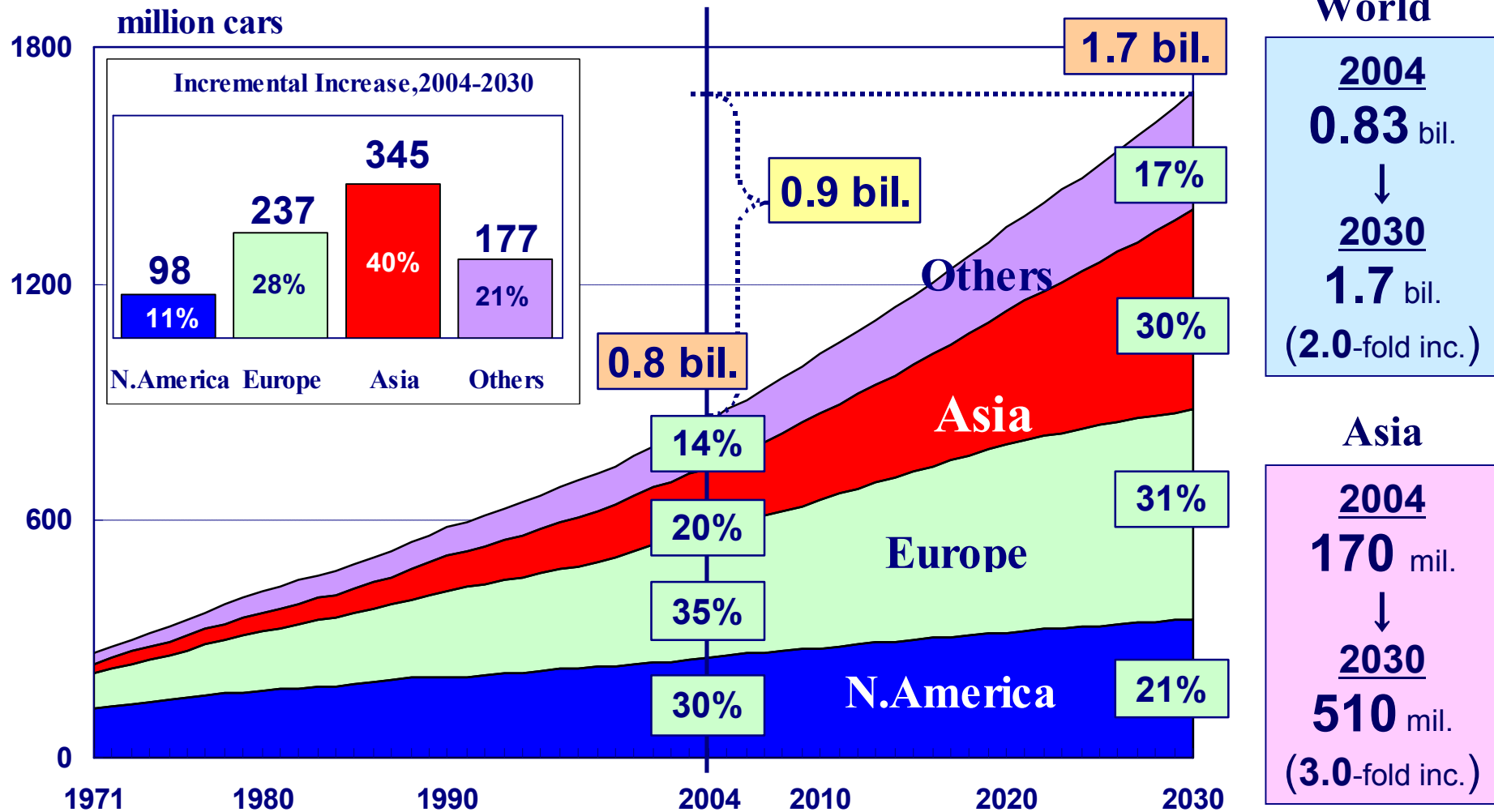
Final Energy Demand ; Asia

(Mtoe)

		Actual		Forecast			AAGR(%)	
		1971	2004	2010	2020	2030	2004/1971	2030/2004
Sector	Industry	268 (53.1)	920 (48.7)	1,045 (47.0)	1,241 (42.7)	1,418 (39.0)	3.8	1.7
	Res/Com	137 (27.3)	498 (26.4)	615 (27.7)	872 (30.0)	1,163 (32.0)	4.0	3.3
	Transport	86 (17.1)	394 (20.8)	491 (22.1)	698 (24.0)	941 (25.8)	4.7	3.4
	Non energy etc.	13 (2.6)	77 (4.1)	85 (3.8)	108 (3.7)	130 (3.6)	5.5	2.0
Energy	Coal	200 (39.6)	469 (24.8)	441 (19.8)	435 (15.0)	401 (11.0)	2.6	-0.6
	Oil	244 (48.4)	882 (46.7)	1,056 (47.5)	1,418 (48.8)	1,823 (50.1)	4.0	2.8
	Gas	11 (2.1)	127 (6.7)	168 (7.6)	256 (8.8)	367 (10.1)	7.8	4.2
	Electricity	50 (9.9)	364 (19.3)	483 (21.7)	687 (23.6)	910 (25.0)	6.2	3.6
	Heat	0 (0.0)	42 (2.2)	71 (3.2)	105 (3.6)	133 (3.7)	-	4.5
	Renewables	0 (0.0)	5 (0.2)	5 (0.2)	6 (0.2)	6 (0.2)	-	0.9
Asia		504 (100.0)	1,888 (100.0)	2,224 (100.0)	2,906 (100.0)	3,639 (100.0)	4.1	2.6

- Transportation and Res/Com sector represent higher increasing rate, on the basis of pursuing for comfortable lifestyle in Asia
- The share of electricity and oil accounts for 25% and 50% respectively in total final demand, based on modernization of energy use supported by income increasing

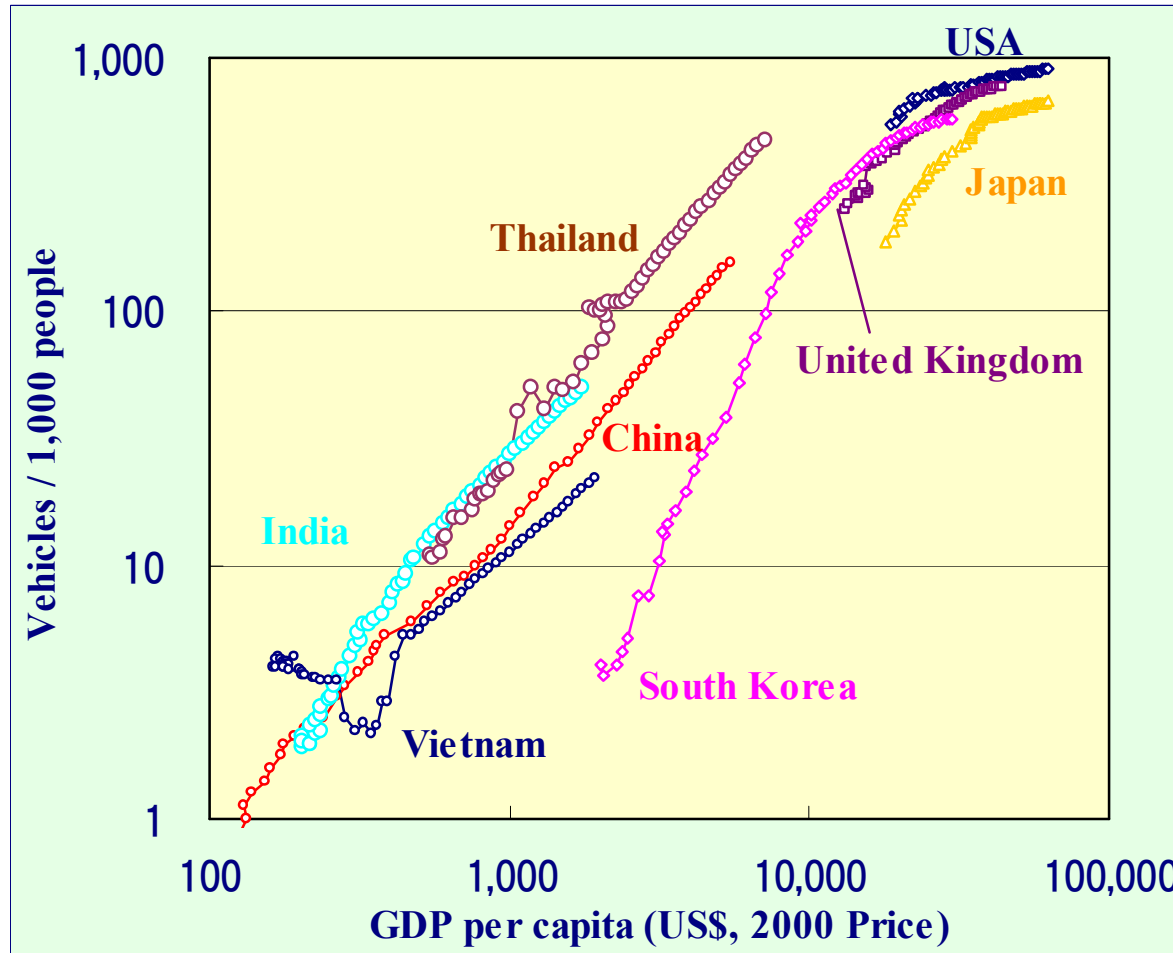
Vehicle Ownership ; World



Approximately 40% of incremental increase comes from Asia, with ownership increase in developed countries representing saturation trend.

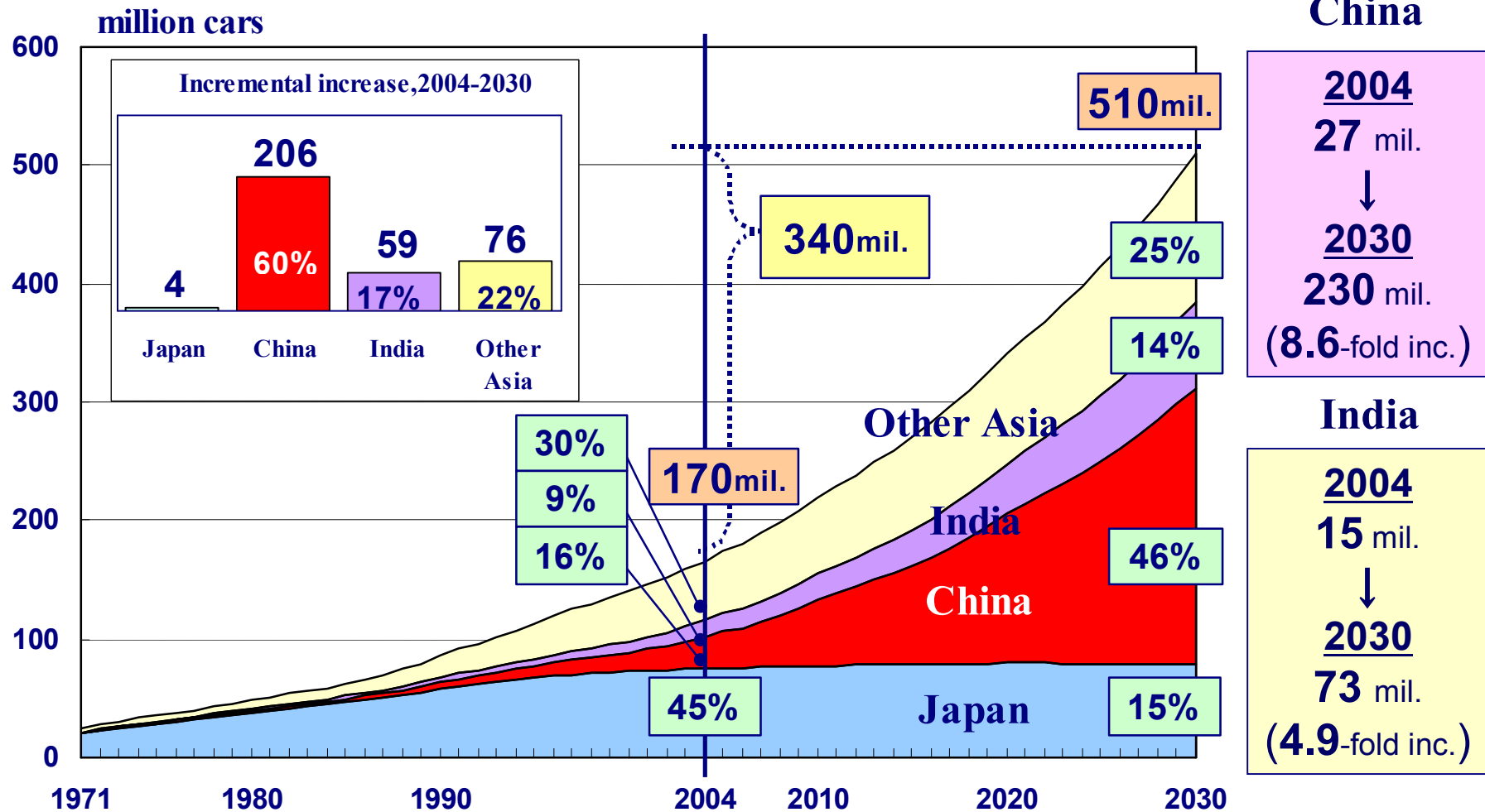
Vehicle Intensity (Selected Countries)

Including both actual and forecast results, 1971-2030



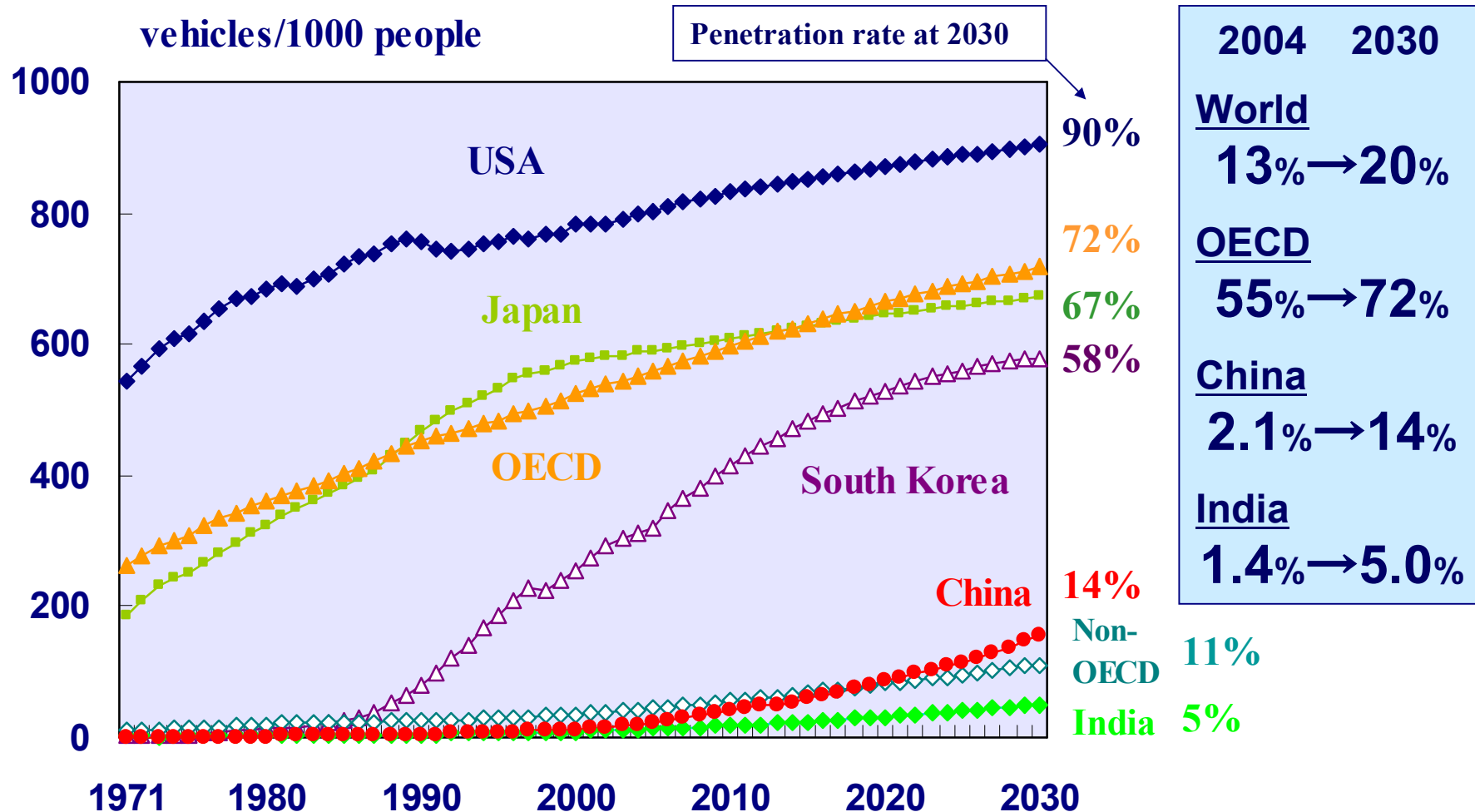
In China and India, the automobile holding rate will increase steadily with rising income level.

Vehicle Ownership ; Asia



China will register substantial growth of vehicle ownership, with Japan representing shallow rising trend

Vehicle Ownership Rate

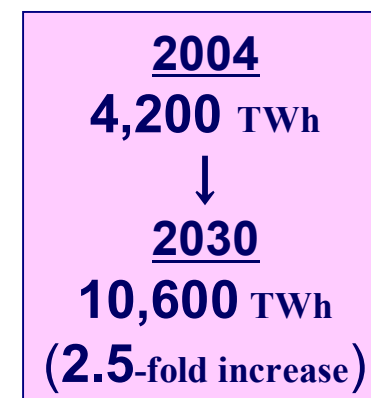


- Vehicle penetration will make progress mainly in Asian nations, the majority of which achieve higher economic growth.
- Although vehicle ownership is projected to expand vigorously in China and India, the automobile holding rate will still remain well below the developed countries; After 2030, these countries have a large room to grow, as a result.

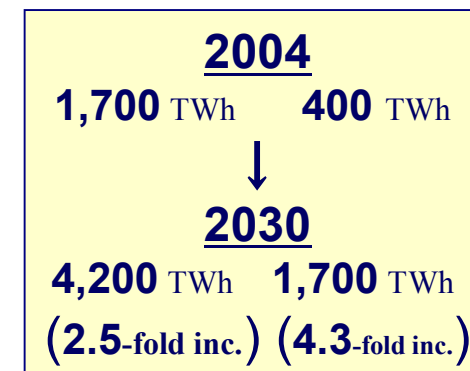
Electricity Demand ; Asia

AAGR, %	Electricity Demand		Final Energy Demand	
	1971-2004	2004-2030	1971-2004	2004-2030
USA	2.9	1.7	0.8	1.0
China	8.6	3.5	4.8	2.4
Japan	3.2	0.8	1.8	-0.2
South Korea	11.5	2.4	7.4	1.8
India	6.8	5.3	4.3	4.3
Indonesia	13.0	6.7	7.9	3.6
Malaysia	10.0	6.4	7.1	4.1
Thailand	10.4	5.8	7.2	4.4
Philippines	5.2	5.1	3.5	4.5
Asia	6.2	3.6	4.1	2.6
OECD	3.2	1.5	1.3	0.7
Non-OECD	4.9	3.7	3.0	2.6

Asia

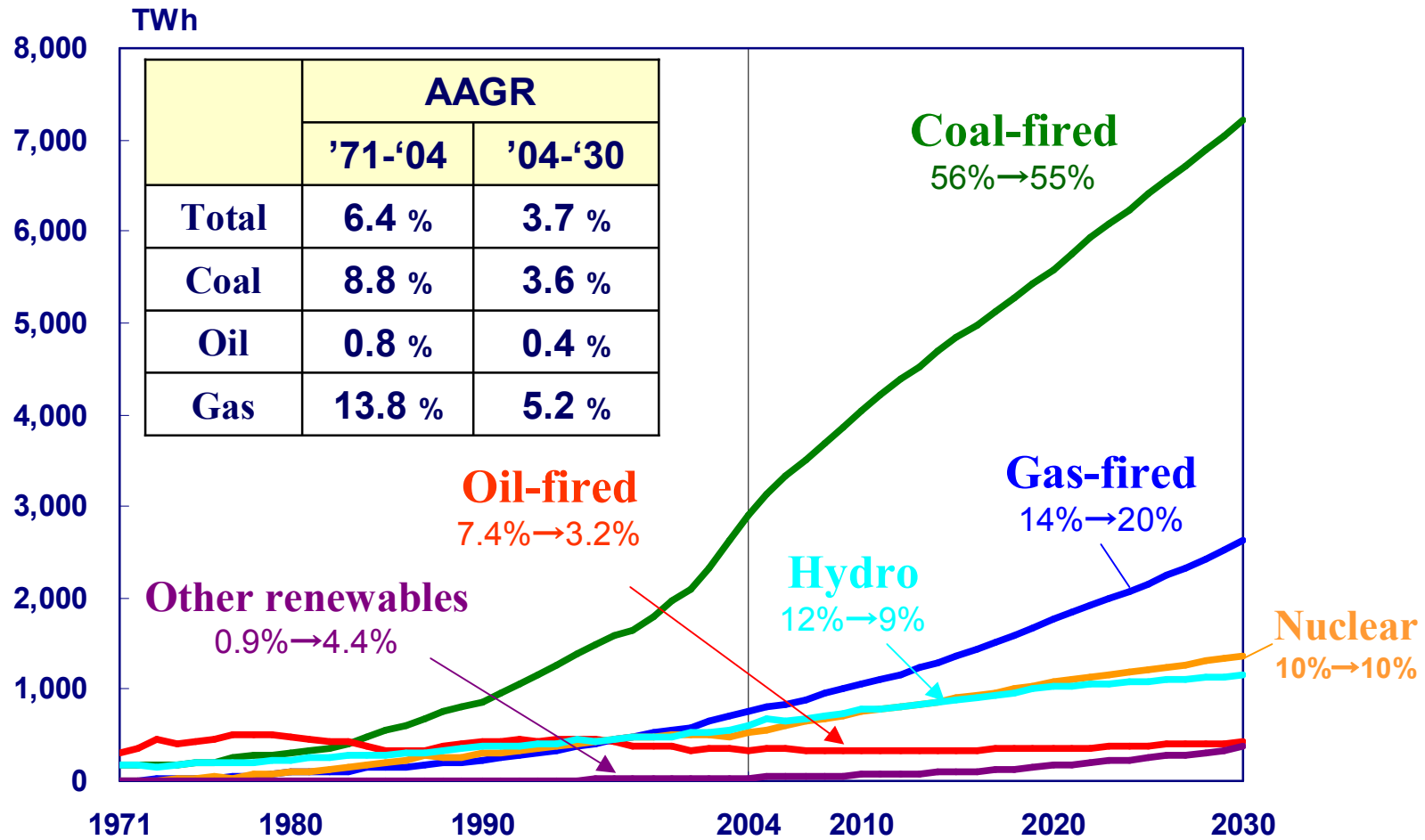


China / India



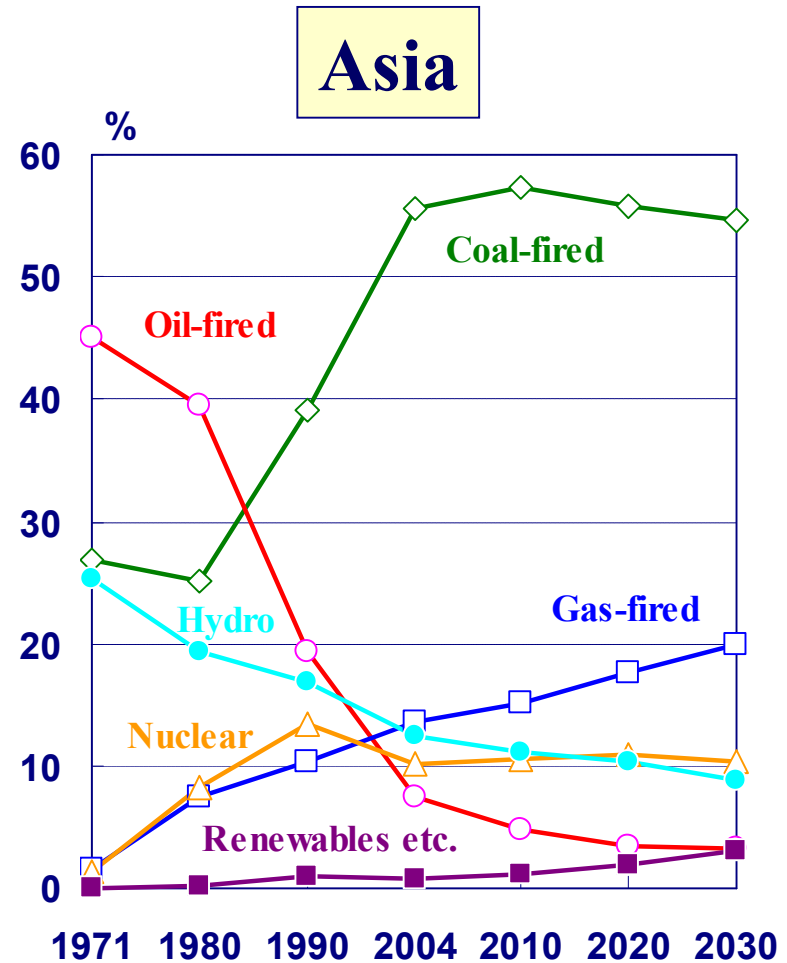
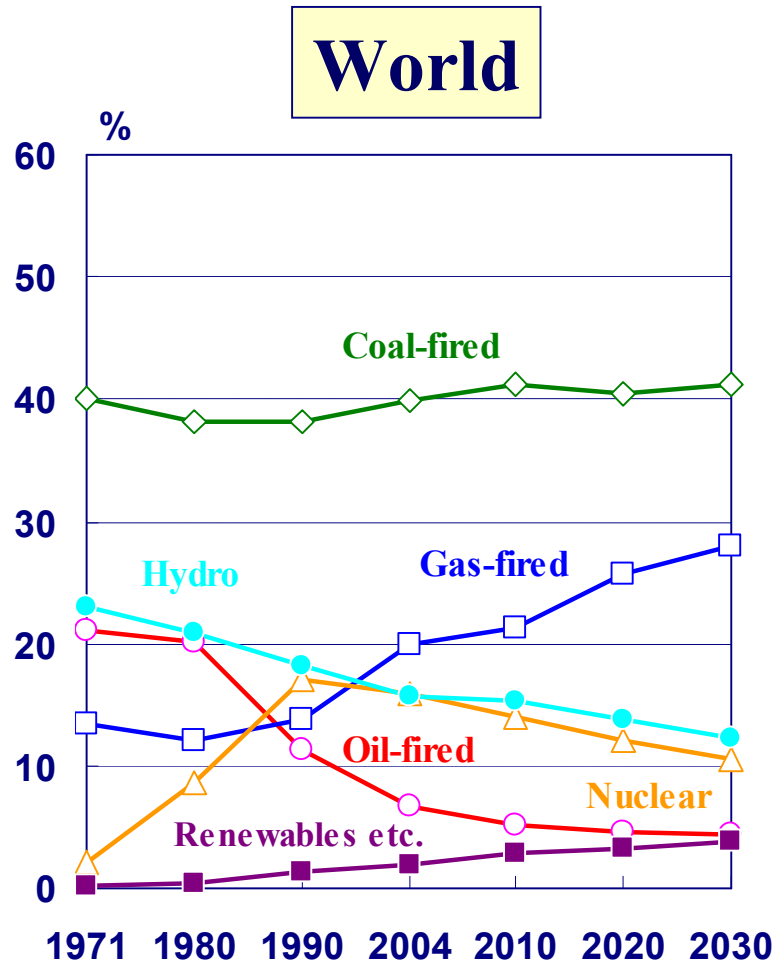
Asia's electricity demand will rapidly increase by sophistication of energy utilization driven by improvement of living standard.

Power Generation Mix by Fuel ; Asia



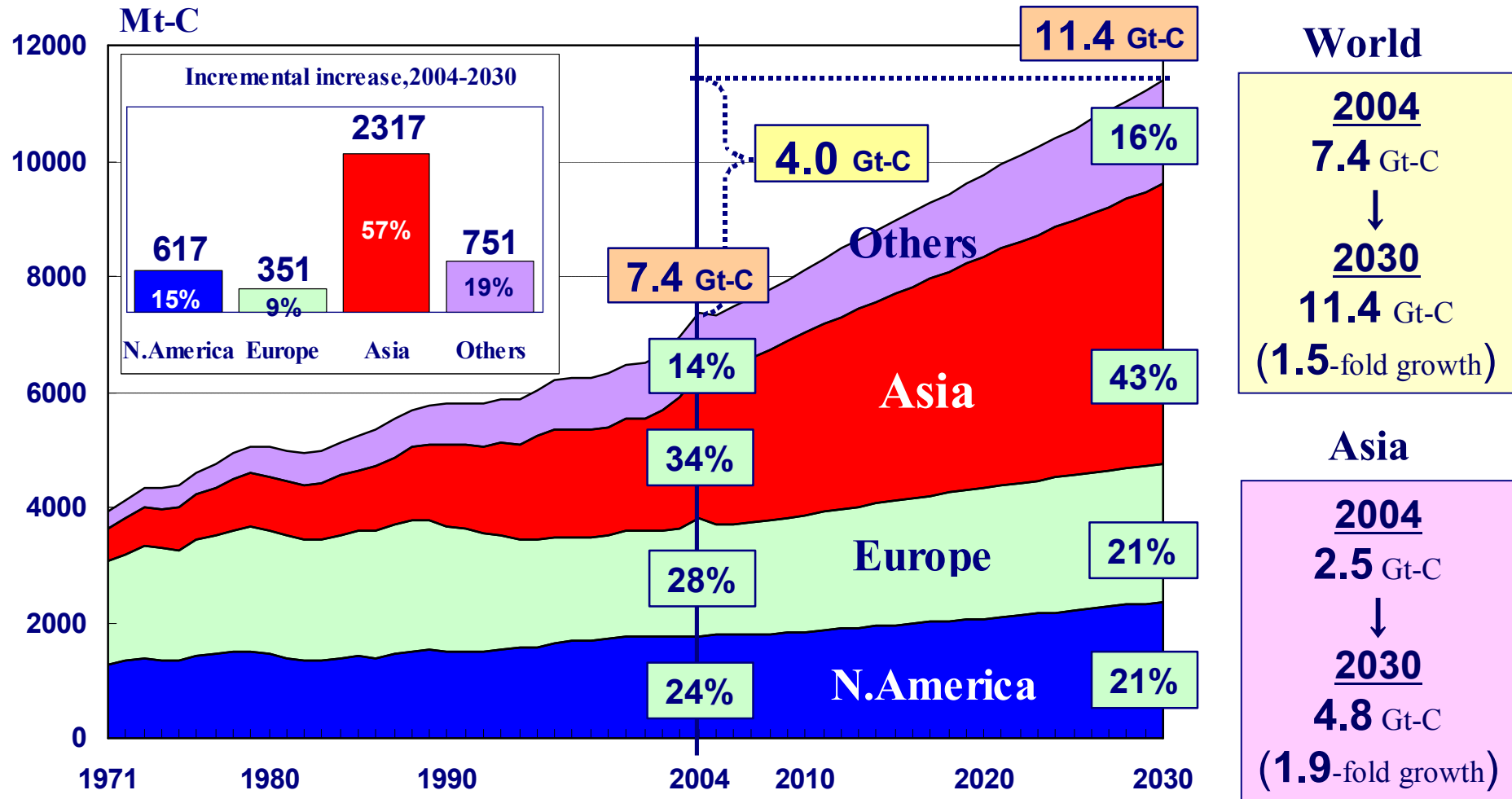
- The share of coal will continue to remain approximately 60%, reflecting on abundant resources and its economic advantages in Asian regions.
- Gas will exhibit a growing trend, which share eventually expands to around 20% by 2030
- The share of nuclear also continue to remain 10% ; Nuclear plays a important roll in power generation mix.

Asian Power Generation Mix by Fuel; World, Asia



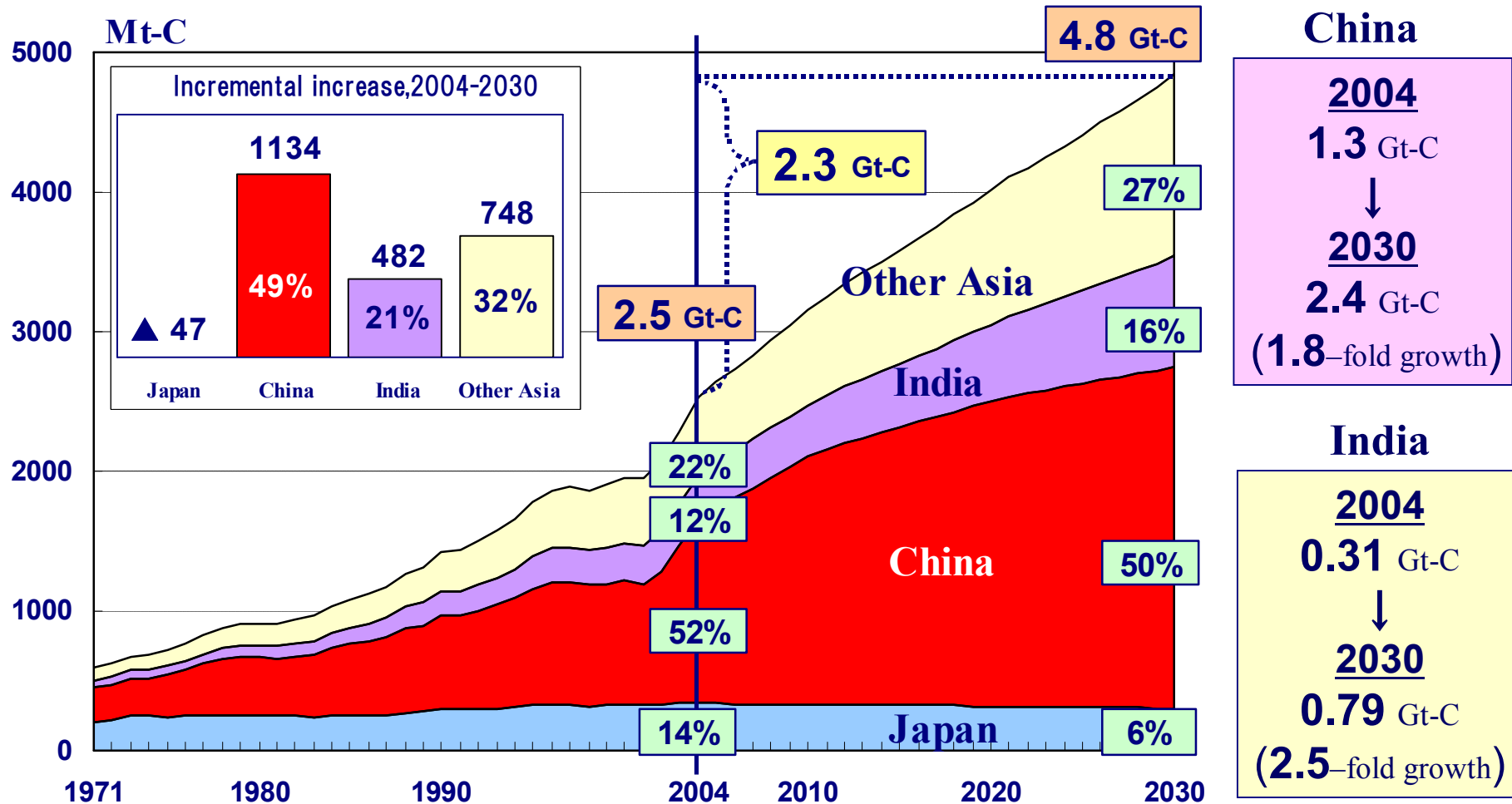
Asian region will cope with rapid growth of electricity demand chiefly by coal and gas

CO₂ Emissions by Region ; World



Incremental increase in Asia will account for around 60%, with N.America and Europe together responsible for 20%

CO₂ Emissions by Region ; Asia



CO₂ emissions of China and India will steadily increase driven by coal consumption, the share accounting for 66% together in Asia.



Energy outlook of major Asian countries

Government Energy Policies in China

[Summary of the 11th 5-year-plan]

■ Basic policy : Resource Conservation and Environmental Protection

△ The Target of Economic Growth: 7.5% annually

△ The Target of Energy Conservation:

Improvement of Energy Intensity (TPES/GDP) by roughly 20% from 2005 to 2010

△ Energy Conservation Policy: Improvement of industrial structure, Promotion of advanced technology, Enhancement of energy administration, Reinforcing the control of energy-intensive industries, Promoting oil-savings technology and alternative energy

■ Points of Energy policy by Sector

Coal: Well Controlled Development: Building up of Large Scale Coal Supply Site

Electricity: Ambitious Development: Enhancement of conversion efficiency in fossil fuel fired power plant, active development of nuclear power plant

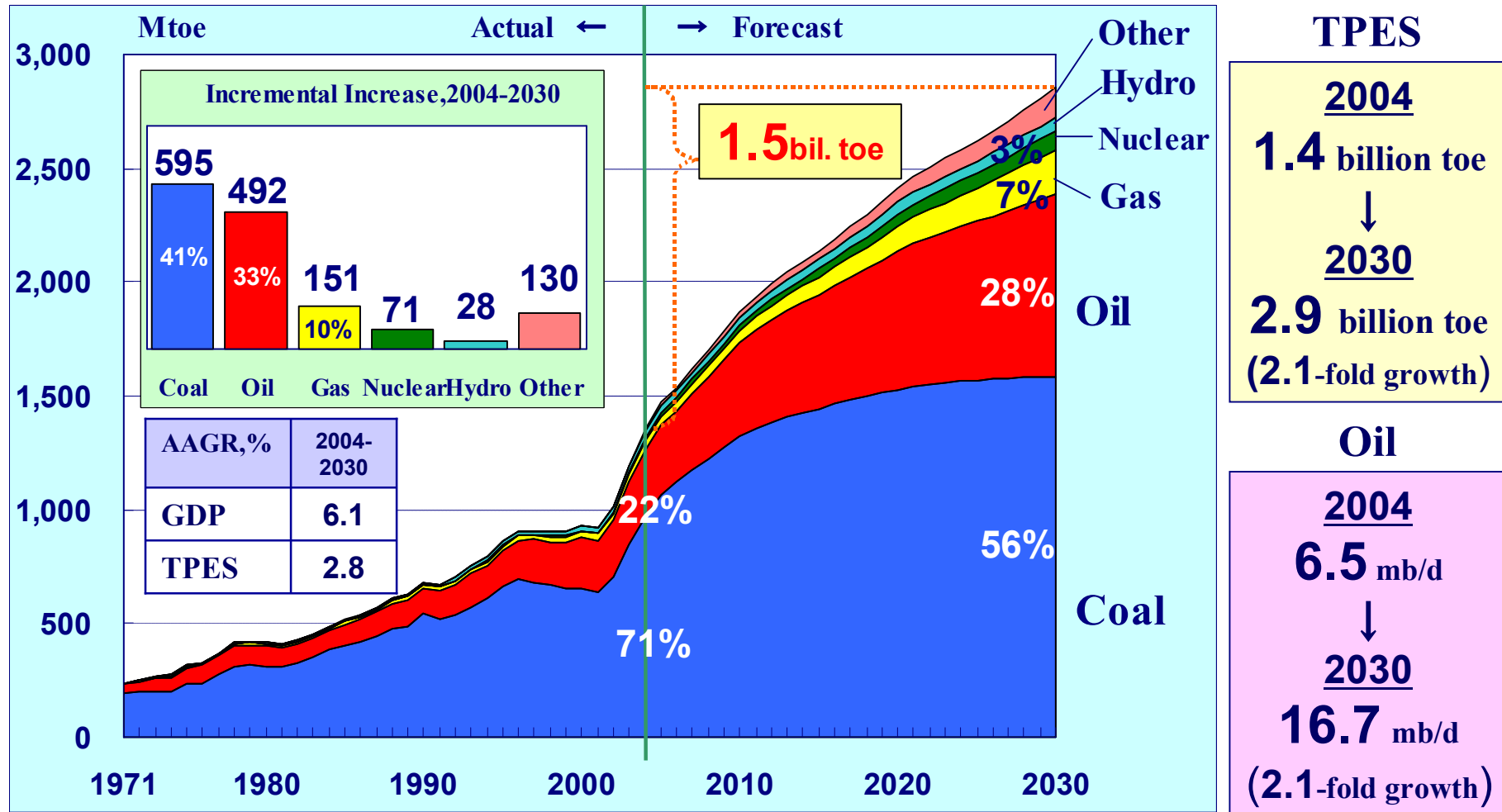
Crude oil and gas: Boosting Acceleration: Acquiring Foreign equity, Building up LNG gasification plant, Expanding National Stock Piling of oil

Renewable: Strong Implementation: Expansion of the share in Primary Energy

Energy Conservation: Strengthen the Implementation

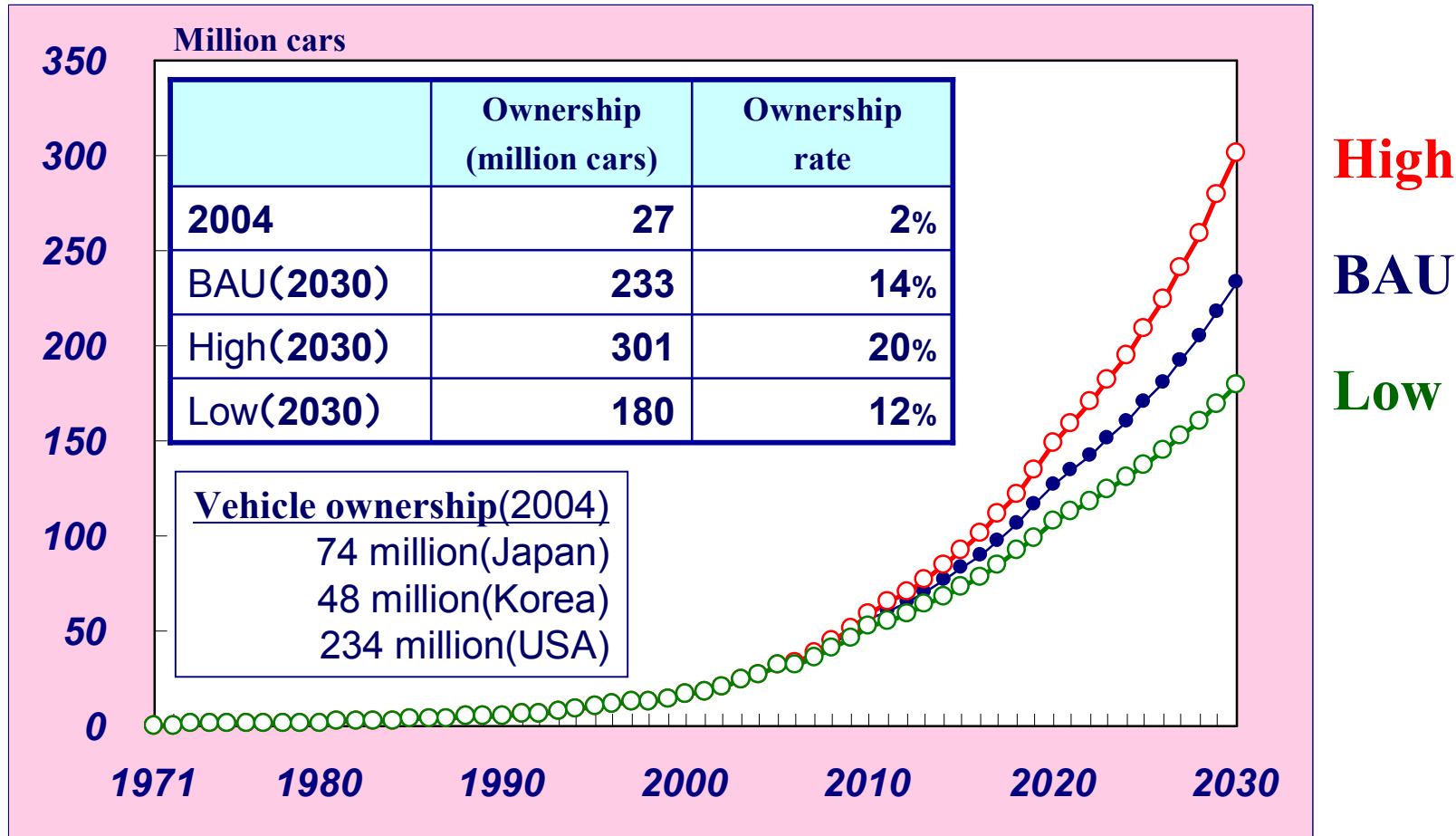
Establishment of the guideline for Energy Conservation, Exploration 10 projects

Primary Energy Demand in China



- Around 40% of incremental increase will be responsible for coal, 30% for Oil
- Although the dependence on coal will slightly decline, it still remain dominant fuel in China
- Oil increase will be stemmed from transportation, gas increase from res/com and power sector **47**

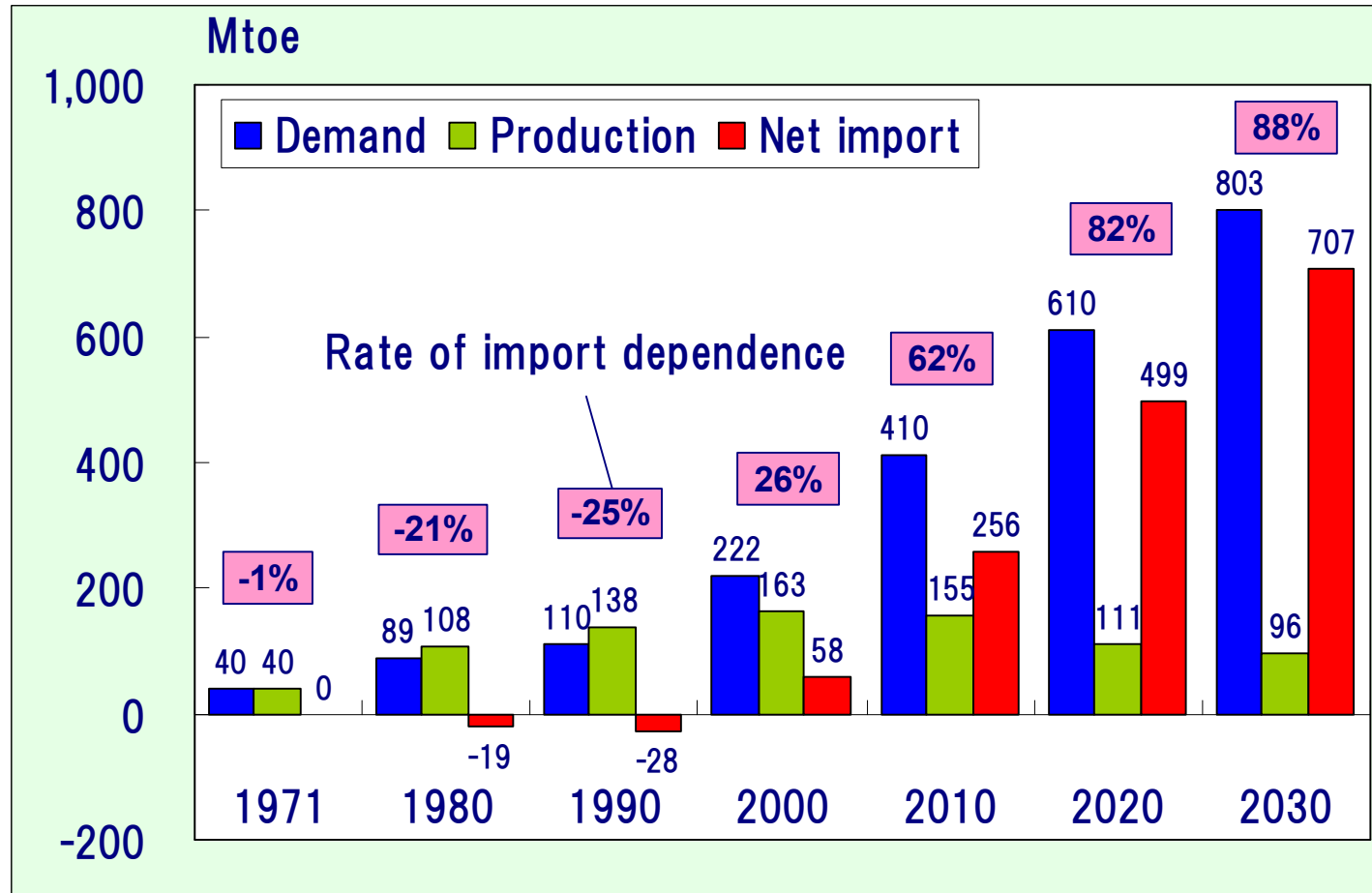
Vehicle Ownership in China



GDP Growth Scenarios 2004-2030

▪ **BAU :6.1%** ▪ **High :7.2%** ▪ **Low :5.1%**

Oil Demand and Supply in China



Net Oil Import

2005
3.1 mb/d

↓

2030
14.7 mb/d
(4.7-fold growth)

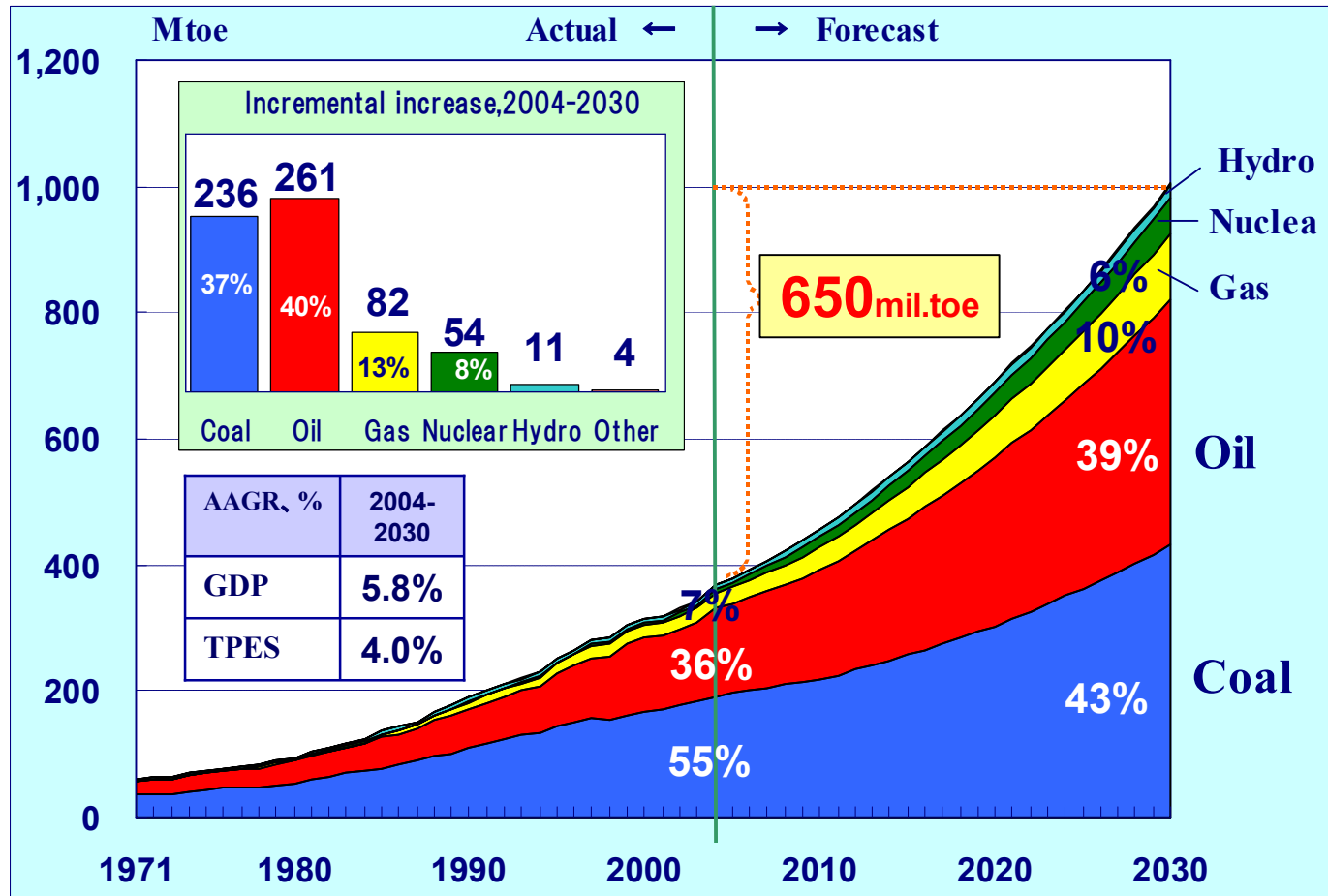
• Net import of oil, representing shortfall of supply, is projected to expand from 150 mil.ton(3.1mb/d) in 2005 to 710 mil. ton(14.7mb/d) in 2030.

• Rate of import dependence will register approximately 90% caused by decline in supply of major domestic oil field such as Daqing.

Government Energy Policies in India

- *Energy Policies in the 10th 5-year plan(2002)*
 - *Strengthen Coal and Electric Power Supply*
 - *Exploration and Development of Oil and Natural Gas*
 - *Acquiring Foreign Oil Equity*
 - *Reforming of Energy Sector*
 - *Enhancement of Energy Efficiency through DSM*
 - *Prevention of Environmental Contamination*
 - *Comprehensive Energy Strategy*
- *Actual implementation of respective policy does not work effectively, because each policy is developed independently by five related ministry and ministries cannot co-operated with each other.*

Primary Energy Demand in India



TPES

2004
0.4 billion toe

↓

2030
1.0 billion toe
(2.8-fold growth)

Oil

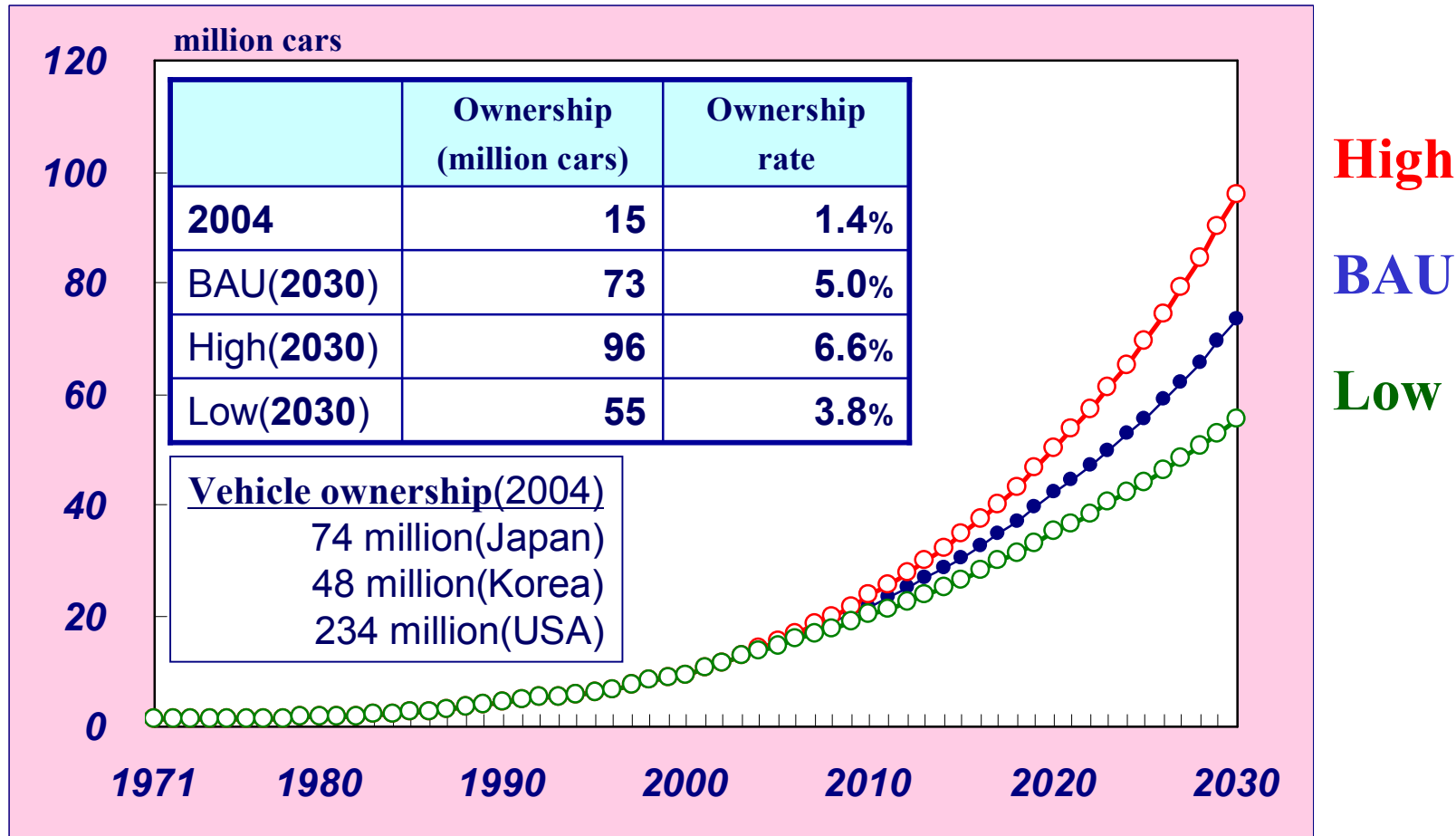
2004
2.6 mb/d

↓

2030
8.1 mb/d
(3.1-fold growth)

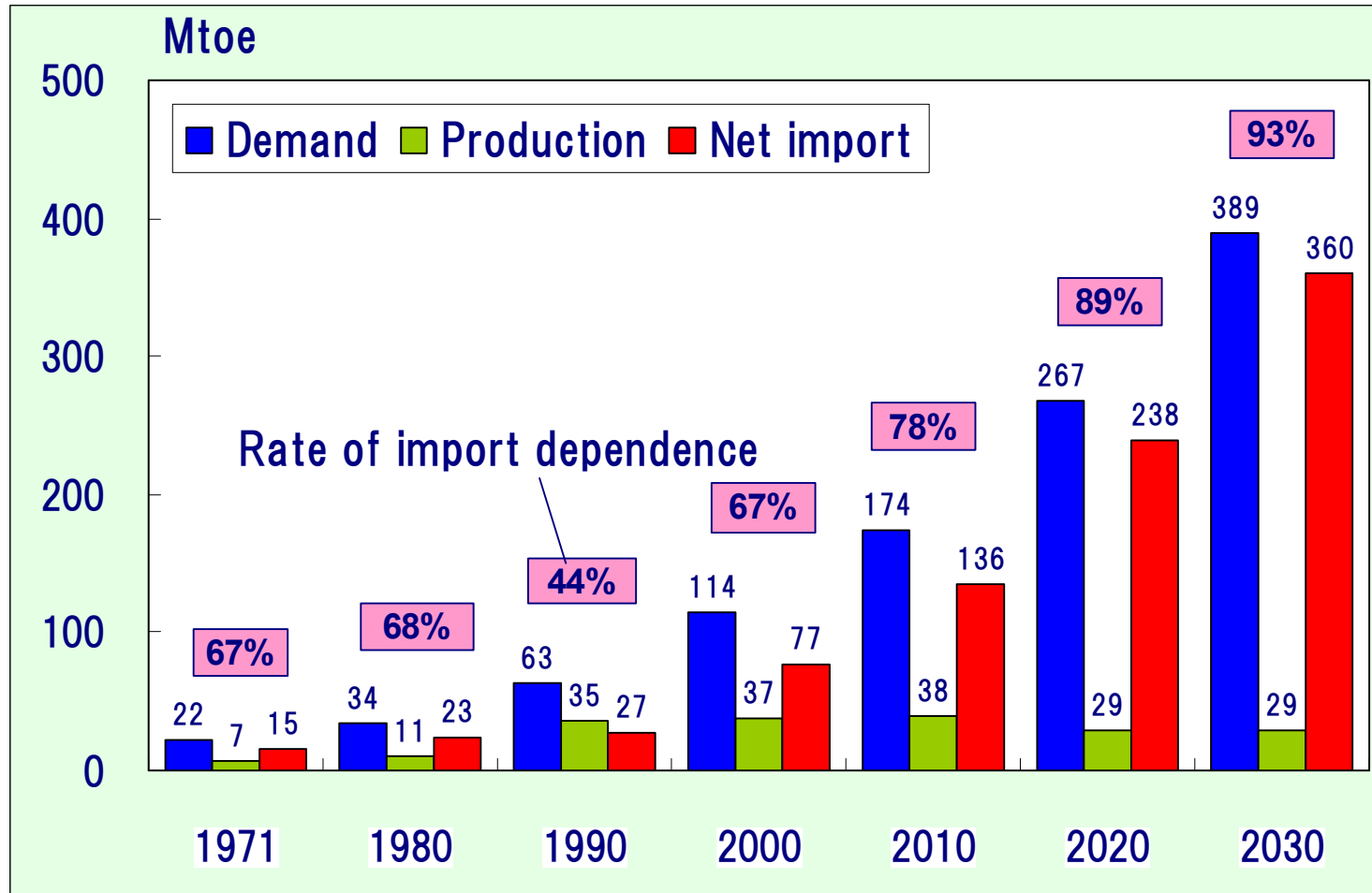
- 40% of incremental increase will be responsible for oil with steadily economic growth and expansion of vehicle ownership.
- Abundant availability of coal will deal with boosting electric power demand.
- Rapid increase of gas demand mainly driven by electric sector will be responsible for LNG import.

Vehicle Ownership in India



GDP Growth Scenarios 2004-2030		
BAU: 5.8%	High: 6.8%	Low: 4.8%

Oil Demand and Supply in India



Net Oil Import

2005
1.7 mb/d

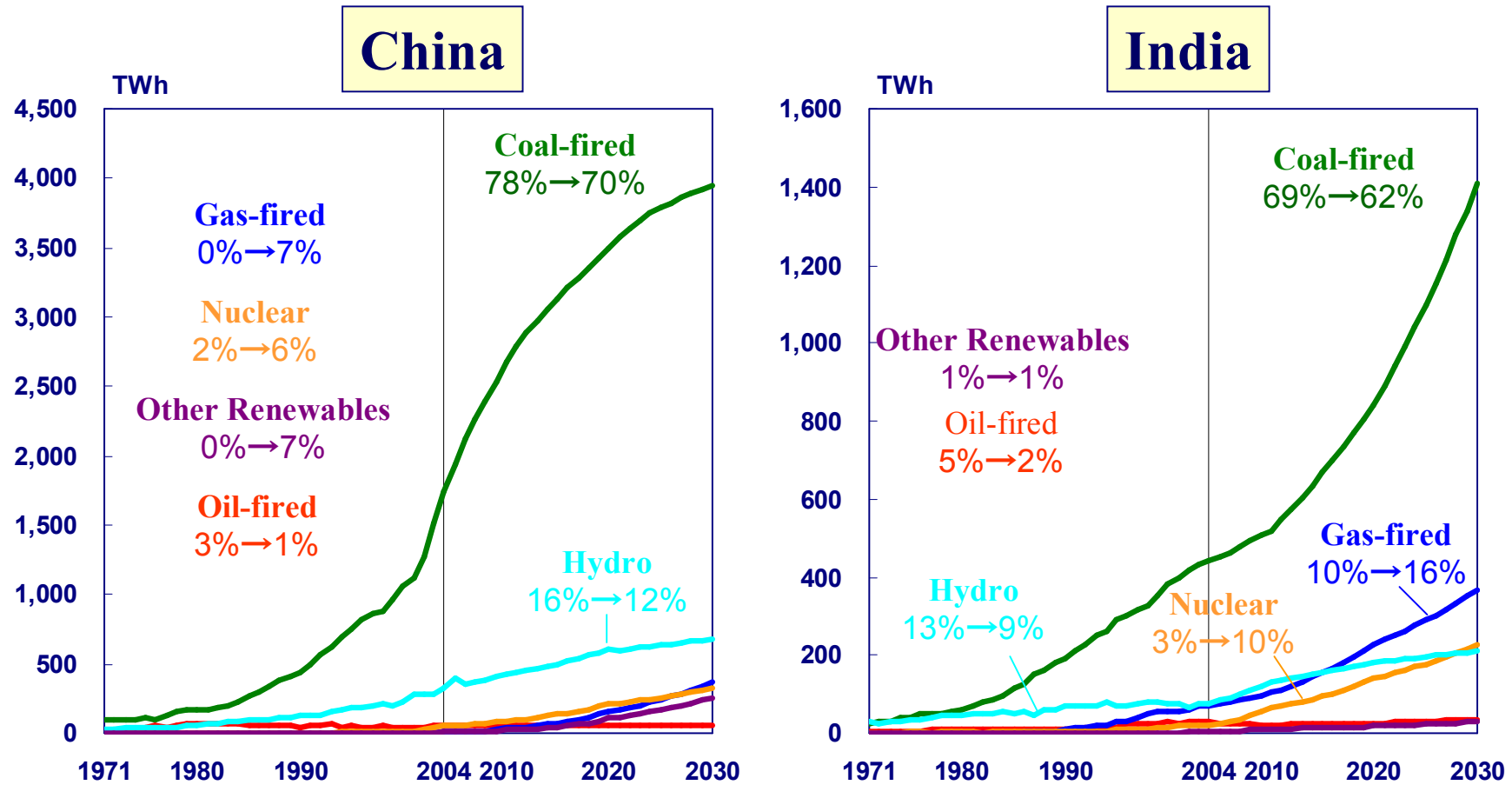
↓

2030
7.5 mb/d
(4.4-fold growth)

- Net oil import is projected to expand from 80 million ton (1.7 mb/d) in 2005 to 360 million ton (7.5 mb/d) in 2030.

- Rate of import dependence will show approximately 90% caused by slowdown of domestic oil production.

Power Generation Mix in China and India



In both China and India, coal-fired continues to remain major power source, although power generation mix will be diversified due to gas-fired and nuclear.

Primary Energy demand (Thailand, Vietnam, Taiwan)

Annual average growth(%)	2004-2030
GDP	4.9
TPES	4.1

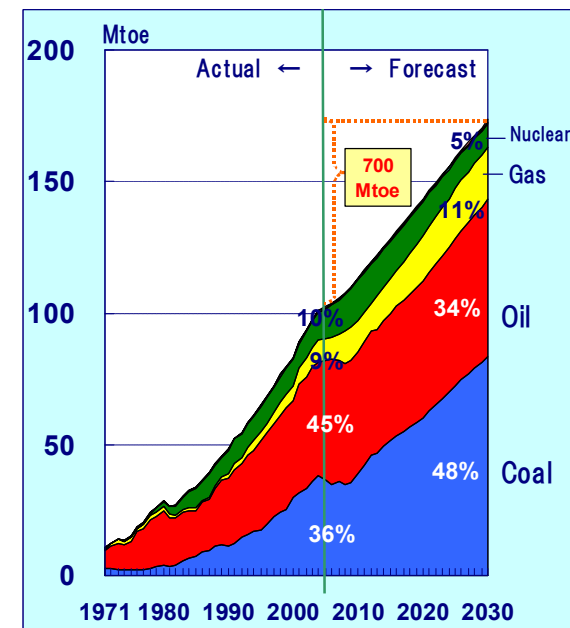
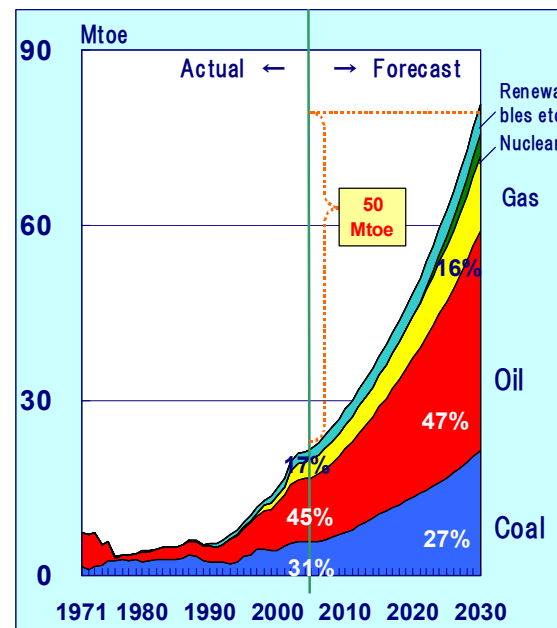
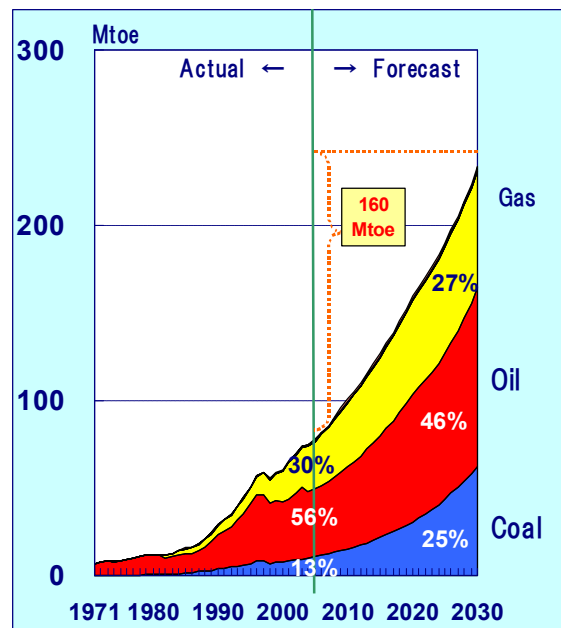
Thailand

Annual average growth(%)	2004-2030
GDP	6.5
TPES	4.4

Vietnam

Annual average growth(%)	2004-2030
GDP	3.2
TPES	2.0

Taiwan



-Thailand: Government energy policy promotes the expansion of coal use mainly for power generation on the purpose of preservation of domestic oil and natural gas resources.

-Vietnam: Vehicle ownership will increase, thereby making oil remaining dominant fossil fuel.

-Taiwan: Particularly in power sector, oil share will decrease, gas share expanding.

Primary Energy Demand (Korea, Indonesia, Malaysia)

Annual average growth(%)	2004-2030
GDP	3.5
TPES	1.8

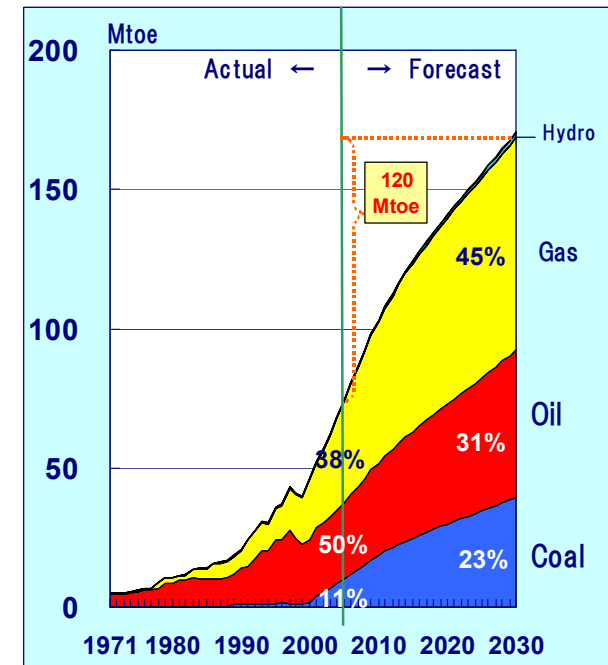
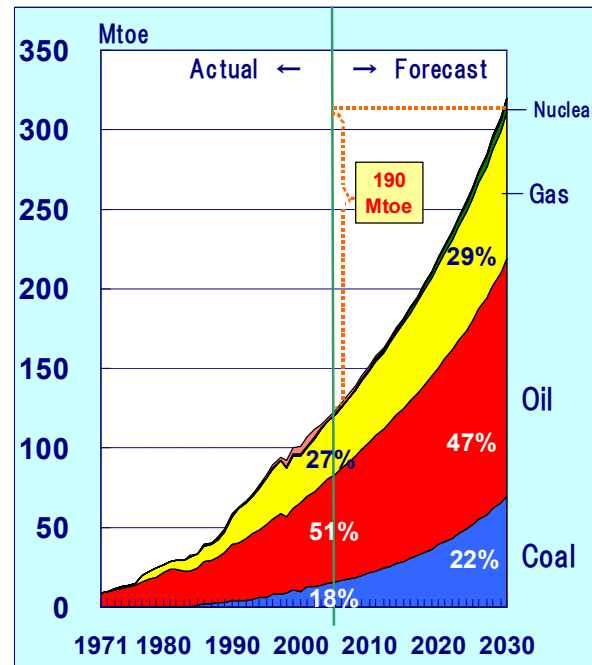
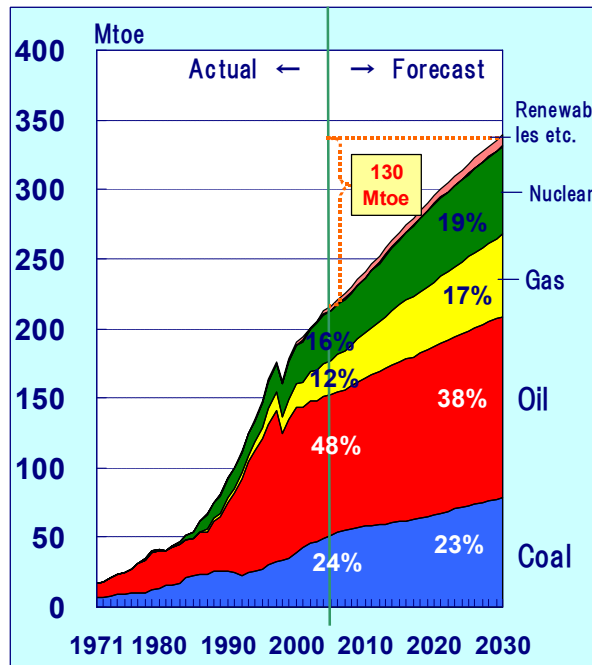
Korea

Annual average growth(%)	2004-2030
GDP	5.4
TPES	3.6

Indonesia

Annual average growth(%)	2004-2030
GDP	5.7
TPES	4.5

Malaysia

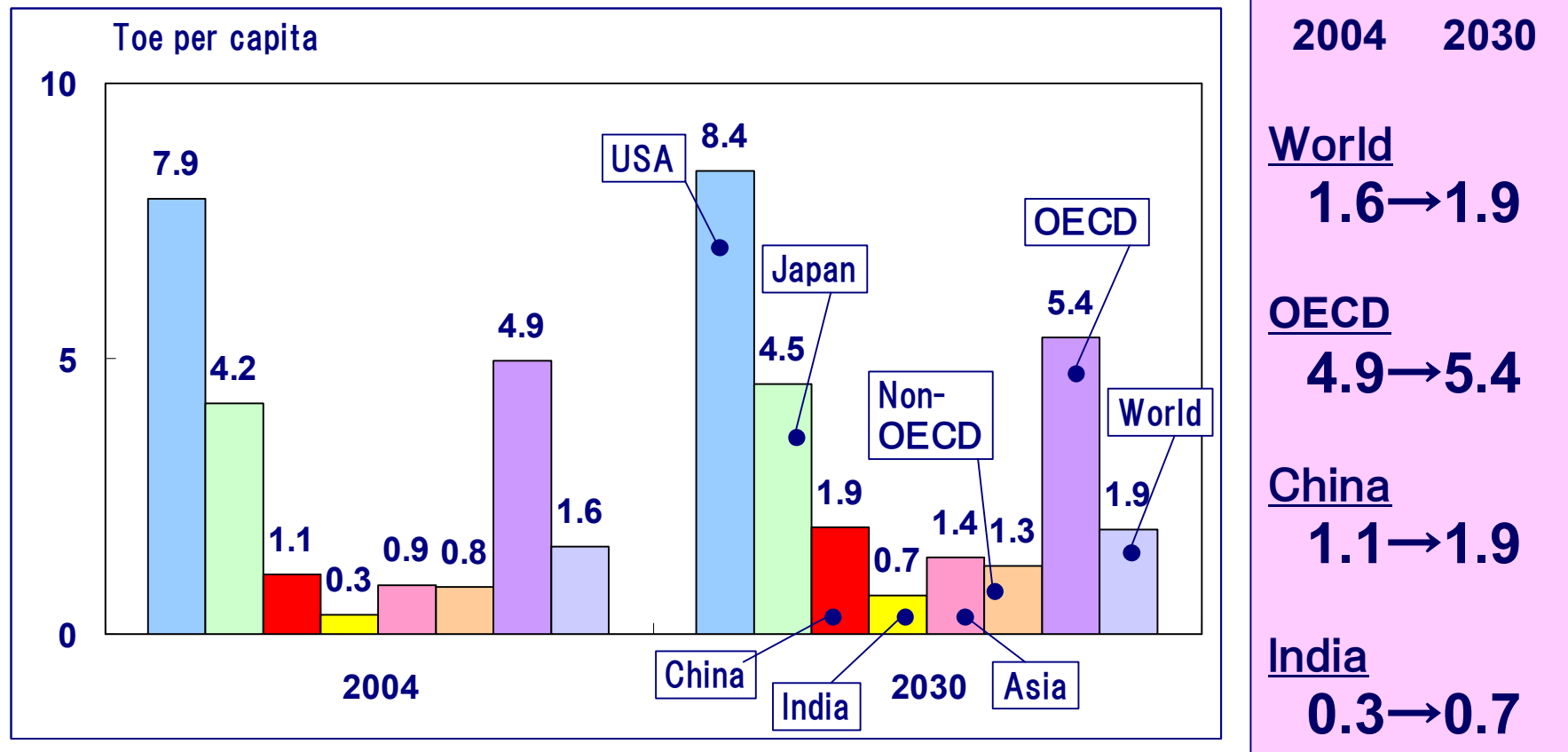


-Korea: Gas will have a growing trend in both power sector and municipal use, with nuclear accounting for approximately 20%

-Indonesia: Accelerating use of domestic coal for power sector will entail gradual increasing share as a result.

-Malaysia: Oil use will expand due to higher automobile penetration, with coal growing in power generation aiming at preservation of domestic natural resources.

Primary Energy Demand per capita



After 2030, developing countries, like China or India, primary energy demand per capita as well as that of a whole country have large potential of expansion, along with economic growth, since energy consumption per person of those countries remain under the level of developed countries.



Energy Supply Outlook

- *Nuclear*
- *Oil Supply/LNG Supply*
- *Energy Investment*

Nuclear

- *Since, in the developed countries of Europe and North America, construction of additional nuclear power plant has essentially been halted, the installed capacity is projected to decline. Energy security concern and environmental issue, however, have revived discussions about the role of nuclear power in these countries.*
- *In Asia, there are significant plan to develop nuclear energy.*

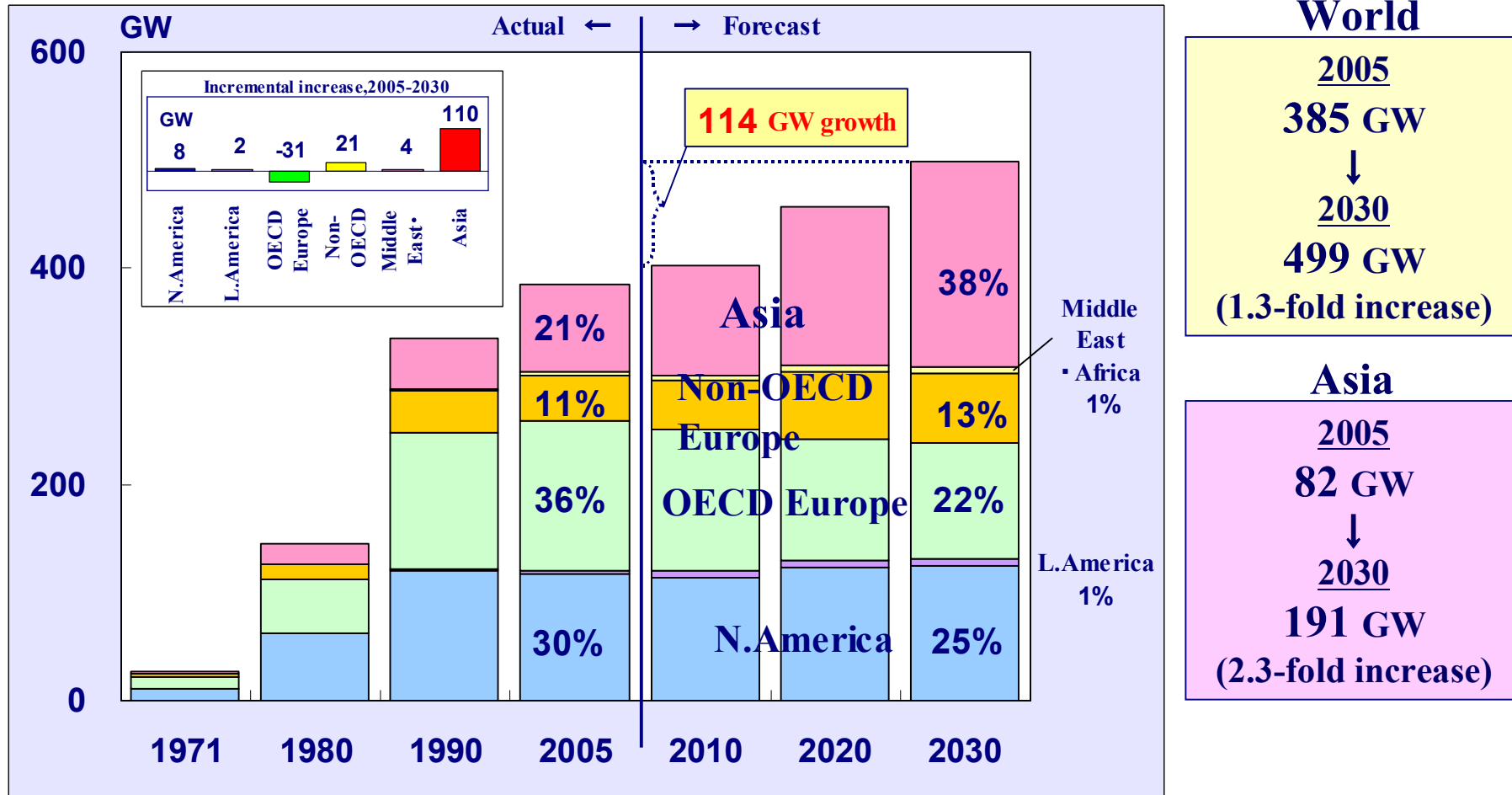
【Nuclear Power Plants in the World; In Operation, Under Construction and Planning】

As of 2005

GW、%	OP		UC and PL		Total	
	Output	Share	Output	Share	Output	Share
China	7	1.8	9.3	12.9	16.3	3.6
East Asia	5.1	1.3	6.7	9.4	11.8	2.6
South Asia	3.8	1.0	4.2	5.9	8	1.7
Korea	17.7	4.6	9.6	13.3	27.3	6.0
Japan	49.6	12.8	17.2	23.9	66.8	14.6
Asia	83.2	21.5	47.1	65.3	130.3	28.4
World	386.4	100.0	72	100.0	458.5	100.0

(Source) Japan Atomic Industrial Forum, Inc. 「World Nuclear Development」 etc.

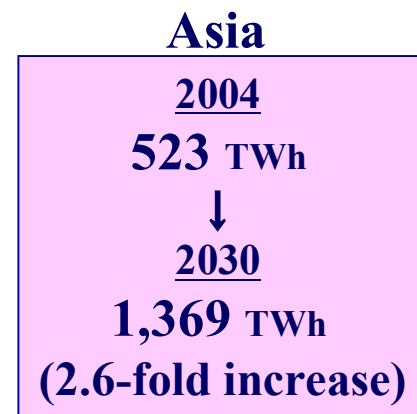
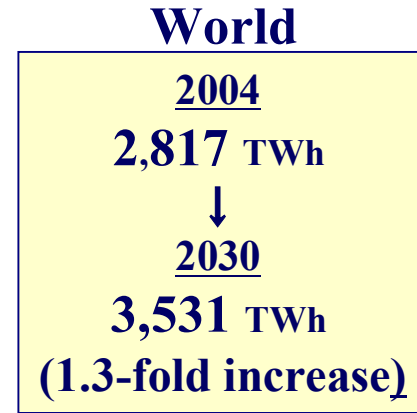
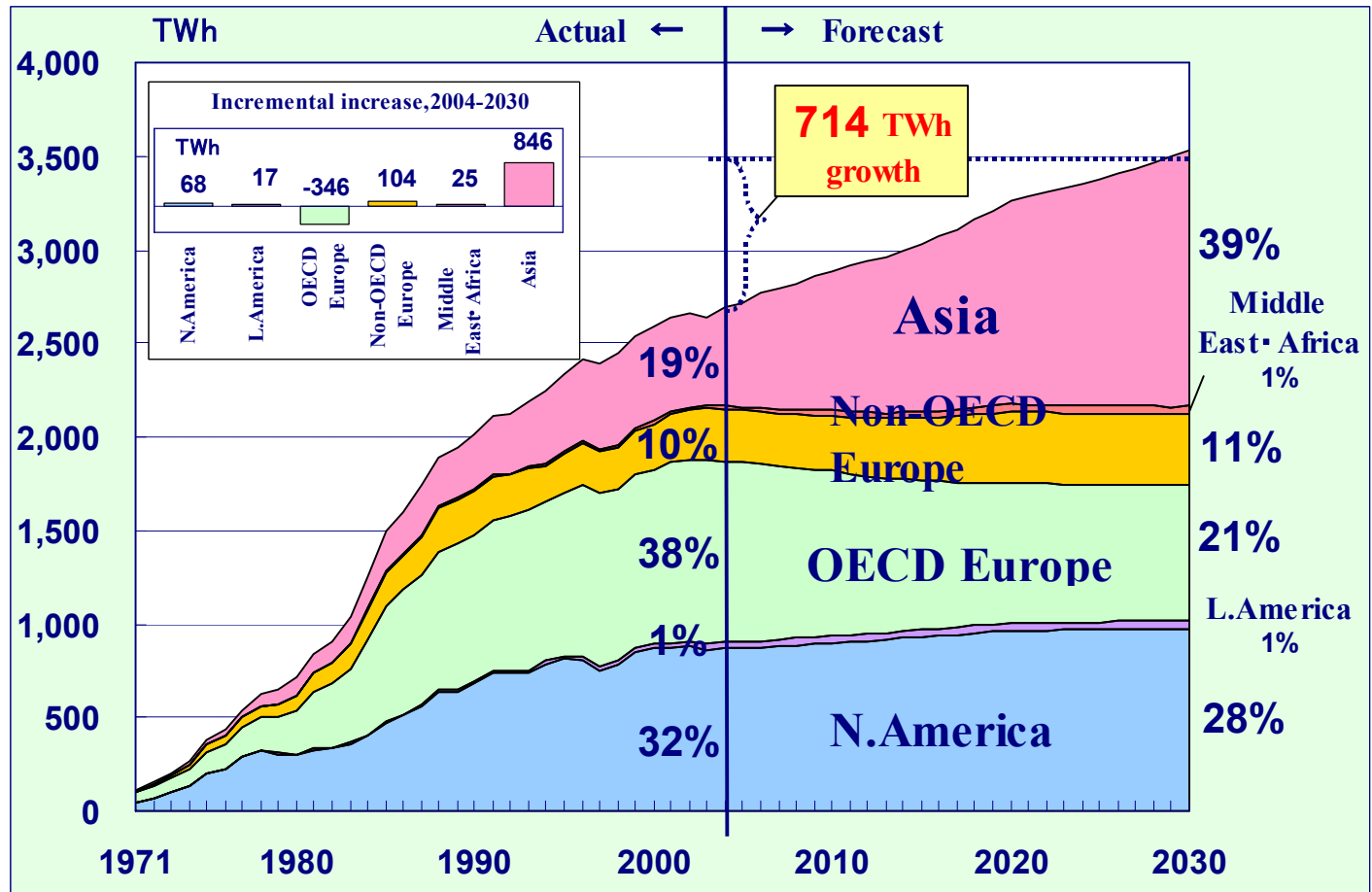
Nuclear Capacity ; World



➤ Nuclear capacity over the world is projected to grow from 385GW in 2005 to 499GW in 2030 (114 GW growth).

➤ The largest increases in the nuclear capacity are expected in Asia (110GW growth). Asian countries are likely to develop nuclear energy most actively and channel the largest investment into nuclear power requirement.

Nuclear Power Generation ; World



➤ Nuclear power generation over the world is forecast to grow from 2,817 TWh in 2004 to 3,531 TWh in 2030 (714 TWh growth).

➤ By 2020 Asia is likely to hold the largest share of the nuclear power generation in the world (from 19% in 2004 to 39% in 2020, 846 TWh growth).

Nuclear Power Policy in Asia (China and India)

【China】

In China, Coal-fired power generation has the largest share.

In December 2005, Chairman HU Jintao set a goal of realizing society harmonized with environment. China has plans to promote the development of nuclear, natural gas-fired and renewable energy .

•10th 5years Plan (2001 ~2005)

⇒ As government policy, China promotes the development of nuclear power “moderately”.

•11th 5years Plan (2006 ~2010)

⇒ China decides to accelerate the development of nuclear energy: Development of nuclear power system (1GW class reactor, advanced reactor, and high temperature reactor etc.)

【India】

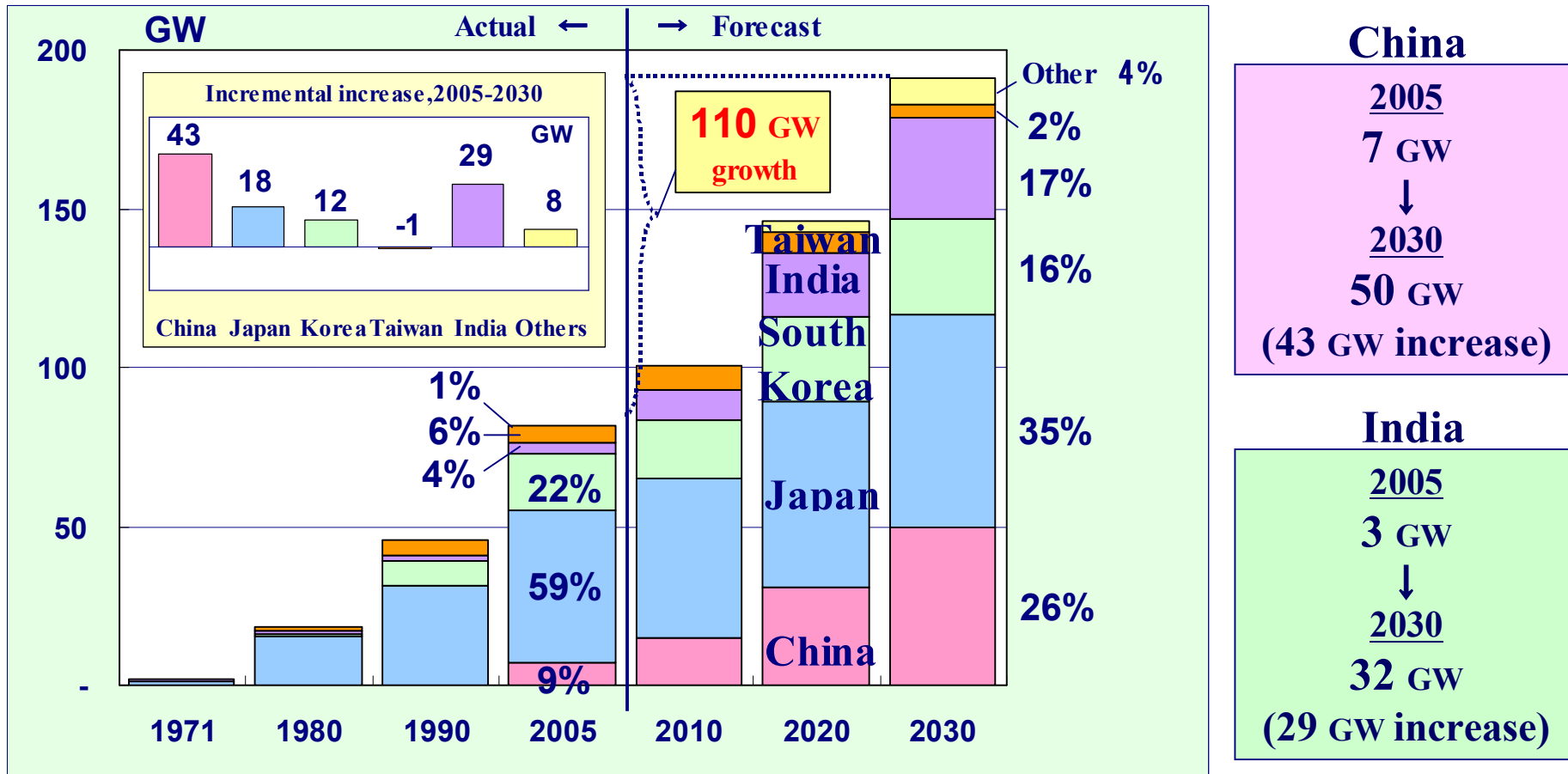
Indian economy grew at an annual growth rate of 8% in 2005. As a result of high economic growth, the demand for power generation is also expected to grow vigorously. Government has plans to promote the development of nuclear power and develop domestic reserve endowment.

Long Term Vision of the Department of Atomic Energy (DAE)

⇒ Nuclear Power Generating Capacity is projected to expand to 20GW by 2020

Recently India has announced a new target “ 40GW in 2020” supported by a development of nuclear energy agreement with the United States.

Nuclear Capacity ; Asia



Nuclear power generating capacity in Asia is projected to grow from 81GW in 2004 to 191GW in 2030 (110GW growth).

Nuclear Capacity ; Asia

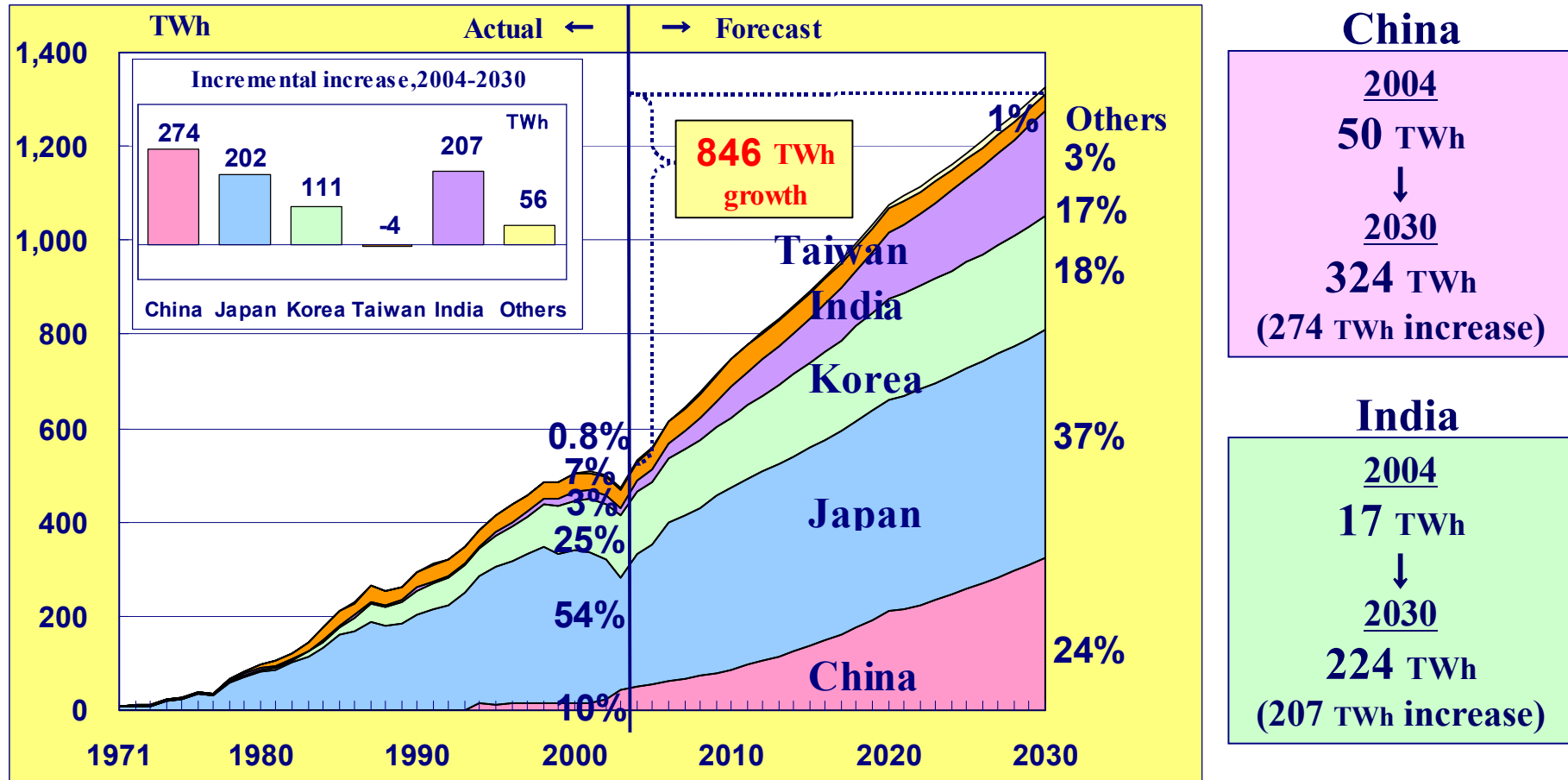
GW	2005	2010	2020	2030
China	7	15	31	50
Korea	18	19	27	30
India	3	9	20	32
Chinese Taipei	5	8	7	5
Indonesia	0	0	2	4
Vietnam	0	0	0	2

➤ *In both China and India, their economy are likely to grow at high rate by 2030 and their demand for power generation are also forecast to grow astoundingly. In order to secure the energy supply concern and mitigate greenhouse-gases, their nuclear power capacity is expected to expand vigorously.*

➤ *In Japan, it is projected to grow from 48GW in 2005 to 66GW in 2030.*

➤ *In Southeast Asia, there is movement to construct new nuclear power plant.*

Nuclear Power Generation ; Asia



Reflecting on the active development of constructing new nuclear power plants, the Chinese share of the nuclear power generation in Asia is forecast to grow from 10% in 2004 to 24% in 2030. The Indian share is also likely to expand from 3% in 2004 to 17% in 2030.

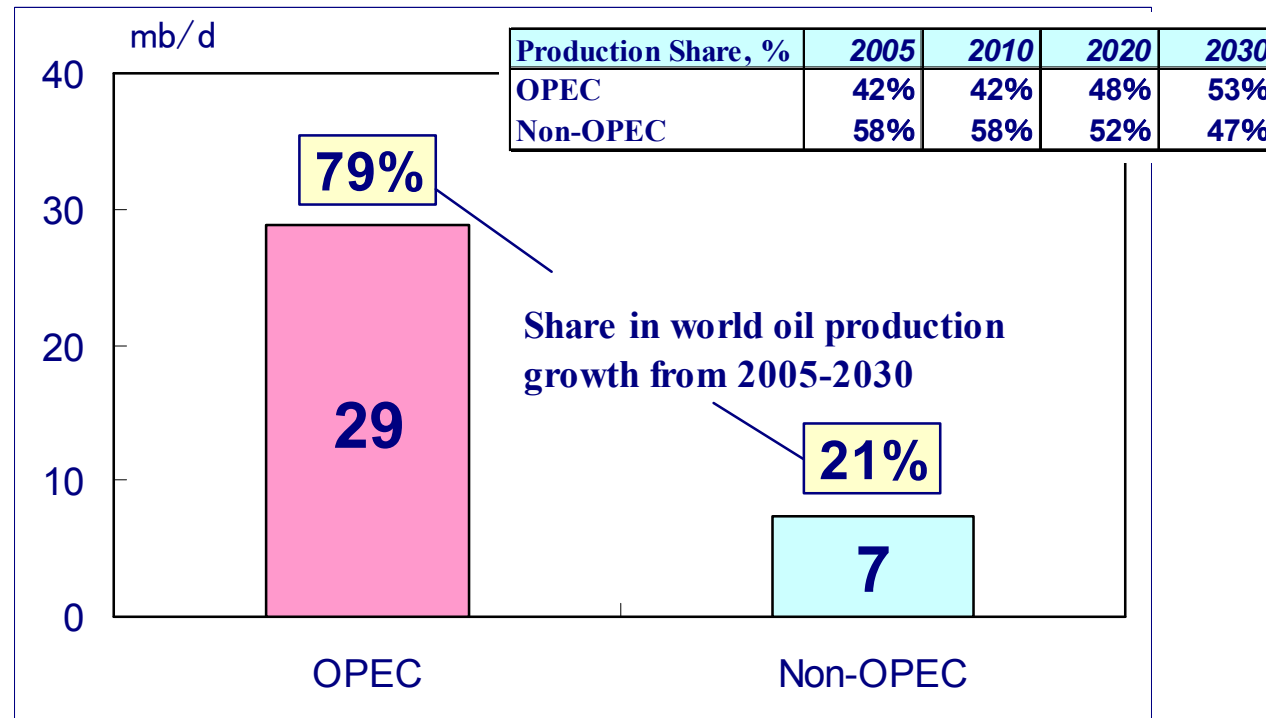
Oil Supply Outlook ; World

mb/d	2005	2010	2020	2030	2005-2030
OPEC	34	35	48	63	29
Middle East OPEC	23	25	35	46	22
Other OPEC	10	10	13	17	6.5
Indonesia	1.1	1.1	1.0	0.9	▲ 0.2
Non-OPEC	47	48	52	55	7.4
N.America	9.9	9.4	9.2	9.1	▲ 0.8
L.America	7.7	8.0	10	11	3.3
Europe (inc. Russia)	18	19	22	23	4.9
Middle East	1.7	1.6	1.0	0.8	▲ 0.9
Africa	3.5	4.6	5.2	6.7	3.2
Asia	6.3	5.8	4.4	4.1	▲ 2.3
China	3.6	3.2	2.3	2.0	▲ 1.6
Malaysia	0.8	0.9	0.9	0.9	0.0
Thailand	0.3	0.2	0.1	0.1	▲ 0.1
Vietnam	0.4	0.5	0.3	0.3	▲ 0.1
India	0.8	0.8	0.6	0.6	▲ 0.2
World Total	81	83	100	117	36

Oil production in Asia is projected to modestly decline

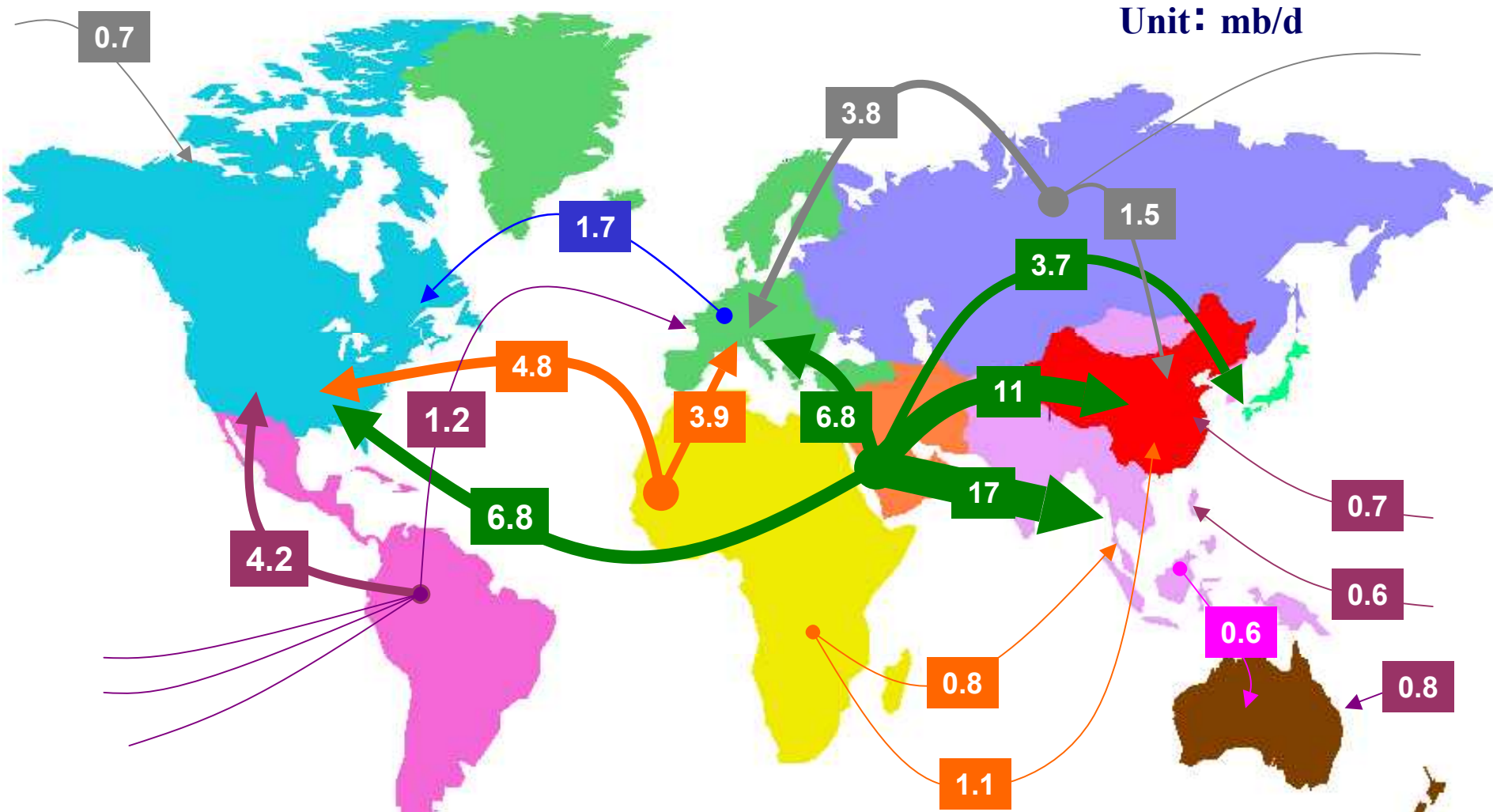
Oil Supply Outlook ; OPEC/Non-OPEC

【Oil production increase from 2005 to 2030】



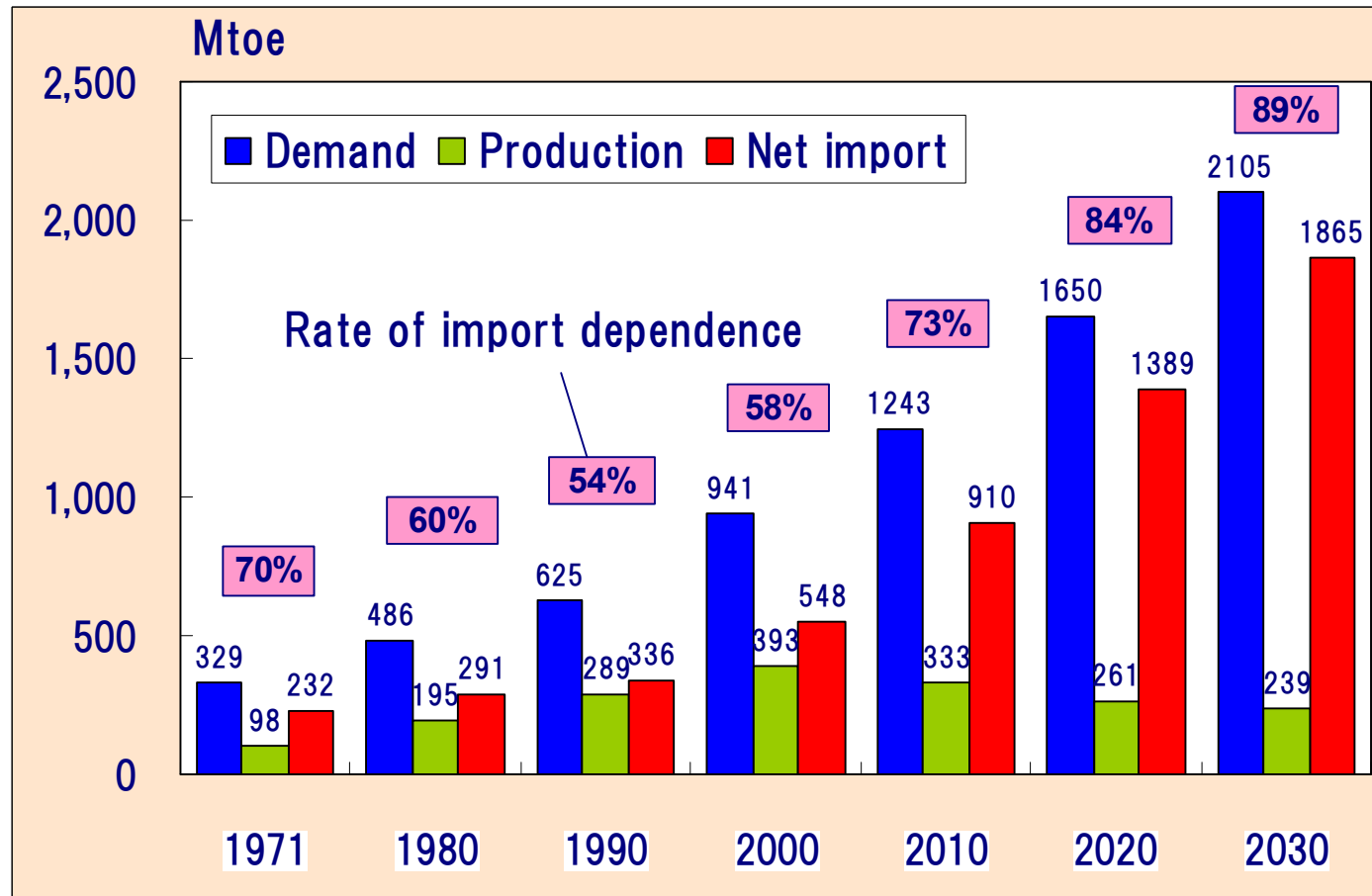
- *Approximately 80% of world oil production increase from 2005 to 2030 will be dominated by OPEC; OPEC share in the world oil production is likely to expand over 50% by 2030*
- *In promising oil production countries such as Middle East OPEC, oil exploration and development are constrained for the international oil company due to the legal restriction of participation for IOC to the domestic oil development and more serious socio-economic situation in the Middle East. Unless the adequate upstream investment is not channeled into global oil production, international oil market will become tightened for the future.*

World Oil Trade (2030)



Oil export from Middle East to Asia is projected to grow from 13.1 mb/d in 2005 to 31.0 mb/d in 2030, achieving 2.4-fold increase. In major oil-consuming countries, such as China and India, dependence on Middle Eastern oil is forecast to rise, and roughly 70% of Middle Eastern crude is exported to Asian region

Oil Demand and Supply in Asia



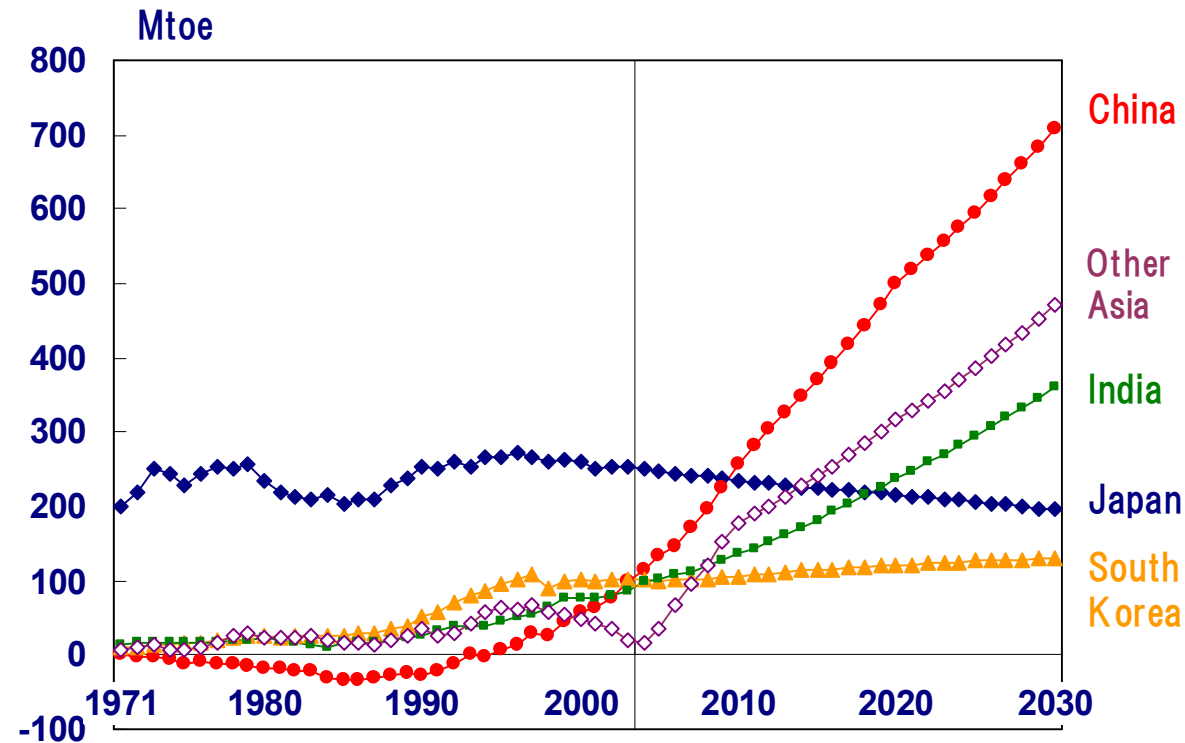
Net Oil Import

2005
14.8 mb/d
↓
2030
38.9 mb/d
(2.6-fold growth)

- Net oil import is projected to increase from 710 Mtoe (14.8 mb/d) in 2005 to 1,900 Mtoe (38.9 mb/d) in 2030.

- Rate of import dependence achieves approximately 90% caused by slowdown of regional oil production (China, India, Indonesia etc.) .

Net Oil Import in Asia



- In China, net oil import has continued to increase since 1993 in which China became a net import country. The amount of oil import is projected to grow from 3.1 million B/D in 2005 to 14.7 million B/D (5-fold increase) in 2030. This is reflecting on expansion of demand mainly by vehicle ownership growth and on stagnation of domestic oil supply due to the aging of main oil fields such as Daqing.

- China is forecast to be the biggest oil import country in Asia around 2010, outstripping Japan's net oil import.

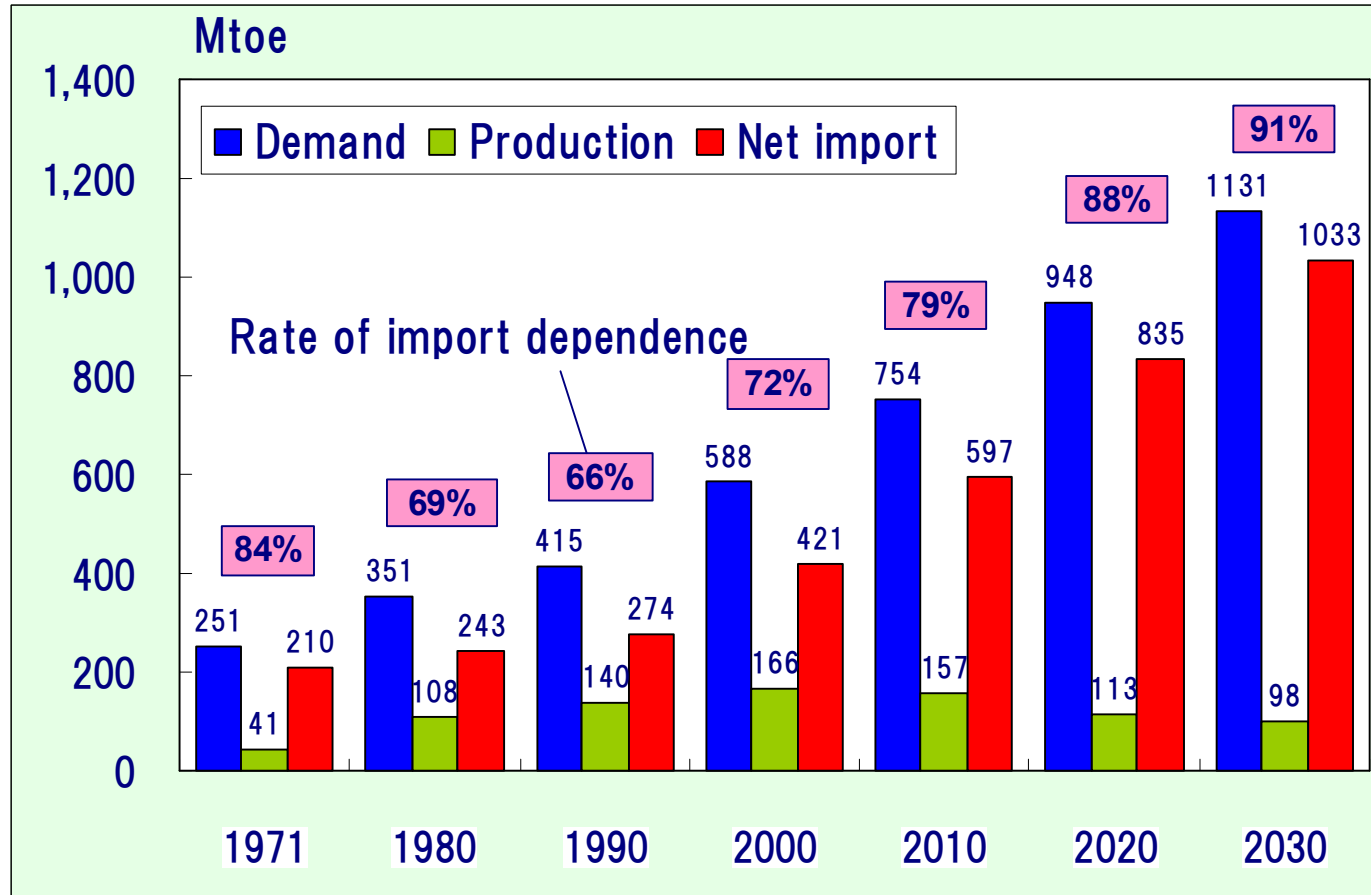
Oil Import Dependence in Asia

(Net oil import, ▲ denotes net oil export position)

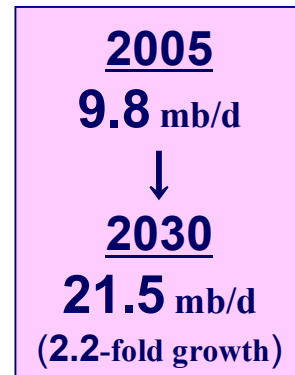
	2004	2010	2020	2030
China	49%	62%	82%	88%
Indonesia	▲ 0.1%	35%	56%	71%
Malaysia	▲ 74%	▲ 26%	5%	23%
Thailand	76%	80%	91%	94%
India	68%	78%	89%	93%
Vietnam	▲ 76%	▲ 52%	40%	63%
Asia	55%	73%	84%	89%

Oil-import dependence in Asia is forecast to gradually rise, reflecting on the oil consumption increasing based on urbanization, industrialization and motorization, and the stagnation of oil production growth within the region.

Oil Demand and Supply in North East Asia (Japan, China, and Korea)

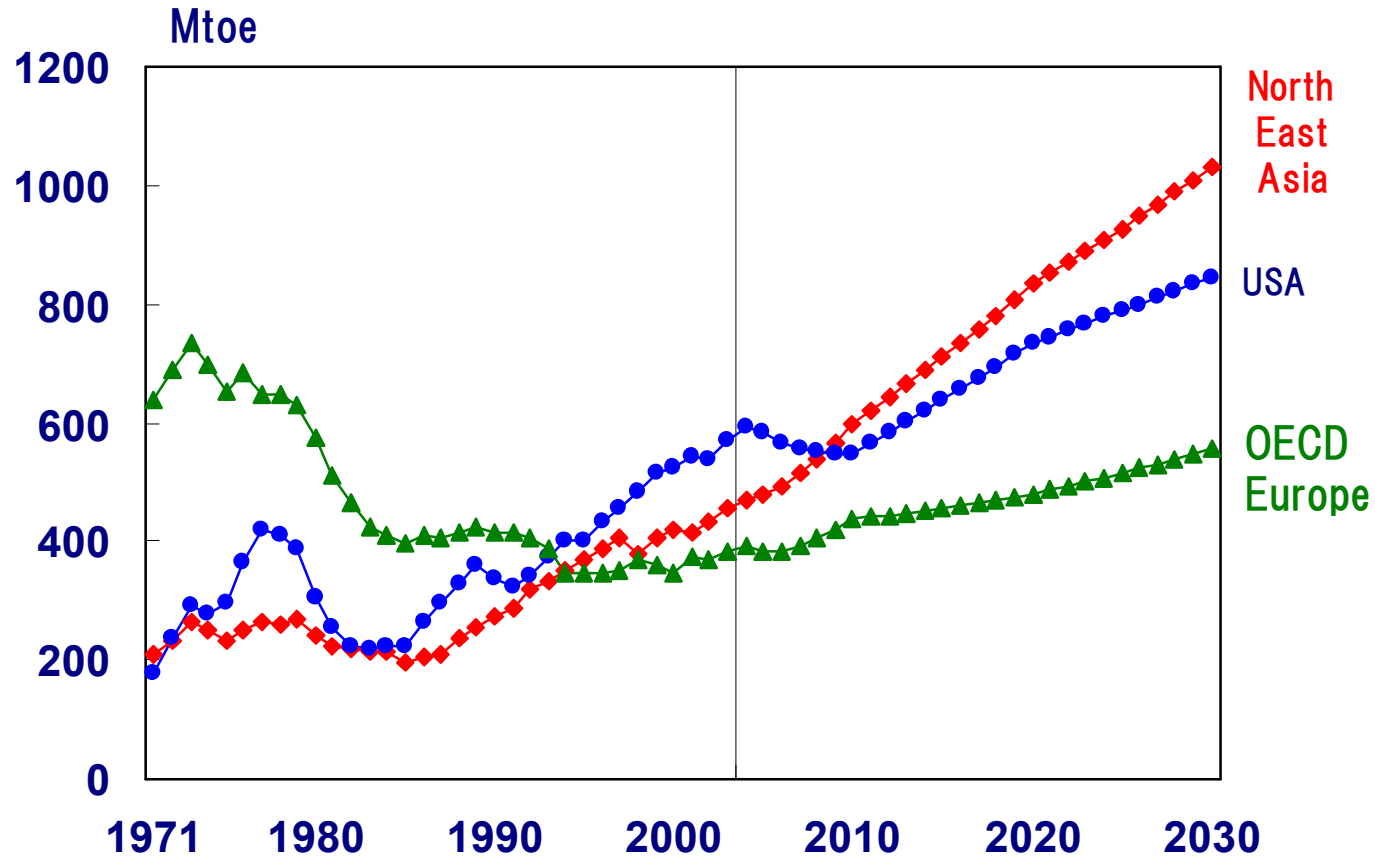


Net Oil Import



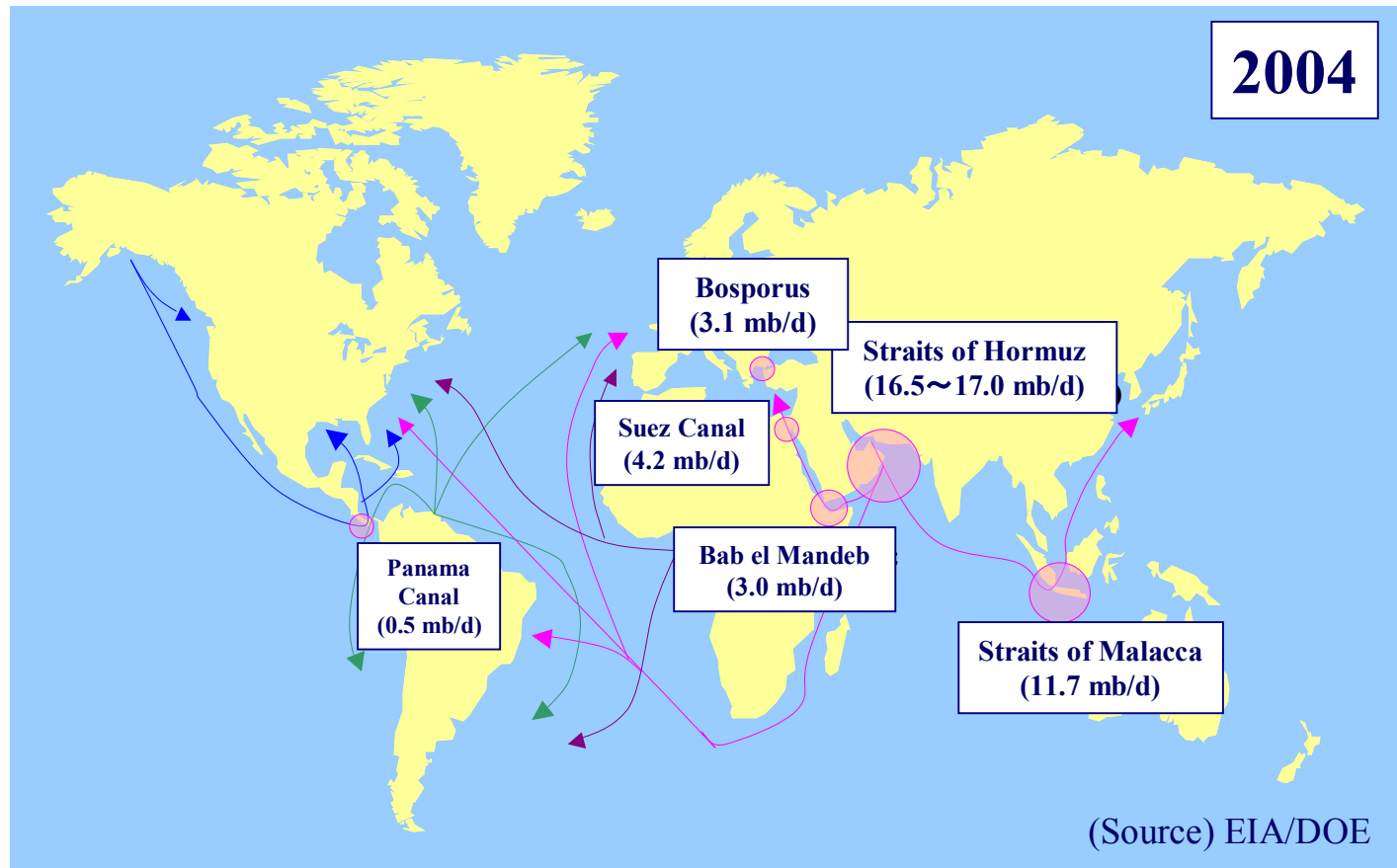
- Oil demand in North-east Asia is projected to expand from 690 Mtoe (14.3 mb/d) in 2005 to 1,130 Mtoe (23.6 mb/d) in 2030.
- Net oil import is anticipated to grow from 470 Mtoe (9.8 million B/D), to 1,030 Mtoe (21.5 mb/d).
- The rate of import dependence will rise to approximately 90% in 2030.

Net Oil Import in North East Asia



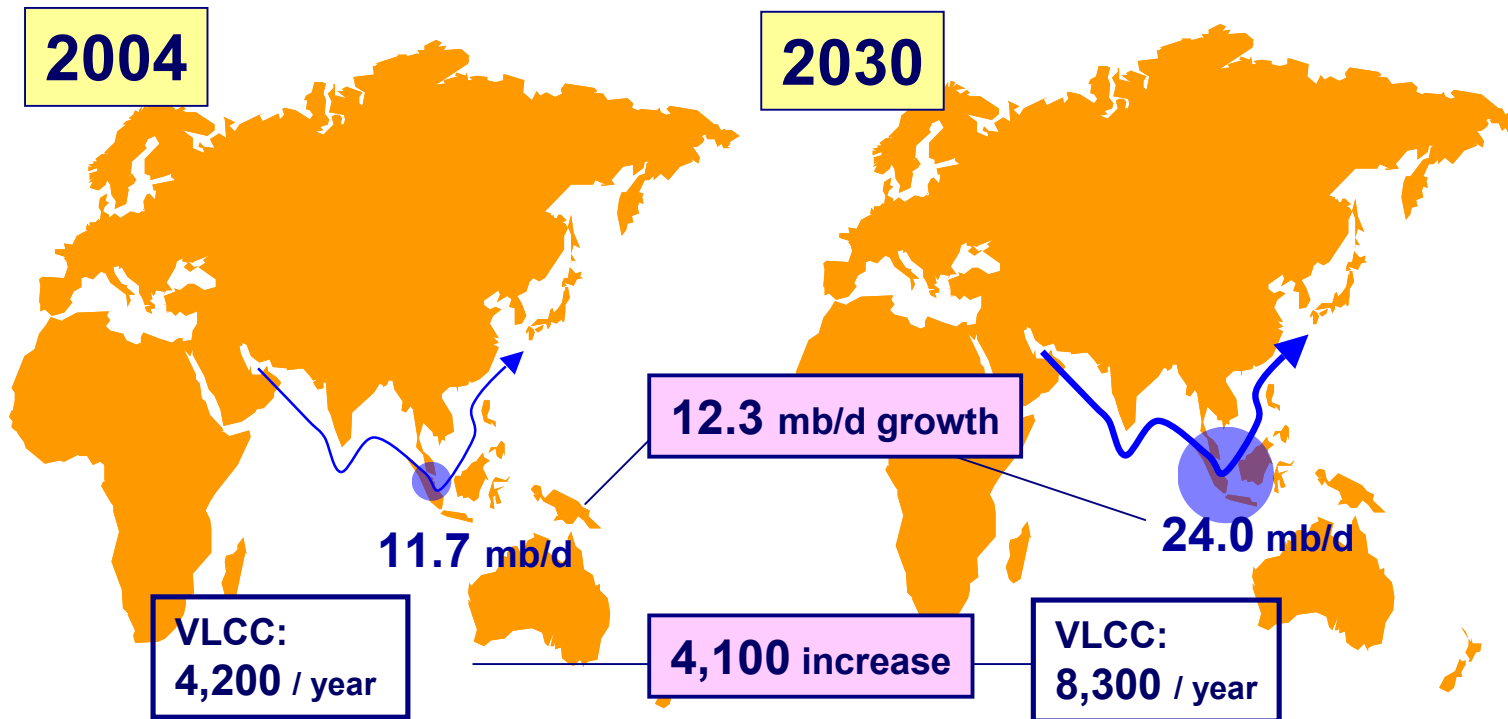
North East Asia (Japan, China and South Korea) is projected to be the biggest oil import region in the world, outpacing USA in the mid-2010s.

Oil Traffic at Major Choke Points



Asian countries like Japan depend on Middle Eastern oil which takes a important part in primary energy supply. The shipping route of crude is mainly from Arabian Gulf to Japan by way of Straits of Hormuz, Indian Ocean, Southeast Asia (such as Straits of Malacca), South China Sea, and East Sea. This route remains an important sea-lane of oil traffic for East Asian countries

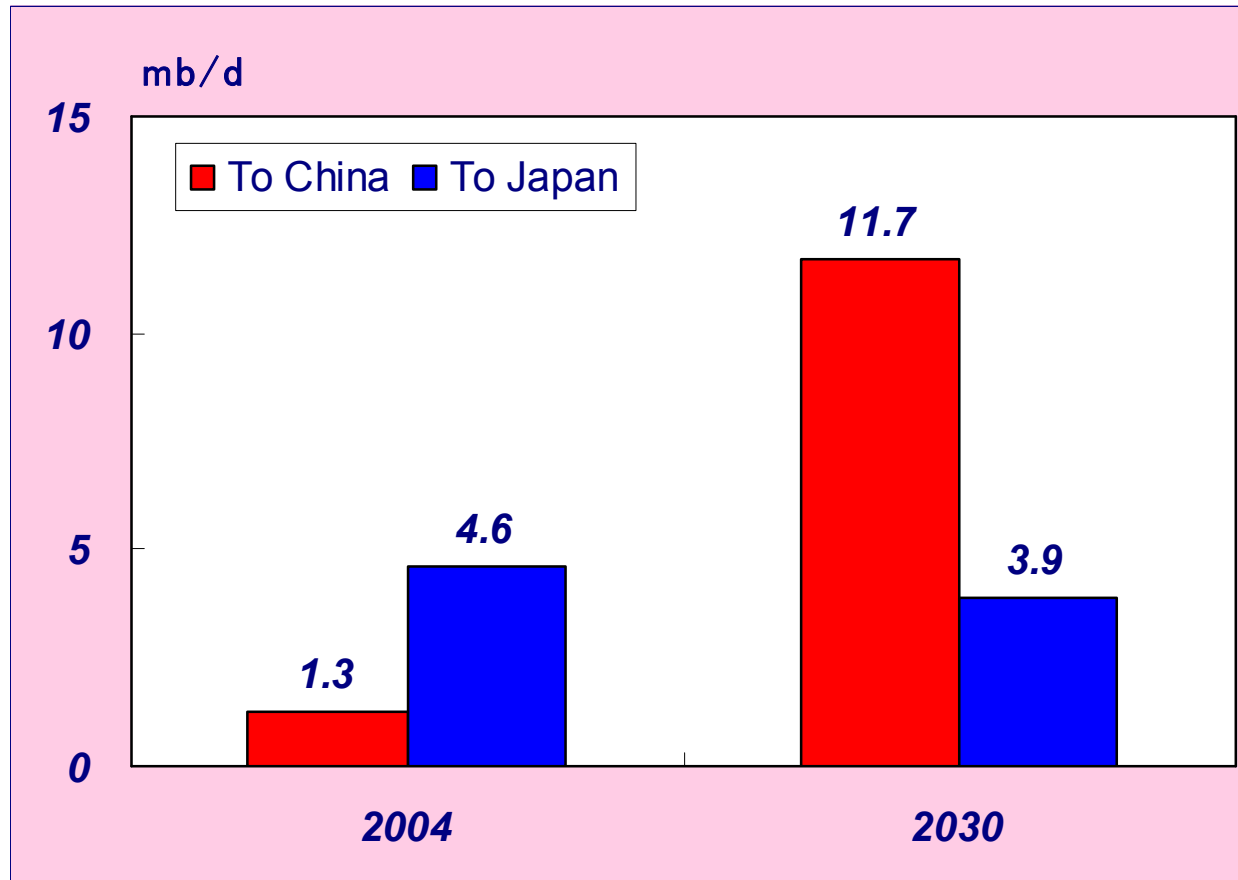
VLCC traffic at Straits of Malacca



- Increase of oil import from Middle-east in East Asia causes oil traffic expansion at the Straits of Malacca

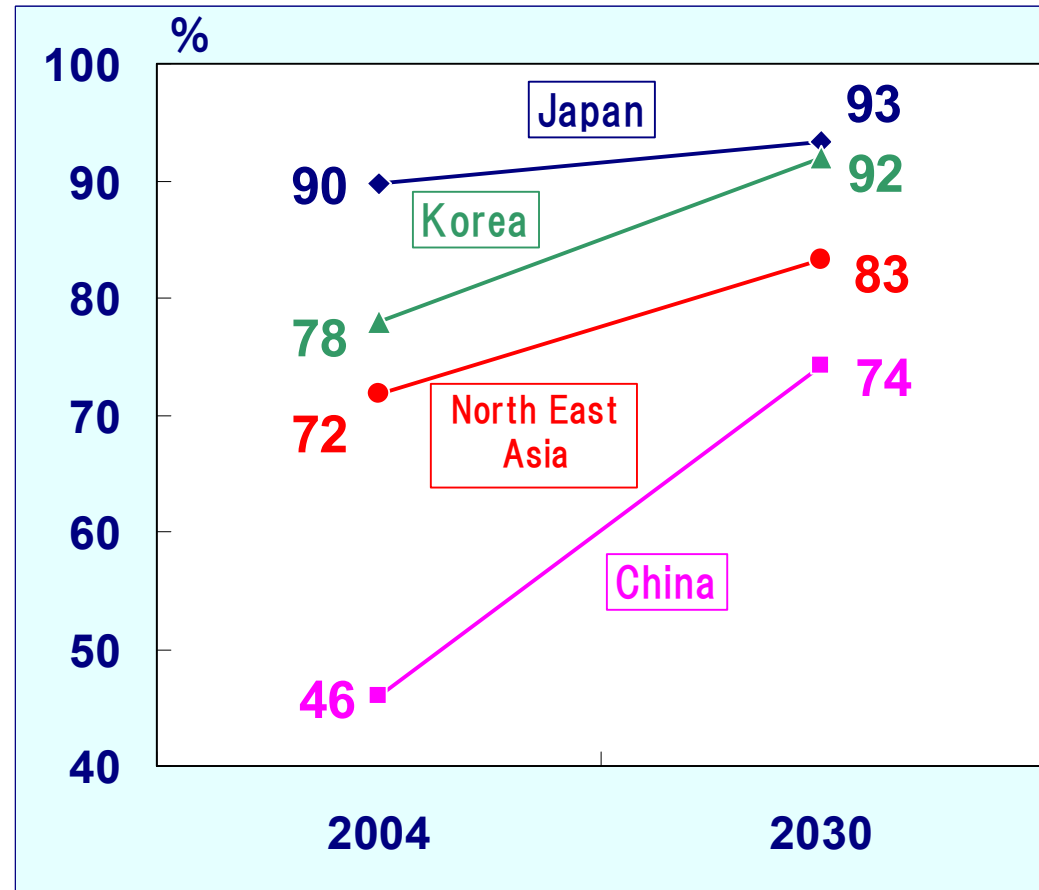
- Volume of oil traffic at Straits of Malacca will expand from 11.7 mb/d to 24.0 mb/d. As a result, the number of VLCC traffic is projected to increase 4,200 (2004) to 8,300 (2030), so traffic congestion becomes much more serious problem for the future.

Oil traffic outlook at Straits of Malacca (by place of destination)



The oil transport to China in the Straits of Malacca will register around 12.0 mb/d, outstripping the transport to Japan by 2030

Dependence on Middle Eastern Crude Oil Import



Dependence on Middle Eastern oil import in China is forecast to expand from 46% in 2004 to 74% in 2030. Reflecting on that, this factor in North East Asia increase from 72% to 83%.

Scenario analysis on Canadian Oil Sands / Russian Crude Oil

Analyzing the impact of Canadian Oil Sands and Russian crude oil on the dependence on Middle Eastern Oil in North East Asia

➤ **Reference**

➤ **Oil Sands**

Assuming that the introduction of Canadian Oil Sands in Asian market is promoted

➤ **Russian Crude Oil**

Export of Russian Crude Oil to Asian region make gradual progress on current development schedule

➤ **Oil Sands + Russian Crude Oil**

Both Oil Sands and Russian Crude Oil are introduced into Asian market.

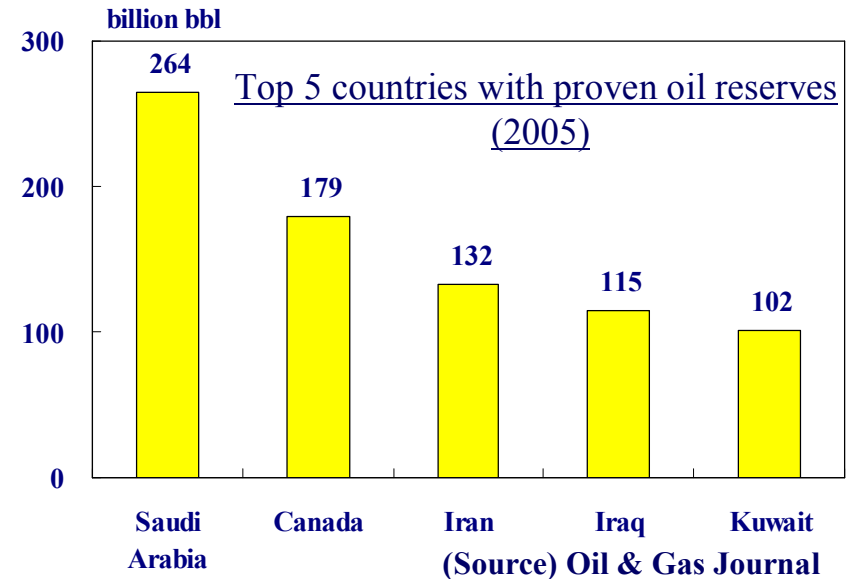
Canadian Oil Sands

Oil reserves in **Canada**, including oil sands, reach **180 billion bbl**

→ **Canada is the world's second-largest oil holding country after Saudi Arabia**

Production of Canadian Oil Sands currently exhibits **1 million b/d**; Canada is **the world's 7th largest oil producing country**;

Oil production in Canada is expected to achieve **4.2 mb/d by 2020**, quadruple of current production level.



Canadian Oil Sands Scenario

→ **Oil Sands export from Canada to Asia-Pacific region**

Oil Sands are assumed to be exported to Asia besides USA, existing large market; If Asian countries replace middle eastern oil by Canadian Oil Sands, Oil Sands contribute to **mitigate middle east dependence, diversify oil supply, and alleviate the oil traffic at Straits of Malacca.**

Assumption: Canadian Oil Sands

- **Oil Sands Production** is expected to increase from **0.8 mb/d in 2003 to 3.6 mb/d in 2030**
- **Oil Sands export to USA** will grow from **0.99 mb/d in 2003 to 1.39 mb/d in 2030**; **Export to Asia expands to 1.27 mb/d in 2030**

【Oil Sands Outlook for 2030】

mb/d	2003	2010	2020	2030
Production	3.10	3.50	4.20	5.00
Conventional	2.30	1.70	1.50	1.40
Unconventional (Oil Sands)	0.80	1.80	2.70	3.60
Domestic consumption	2.11	2.13	2.25	2.34
Export to USA	0.99	1.03	1.16	1.39
Export to Asia	0.00	0.34	0.79	1.27

Assumption: Russian Crude Oil

Russian crude oil outlook is assumed based on current several projects

Sakhalin

Current production of Sakhalin I、II amounts to about 300,000 b/d. Sakhalin III and other projects are assumed to be developed after 2010

East Siberia

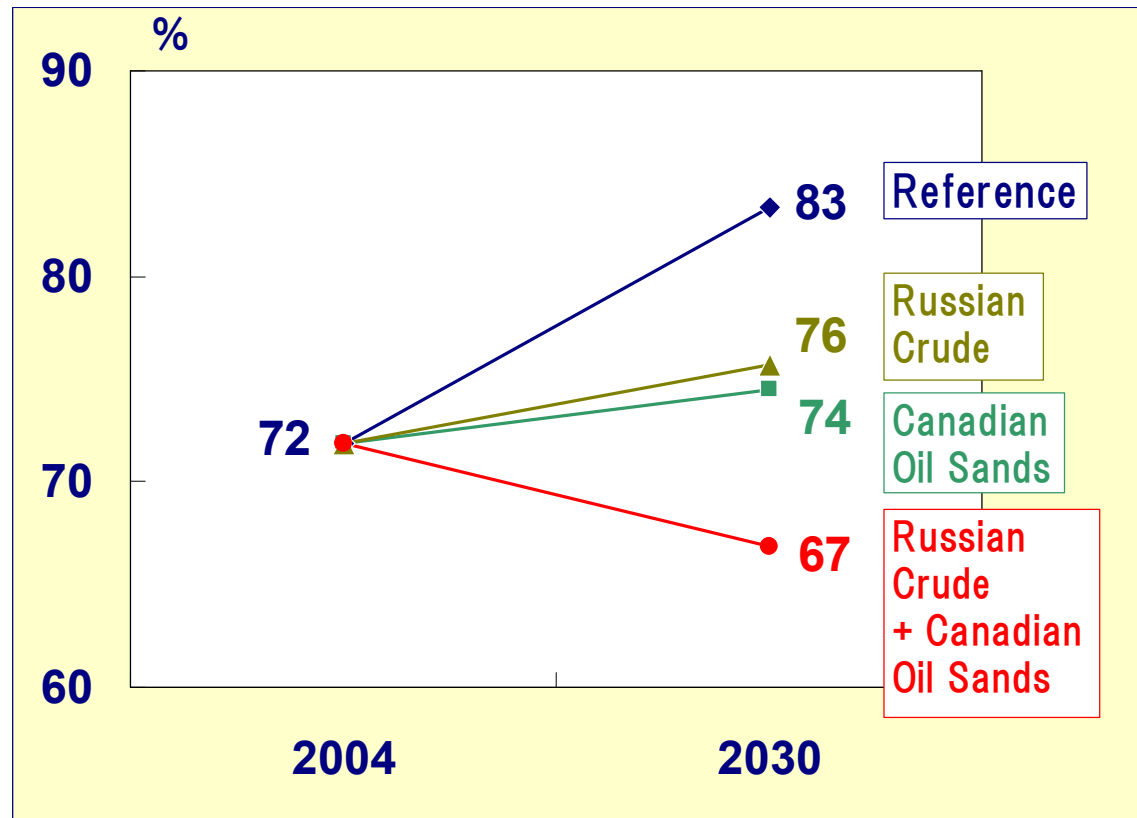
The realization of actual development depends on the establishment of investment environment in this region. Development of oil export pipeline to both Asia-Pacific and China is important.

Kazakhstan-China crude oil pipeline

Oil export was started at 200,000 b/d in 2006

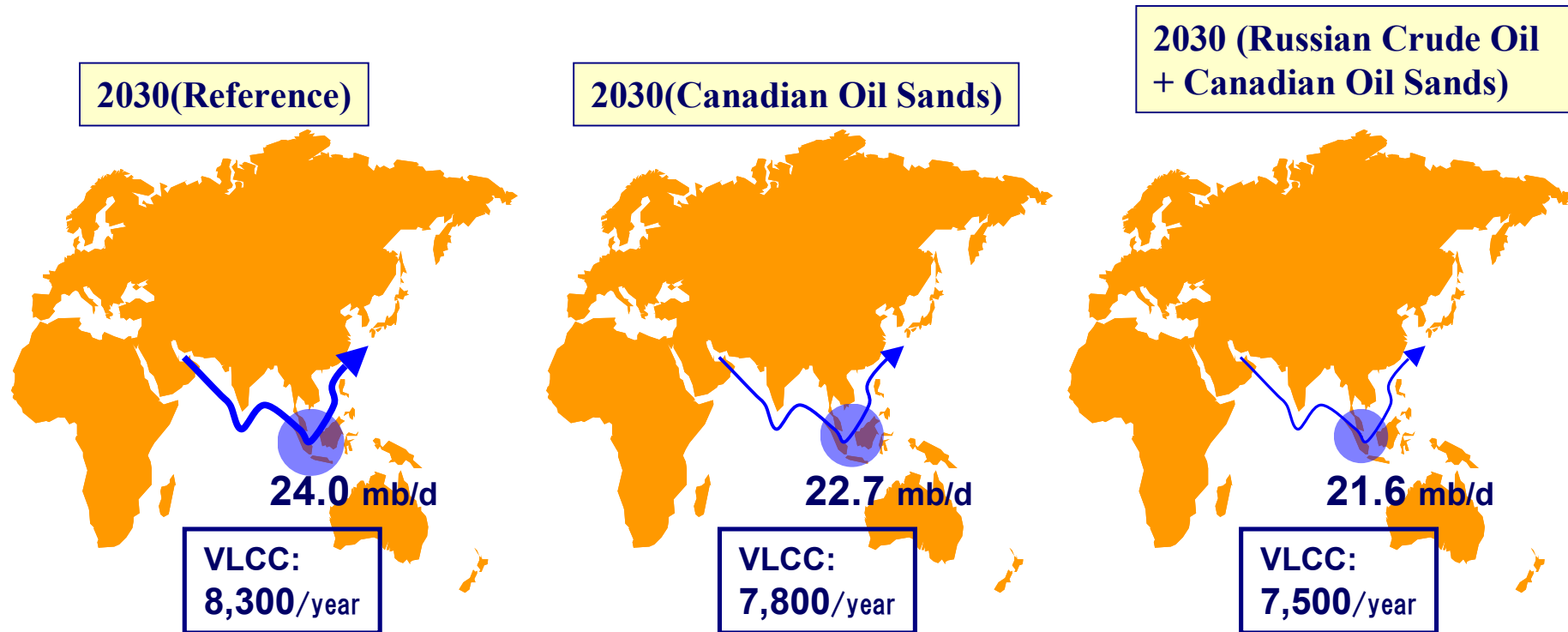
→ Russian crude oil into North East Asia in 2030; 500,000 b/d ~ 2.5 mb/d

Dependence on Middle Eastern Oil Import in North East Asia



Dependence on Middle Eastern oil import is reduced by 9 points from 83% to 74% through the import of Canadian Oil Sands, by 7 points to 76% through Russian Crude Oil import. If both oils are introduced into North East Asia, dependence on Middle East is mitigated by 16 points from 83% to 67%.

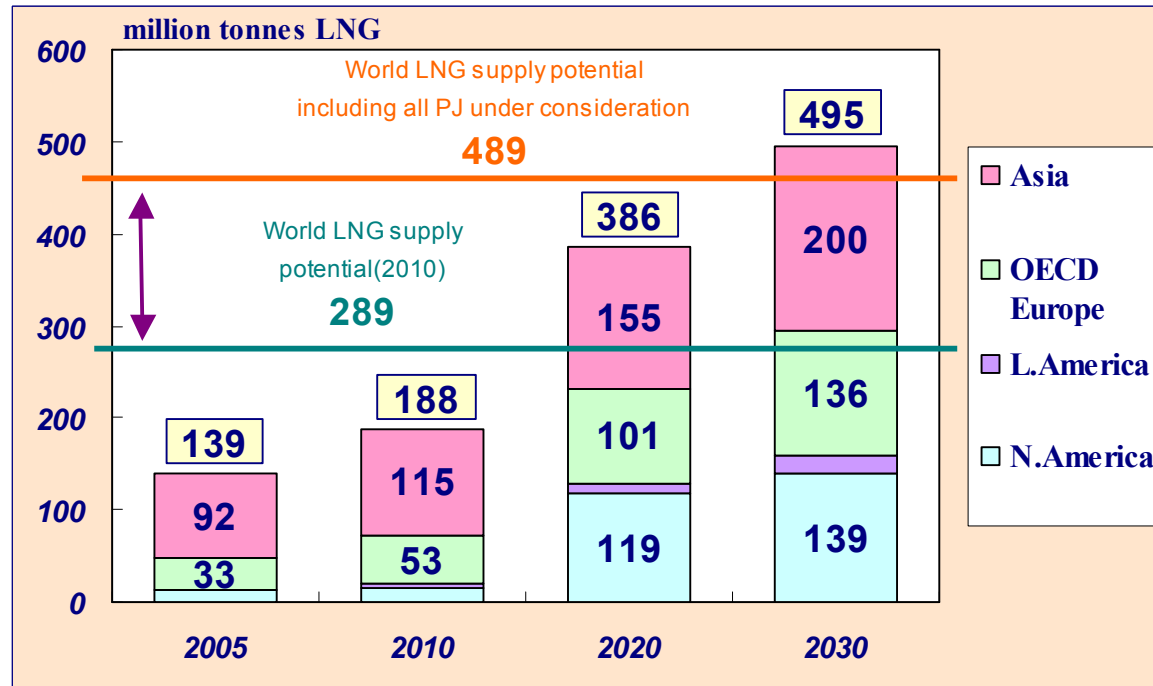
VLCC traffic at Straits of Malacca



➤ *Oil Sands import will reduce VLCC passage at Malacca Straits by 500 passing, Russian Crude and Oil Sands together by 800 passing.*

➤ *Crude oil import other than from Middle East will alleviate the VLCC congestion at Straits of Malacca*

LNG Outlook ; World

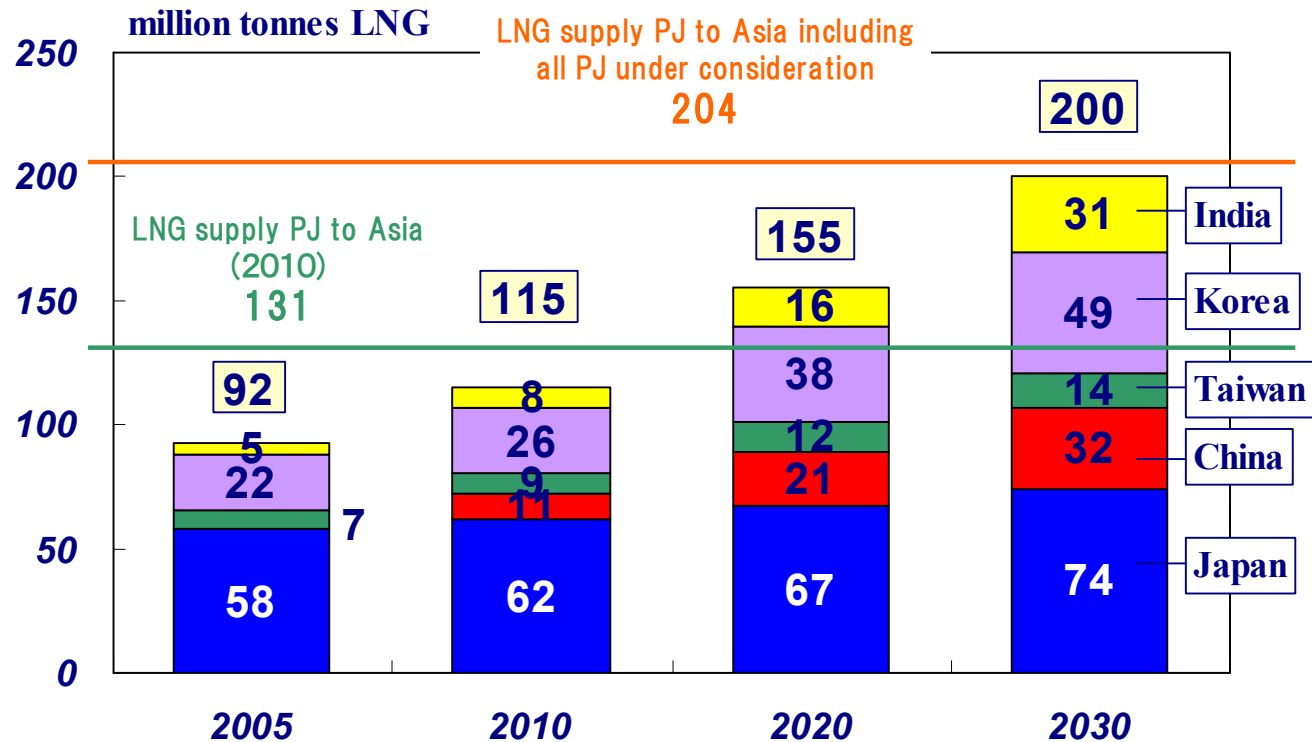


* “World LNG supply potential(2010)” includes existing, constructing LNG PJ, and the PJ contracted on SPA•HOA basis. “World LNG supply potential including all PJ under consideration” incorporates both “World LNG supply potential(2010)” and PJ under consideration for commercialization.

● *World LNG demand will expand from 139 million ton in 2005 to 495 million ton in 2030, achieving 3.6-fold growth. LNG import in Europe and USA is projected to increase rapidly, mainly because of growing gas demand in power generation sector and sluggish gas supply growth; LNG demand of Europe and USA will exceed that of Asia by 2020.*

● *World LNG demand and supply are forecast to be balanced in 2030. If the development of future LNG project is stagnated, world LNG market will become tightened after 2010; The development of LNG project is major challenge in order to ensure world LNG market.*

LNG Outlook ; Asia

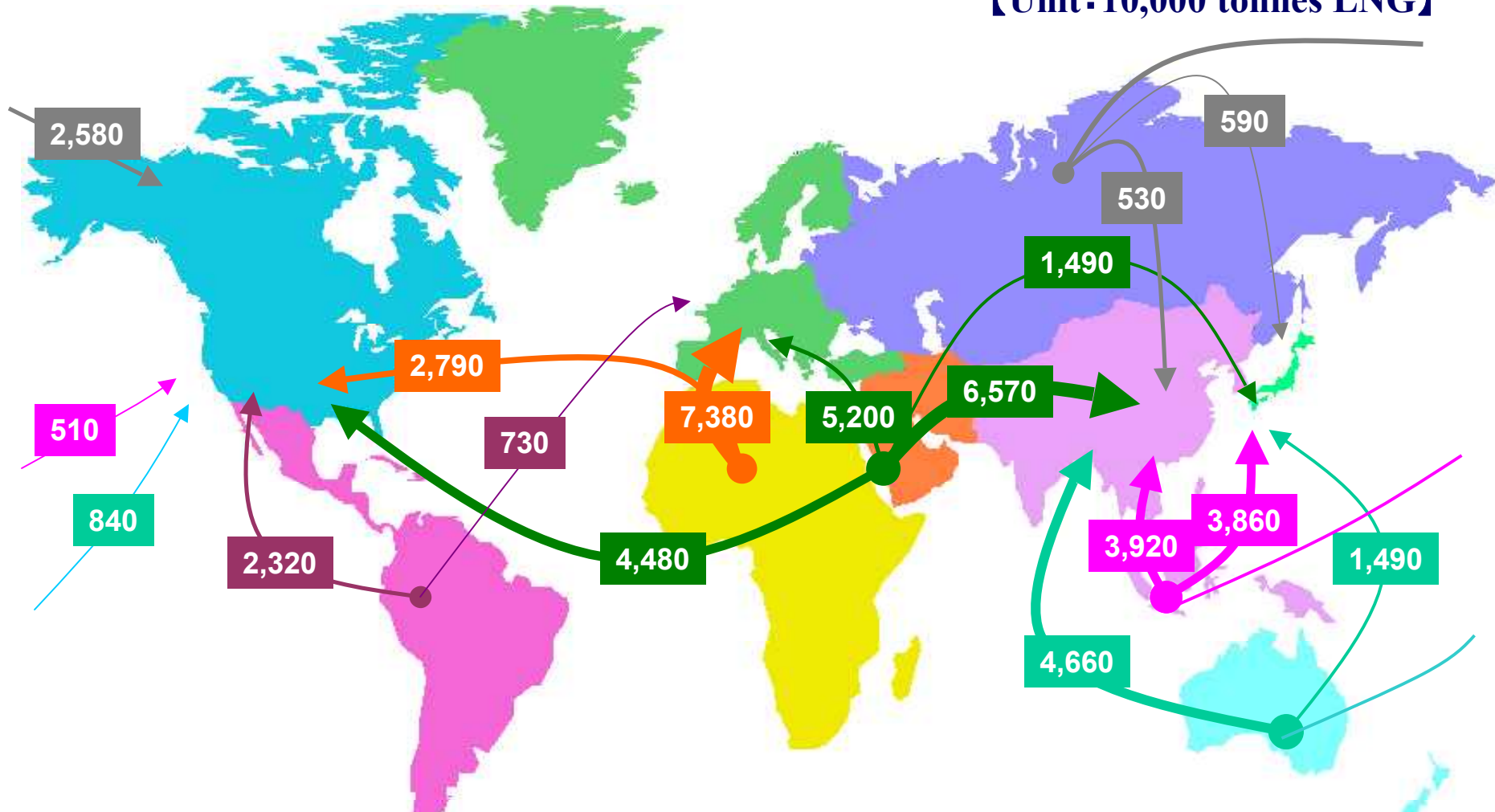


* “World LNG supply potential(2010)” includes existing, constructing LNG PJ, and the PJ contracted on SPA·HOA basis. “World LNG supply potential including all PJ under consideration” incorporates both “World LNG supply potential(2010)” and PJ under consideration for commercialization.

- *LNG import in Asia will expand from 92 million ton in 2005 to 200 million ton in 2030, achieving 2.2-fold growth. LNG import in China will expand to 32 million ton in 2030, and in India, to 31 million ton*
- *Considering all the PJ to Asia under consideration for commercialization, LNG demand and supply is likely to be balanced for 2030.*

World LNG Trade (2030)

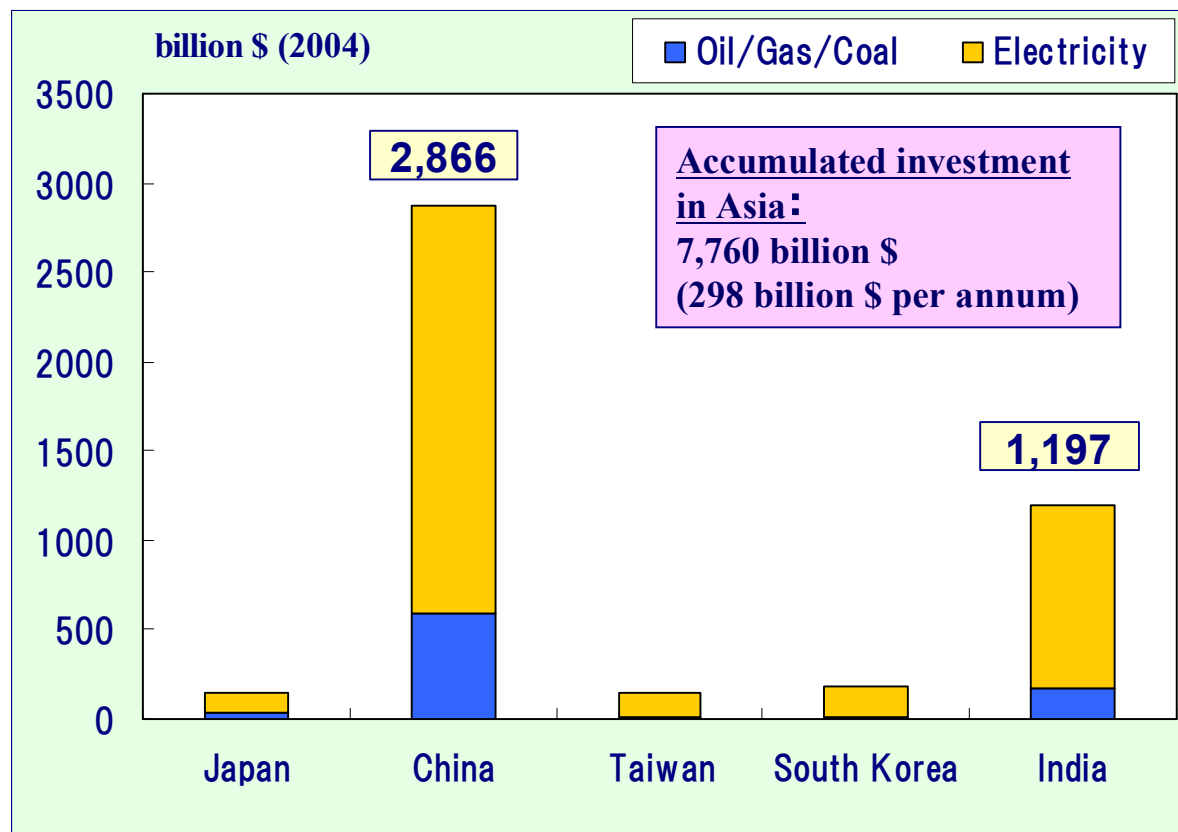
【Unit: 10,000 tonnes LNG】



Rapid LNG import growth in Europe and USA, based on growing gas demand in power generation and sluggish regional gas supply, will entail globalization of LNG trade.

Energy Investment in Asia

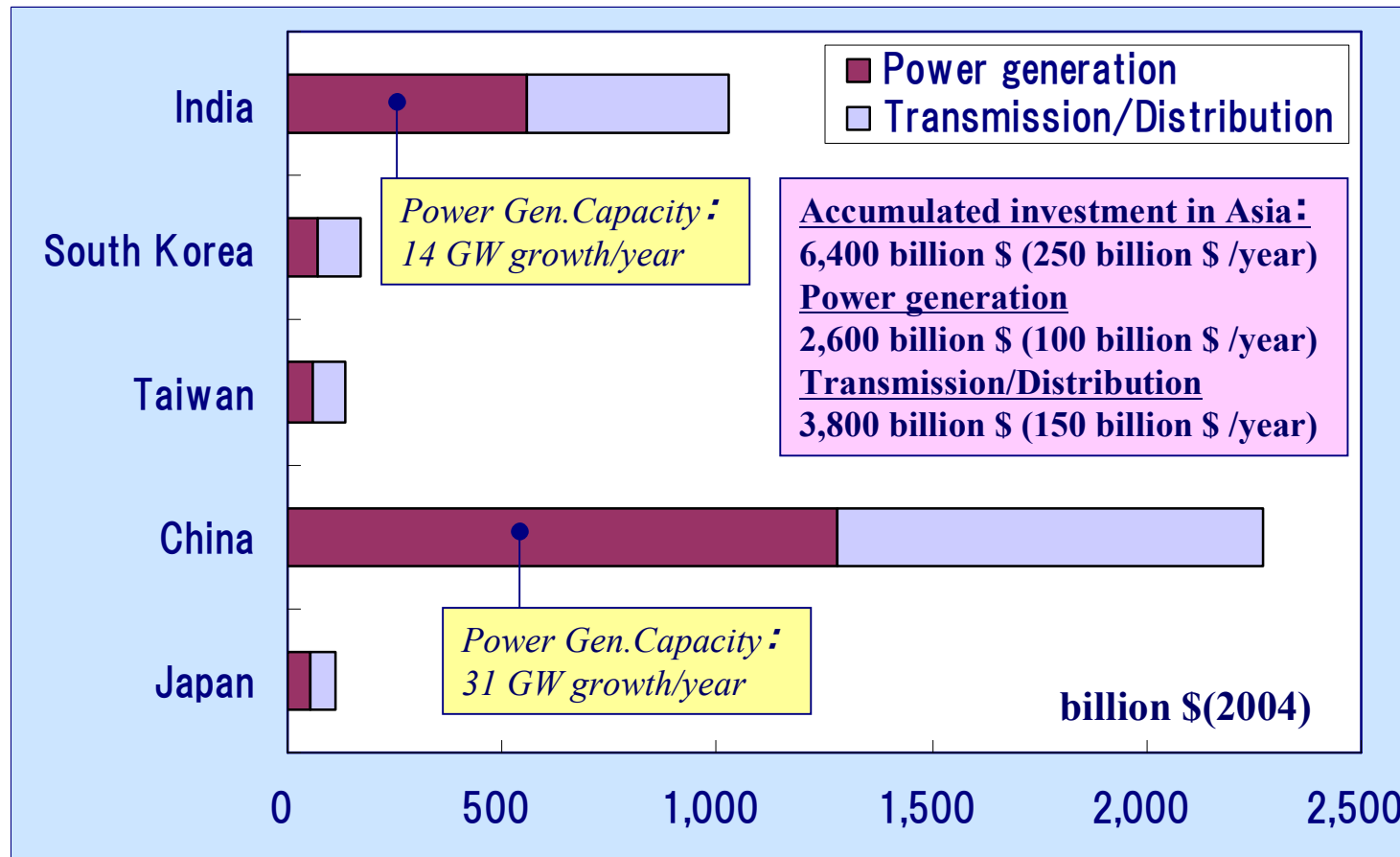
【Accumulated investment from 2004 to 2030】



- Investment in China has around 40% of total investment in Asia, and in India, 20%. Both China and India dominates half of total investment in Asia
- By sector, roughly 80% of total investment in Asia is channeled into power sector, including power generation, transmission and distribution.

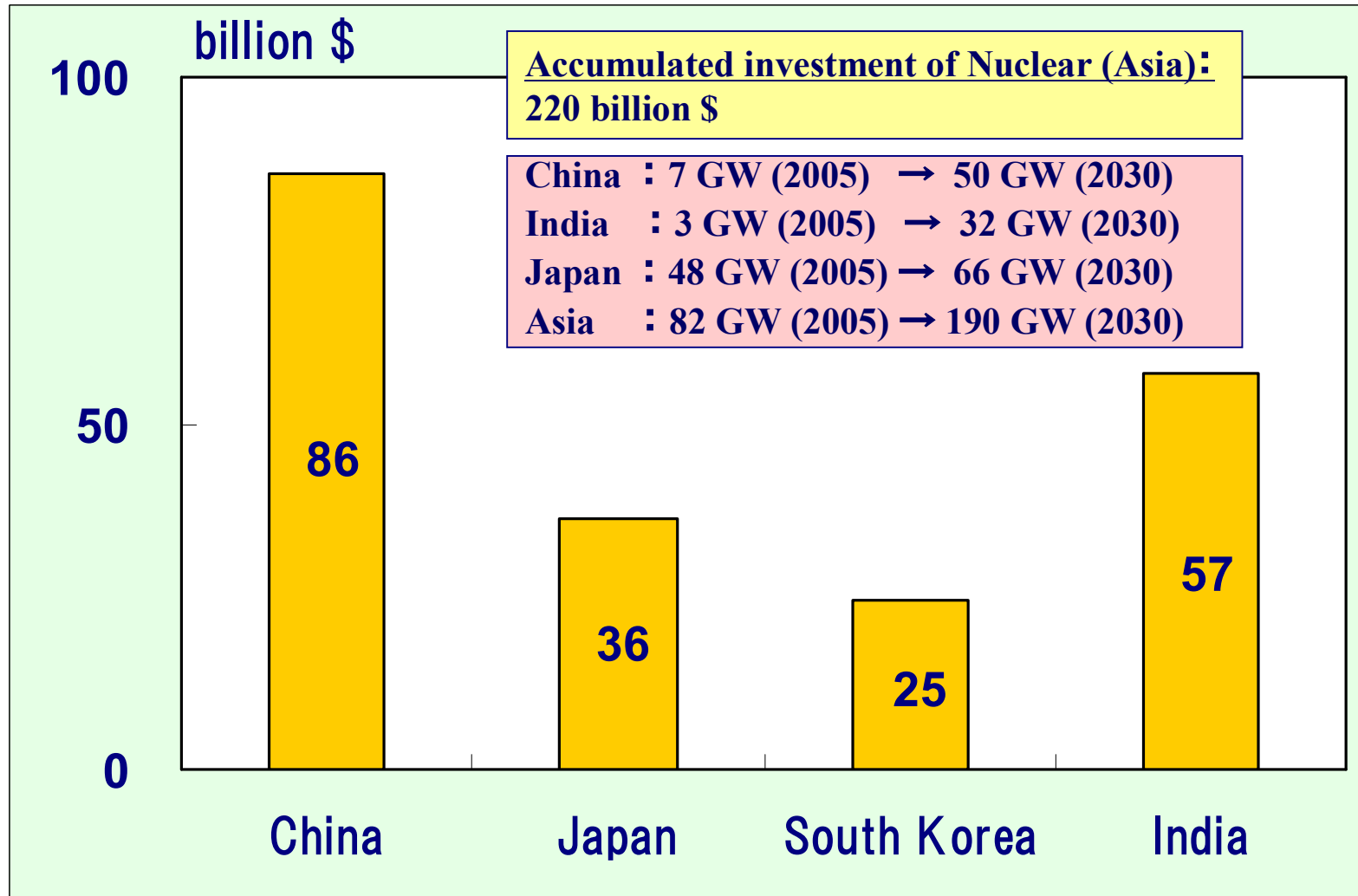
Energy Investment in Asia (Power Sector)

【 Accumulated investment from 2004 to 2030 】



40% of investment in power sector of Asia is carried out in power generation, and 60%, in transmission and distribution.

Energy Investment Outlook in Asia (Nuclear)



Renewable Energy Policies in China and India

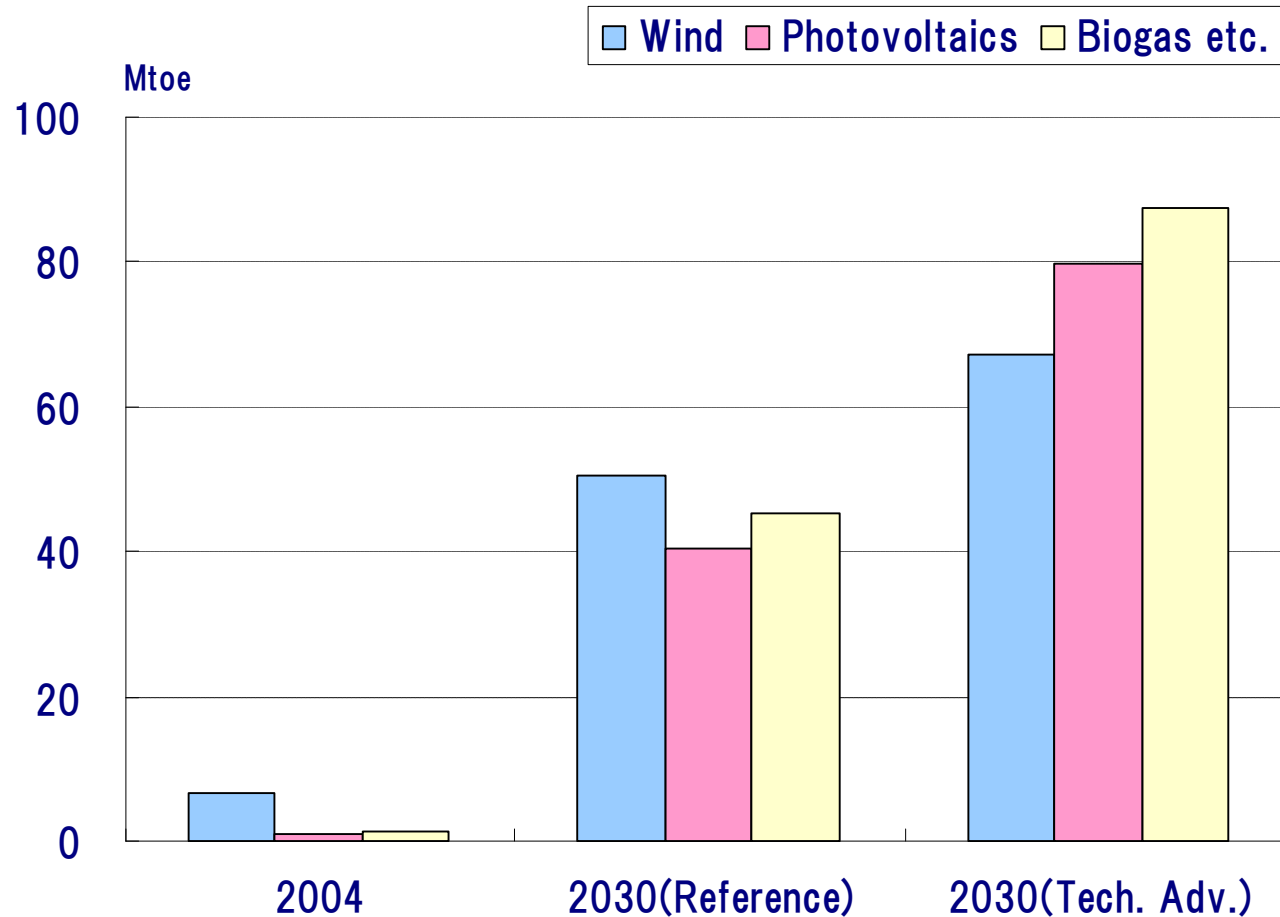
【Renewable Energy Policies in China】

Policy	Basic Policy	<ul style="list-style-type: none"> ① Promotion of renewable energy industries based on sustainable development strategy ② Development and utilization of renewable energy is a important tool of western large scale development. ③The accession to WTO is a chance and challenge to build up renewable energy industries.
	Agenda	<ul style="list-style-type: none"> ①Creation of encouragement policy ②Enhancement of infrastructure technology ③Implementation of showcase projects ④Improvement of the market and standardization ⑤Changing the people's consciousness and fostering of human resources ⑥Act on international cooperation
	Related Regulations	The law of renewable energy; implemented Jan 1 st in 2006
Target	By 2020	<p>300 million ton of coal equivalent (Mtce)(Chinese original unit:normal coal 7,000kcal/kg)</p> <p>Solar Heat :100Mtce, Wind Power:30Mtce(40GW), Hydro Power:80Mtce(75GW)(micro hydro power), Biogas power generation:28Mtce(20GW), Biogas in family sector :9Mtce, Biogas in industrial sector :8.5Mtce, :5Mtce (2.5GW), Biomass fuel:20Mtce, Others:28.5Mtce</p>

【Renewable Energy Policies in India】

Policy		<ul style="list-style-type: none"> • Satisfy rural energy demand at least • Supply distributed energy for agriculture, mining, commercial and residential sector in rural and urban area. • Electrify 18,000 villages in remote area, cooperated with private sector, NGO or other supporters. • Ensure balances between renewables and power grid.
Target	By 2012	<ul style="list-style-type: none"> • 10% (10GW) of new operating power plant comes from renewables. • Installations;Renewable Power (4.2GW),1.4 million solar systems, •Electrify 5,000 villages •Building up 1.5 million biogas plants and solar heat water system with 1 million collecting area by total.

Renewables in Asia



In Asia, wind power generation will be gradually installed mainly in China, as well as photovoltaic generation chiefly in Japan.

Biomass fuel trend in Asia

【Biomass Ethanol】

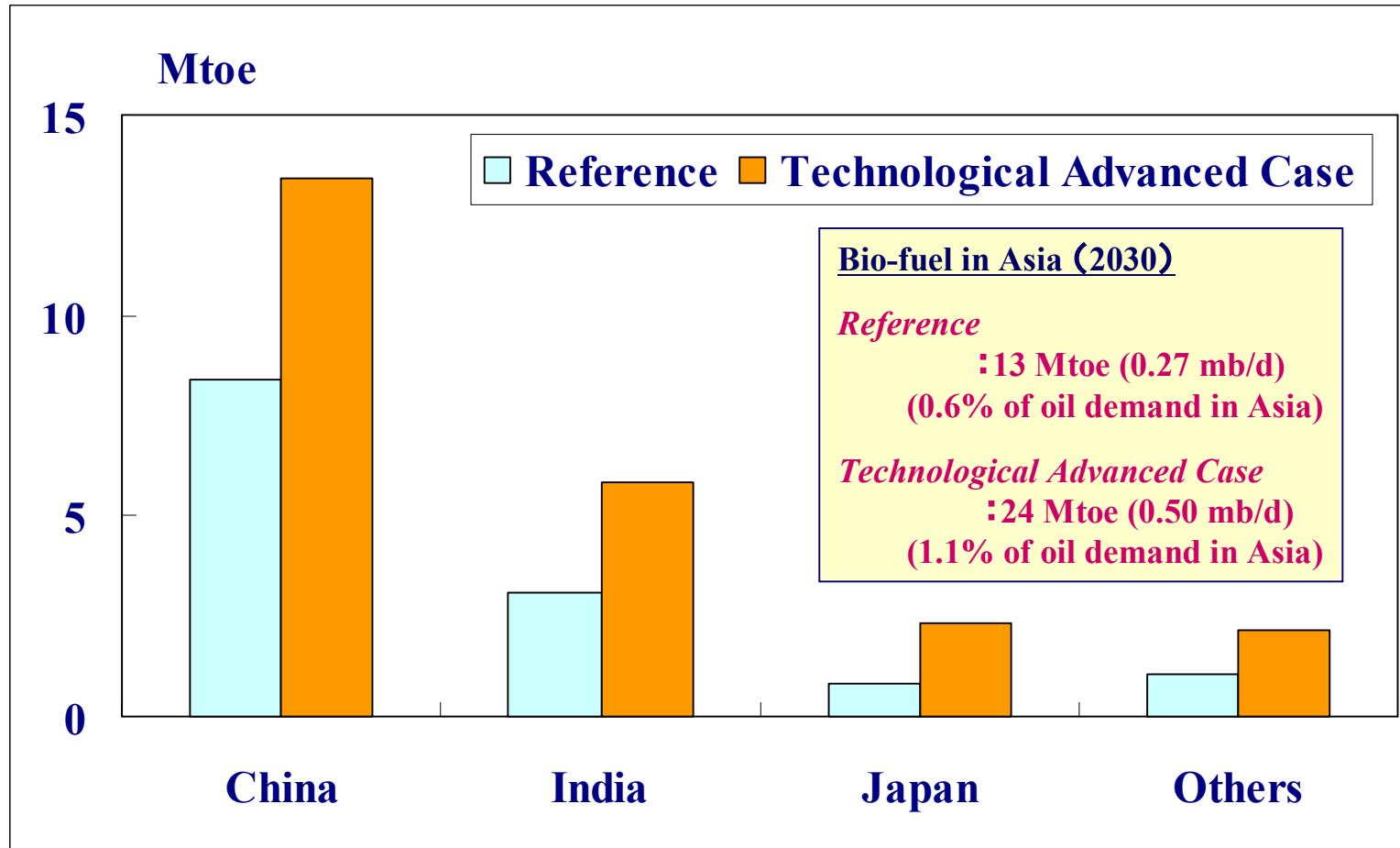
	Target of Installations, Supporting Program	mixing rate (%)	materials
China	<ul style="list-style-type: none"> ▪ By the end of 2005, gasoline is shifted into E10 in five prefectures. (This target comes from the program of expanding ethanol-blended gasoline) ▪ Consumption tax exemption on ethanol suppliers ▪ Subsidizing production of material crops ▪ Refund taxation on ethanol producer 	10%	corn flour
India	<ul style="list-style-type: none"> ▪ From 2003, E5 starts to be sold around India. The final achievement is spreading E10 in all the part of India. ▪ Mitigation of taxation on ethanol-blended gasoline. 	5%	sugarcane
Thailand	<ul style="list-style-type: none"> ▪ The target is all the gasoline converted into E10 by 2011. ▪ Exemption of commodity tax on purchasing ethanol-blended gasoline ▪ Subsidizing E10 production ▪ Exemption of corporation tax on new entrant 	10%	cassava sugarcane
Philippine	<ul style="list-style-type: none"> ▪ In 2010, gasoline is shifted into E10.(target from state program of ethanol fuel, started in 2005) ▪ Car, sold after 1995, adapts to E10 consumption. 	5%	sugarcane

Biomass fuel trend in Asia

【Bio Diesel】

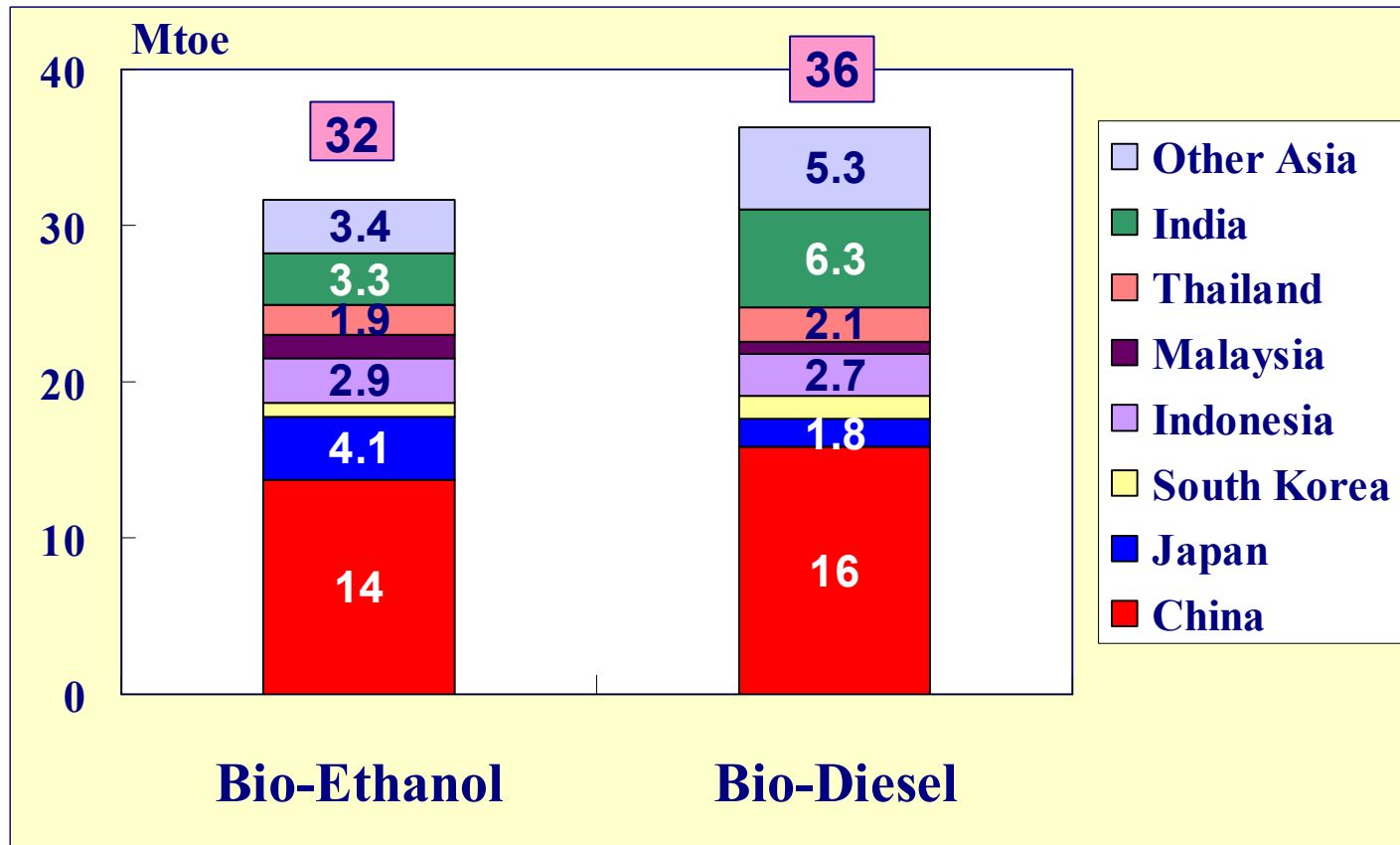
	Target of Installations, Supporting Program	mixing rate (%)	materials
India	2005 ~2007:Verification test 2007 ~2010:Expansion of supply area 2011 ~2012:Expansion to all the area of India	5%	Jatropha
Indonesia	Target of 4.7 GL in 2025 (National Plan)	—	Palm
Malaysia	Develop “National BioFuel Policy”	2~5%	Palm
Thailand	By 2006, introduce B2 (2% mixture), by 2011, B3(3% mixture)	2%	Palm
Philippines	Mandatory in official car at B1 (1% mixture)	1%	Coconut

Biomass fuel outlook in Asia (2030)



In 2030, bio-fuel (including bio-ethanol and bio-diesel) in Asia will increase to 13 Mtoe (0.27 mb/d) in Reference, 24 Mtoe (0.50 mb/d) in Technological Advanced Scenario.

Bio-fuel Maximum Potential in Asia (2030)



**Estimated under the assumption that bio-ethanol(E10) and bio-diesel(BD5) become widespread in all the Asian countries.*

Maximum potential of bio-ethanol in 2030 is 32 Mtoe, bio-diesel, 36 Mtoe. Total 68 Mtoe of bio-fuel could be introduced in Asian region by 2030 (68 Mtoe is equivalent to approximately 3% of Asian total oil demand in 2030)



Technological Advanced Scenario

Technological Advanced Scenario

In technological advanced scenario, we develop energy demand projection where Asian countries implement various energy and environmental policy to secure energy supply and mitigate carbon dioxide emissions

Basically, these policies are assumed reflecting on actual policy in each Asian country. In country where concrete energy policy does not exist, we assume that energy efficiency improve more rapidly than reference case due to technology transfer from developed countries.

Assumed measures:

■ Energy conservation in industry and residential/commercial sector

High efficiency boiler, Coke Dry Quenching equipment(CDQ), Top Gas Pressure Recovery Turbine(TRT), IT-based energy management system, Thermal insulation, High efficiency heat pump etc.

■ Energy-efficiency in transport sector

Hybrid-vehicle, ITS(Intelligent Transport System) etc.

■ Renewables

Bio-fuel for automobile, photovoltaic, Wind-power, Biomass power generation etc.

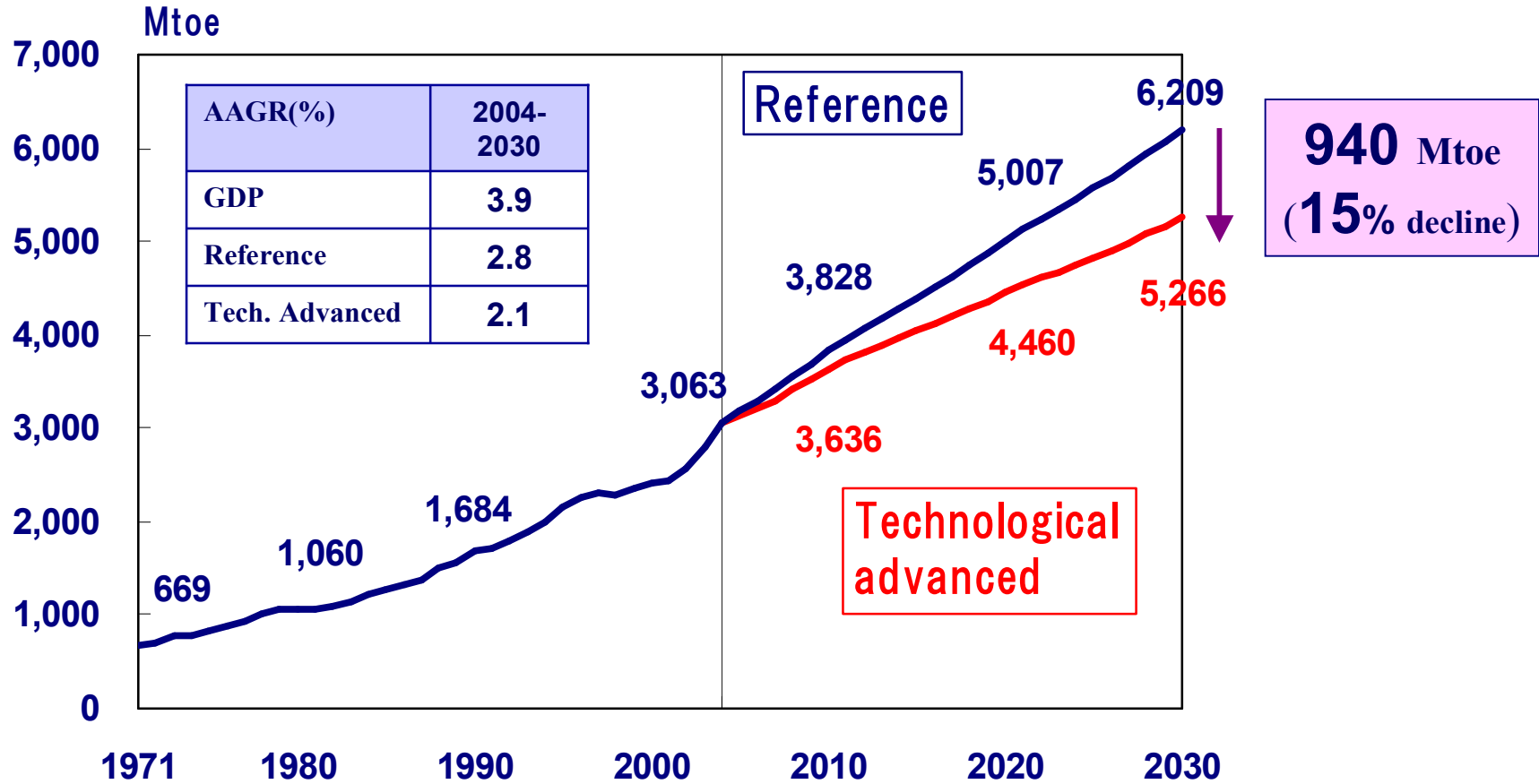
■ Nuclear

Building new nuclear power plant, Enhancement of operating ratio and safety control etc.

■ Energy-efficiency in power generation sector

Coal-fired IGCC/IGFC, Gas-fired MACC etc.

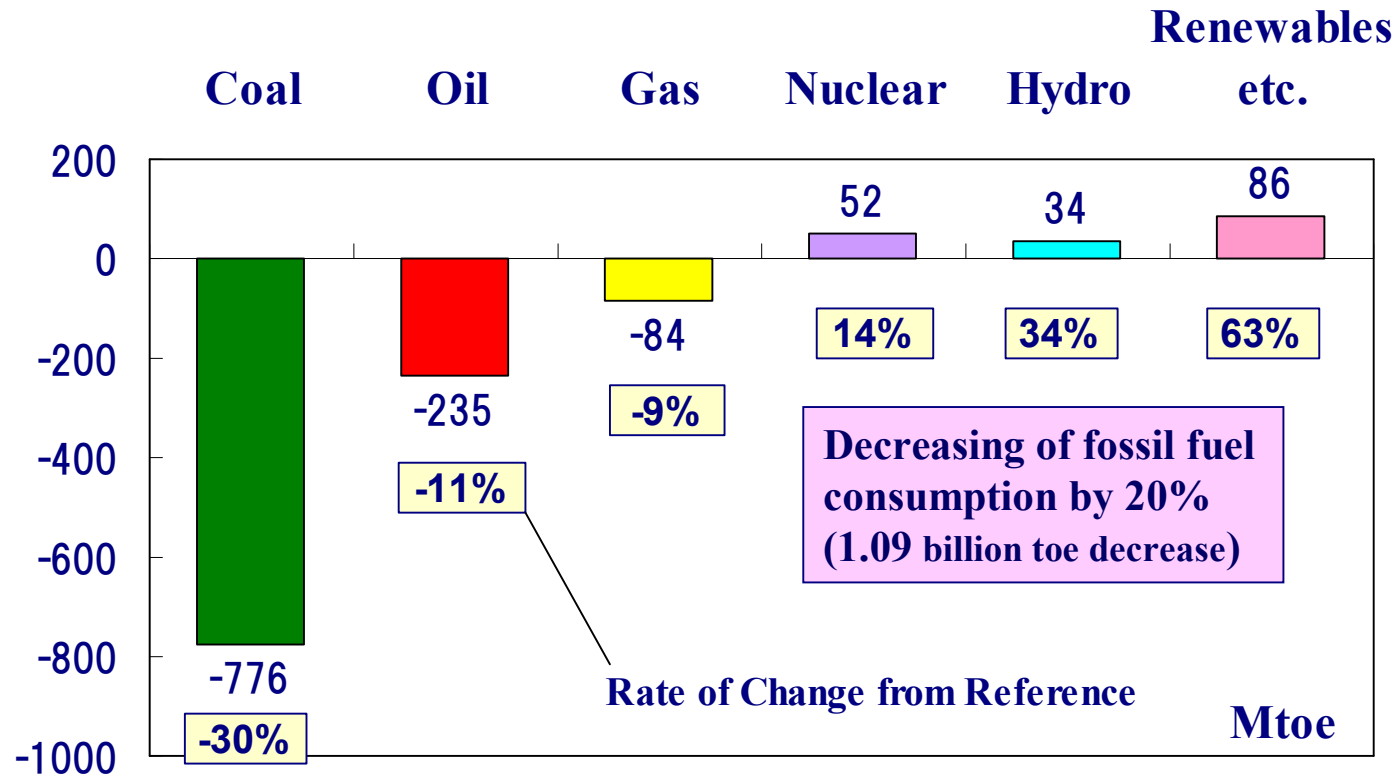
Primary Energy Demand (Asia)



In 2030, aggregate primary energy demand is reduced by around 15% (940 Mtoe, 1.8 times scale of Japan's current primary energy demand)

Change in Energy Demand by Energy Source (Asia)

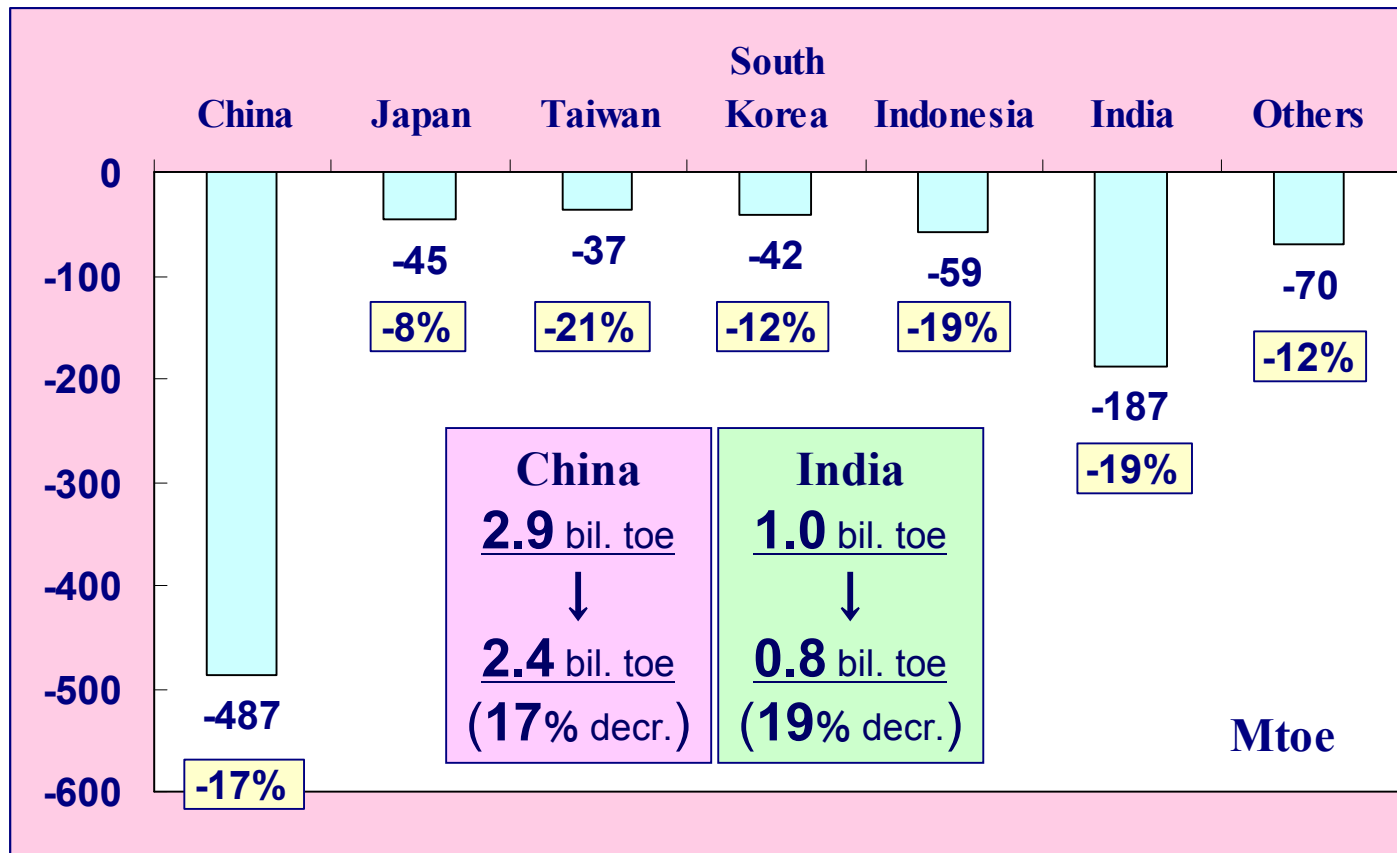
【Change of Energy Demand in 2030】



- Coal consumption could be largely reduced by introducing highly efficient technology and clean coal technology (CCT)
- Enhancing efficiency in transport sector contributes to reduce oil consumption in Asia, and is expected to stabilize international oil market

Change in Total Primary Energy Demand (Asia)

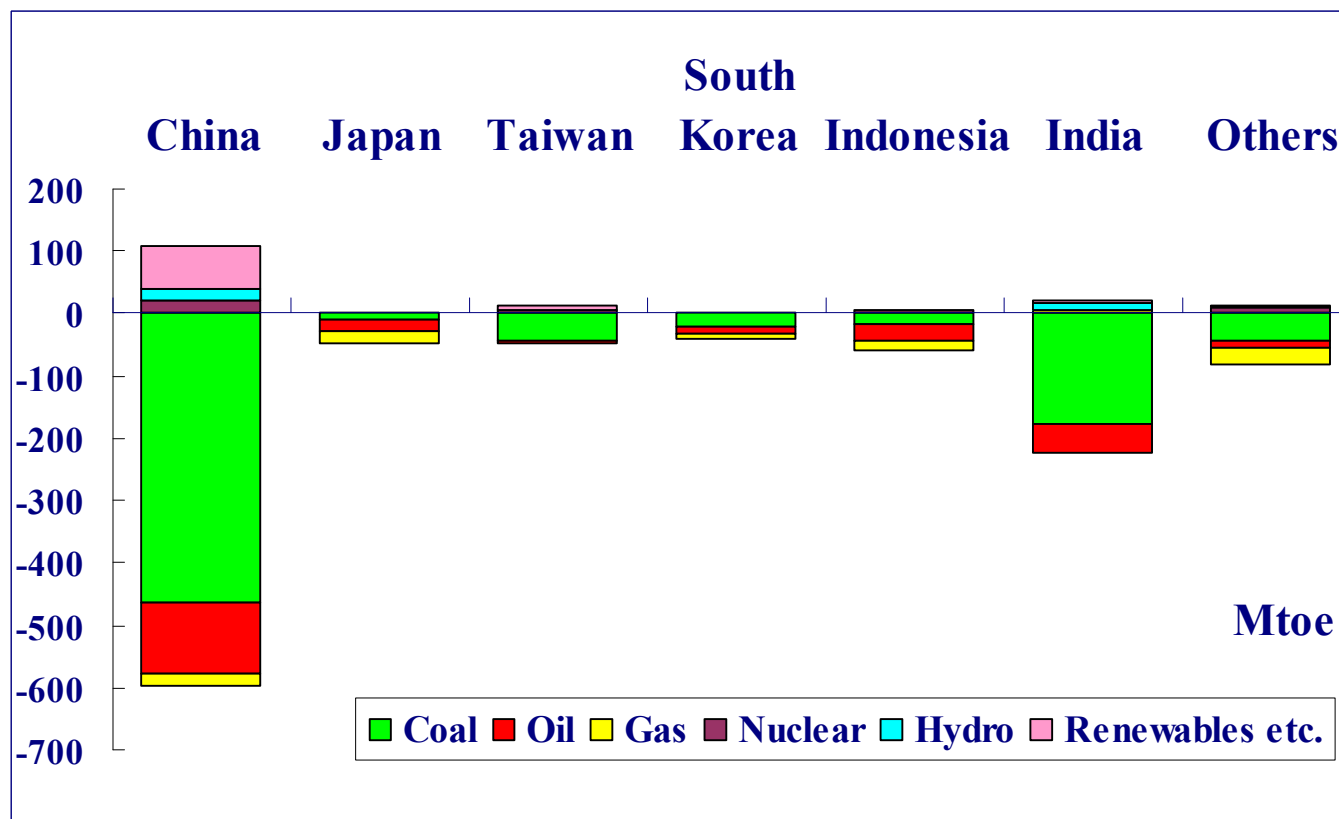
【 Change of Total Primary Energy Demand in 2030 】



Potential of energy conservation is large in both China and India through enhancing energy consumption efficiency

Change in Energy Demand (Asia)

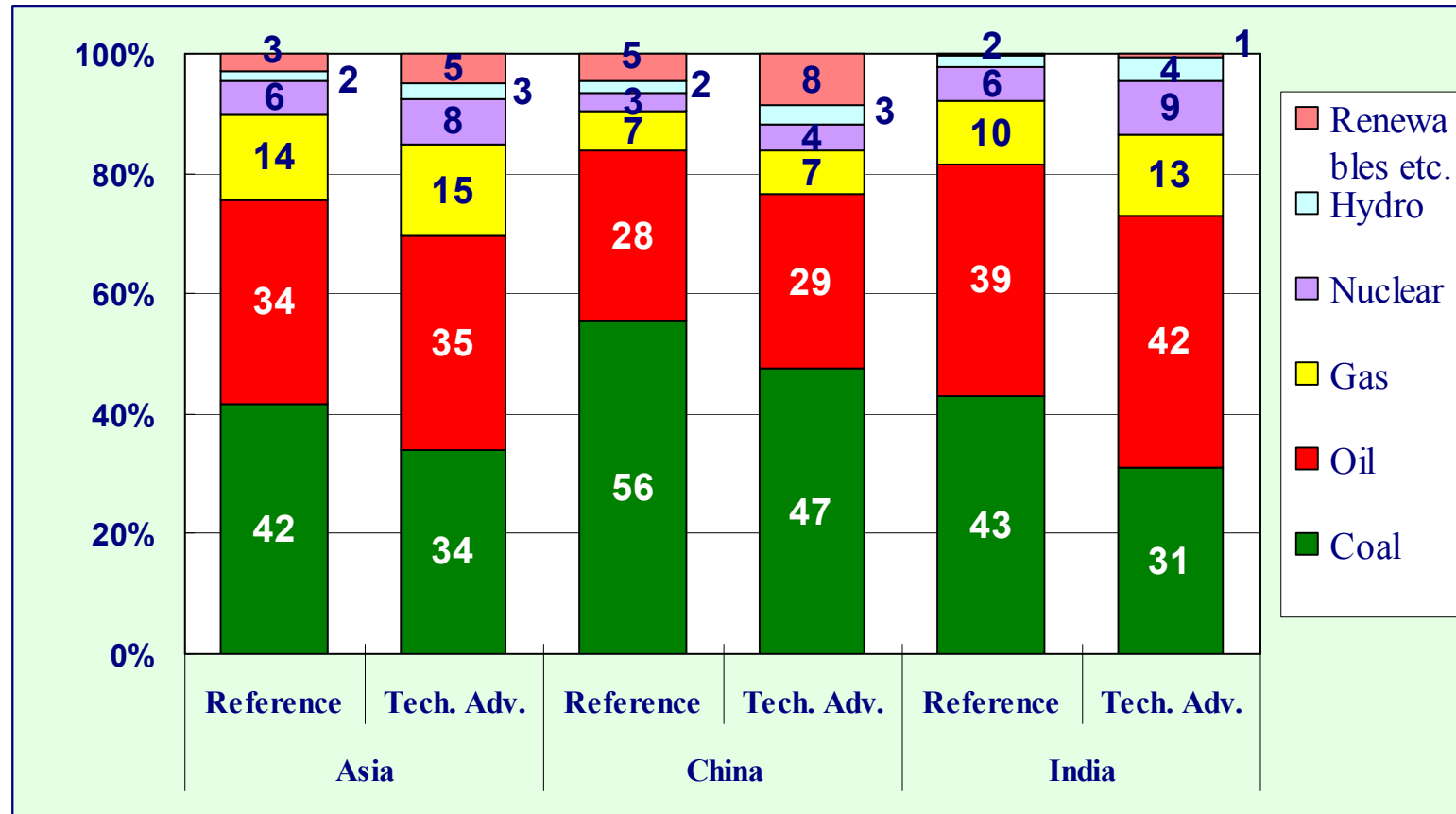
【 Change of Energy Demand in 2030 】



In China, coal consumption is dramatically reduced through improving the efficiency of coal-fired power plant, promoting nuclear and renewables. Also in India, coal is largely decreased with improving the efficiency of coal-fired power plant, promoting hydro and renewables.

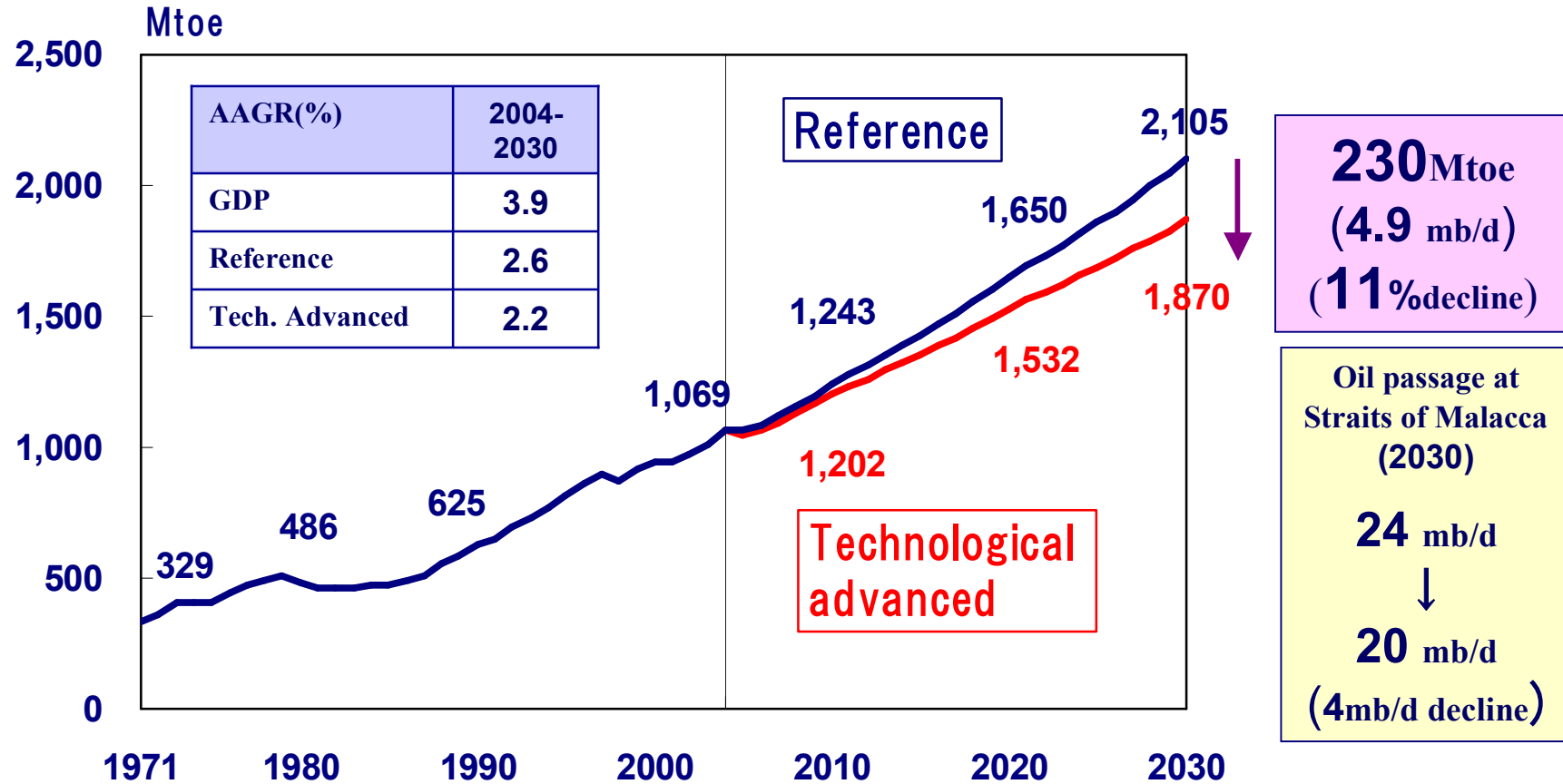
Fuel Mix Change

【Fuel mix change in 2030】



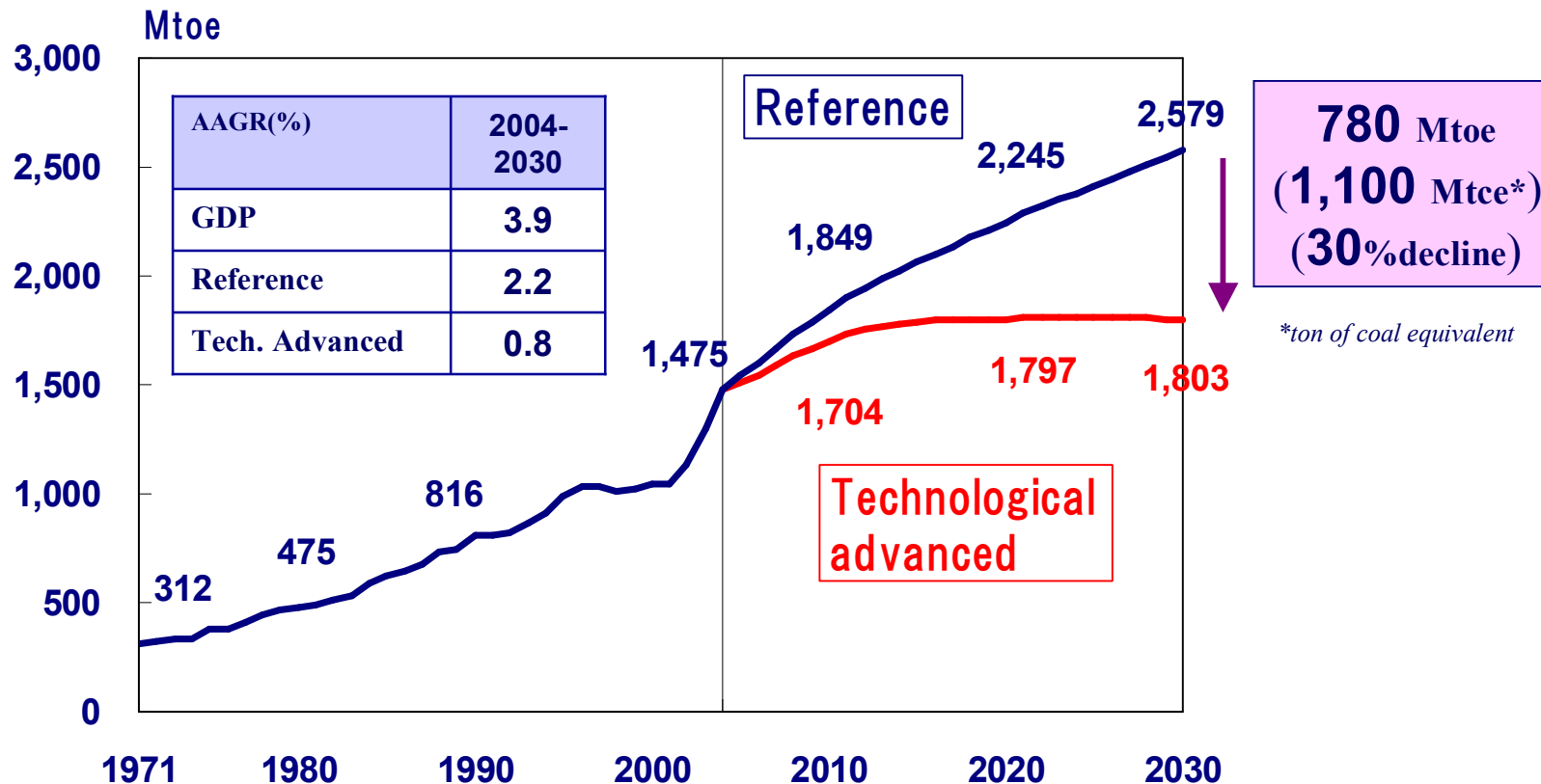
- In technological advanced scenario, the share of coal decreasing; oil, gas, nuclear, renewables increasing; Diversification and decarbonization promote
- Fossil fuel dependence decreasing by 5% in Asia as a whole

Oil Demand (Asia)



- In 2030, energy conservation in oil amounts to about 11%(230 Mtoe, 4.9 mb/d)
- This conservation volume is roughly equivalent to the annual oil production of Iran and Oman together.

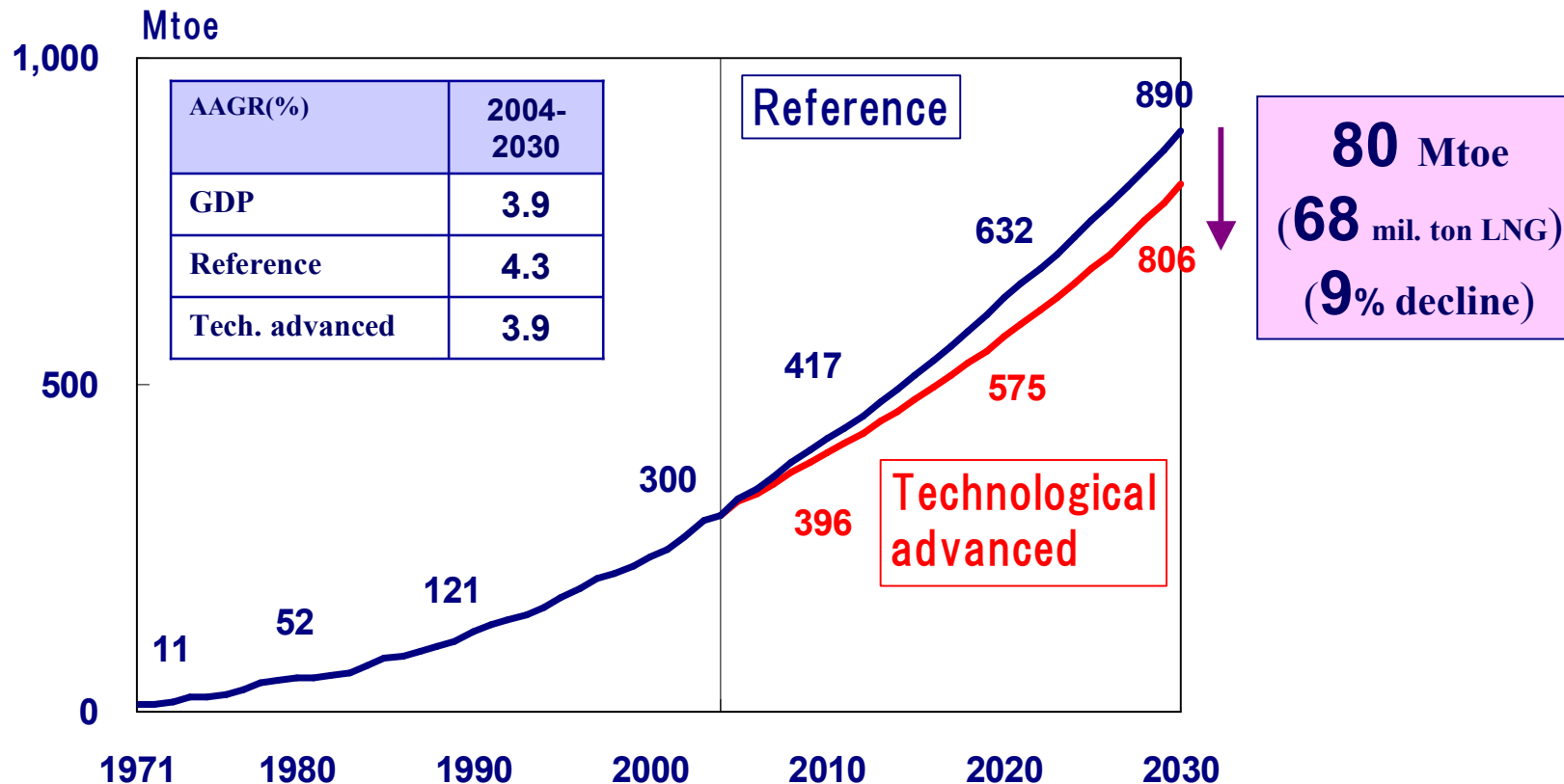
Coal Demand (Asia)



In 2030, energy conservation in coal achieves about 30%(780 Mtoe), the scale of which corresponds to 3.6 times of coal demand in India, 0.7 times in China

⇒ Promoting clean coal technology in Asia has tremendous significance in order to ensure coal supply and environmental protection

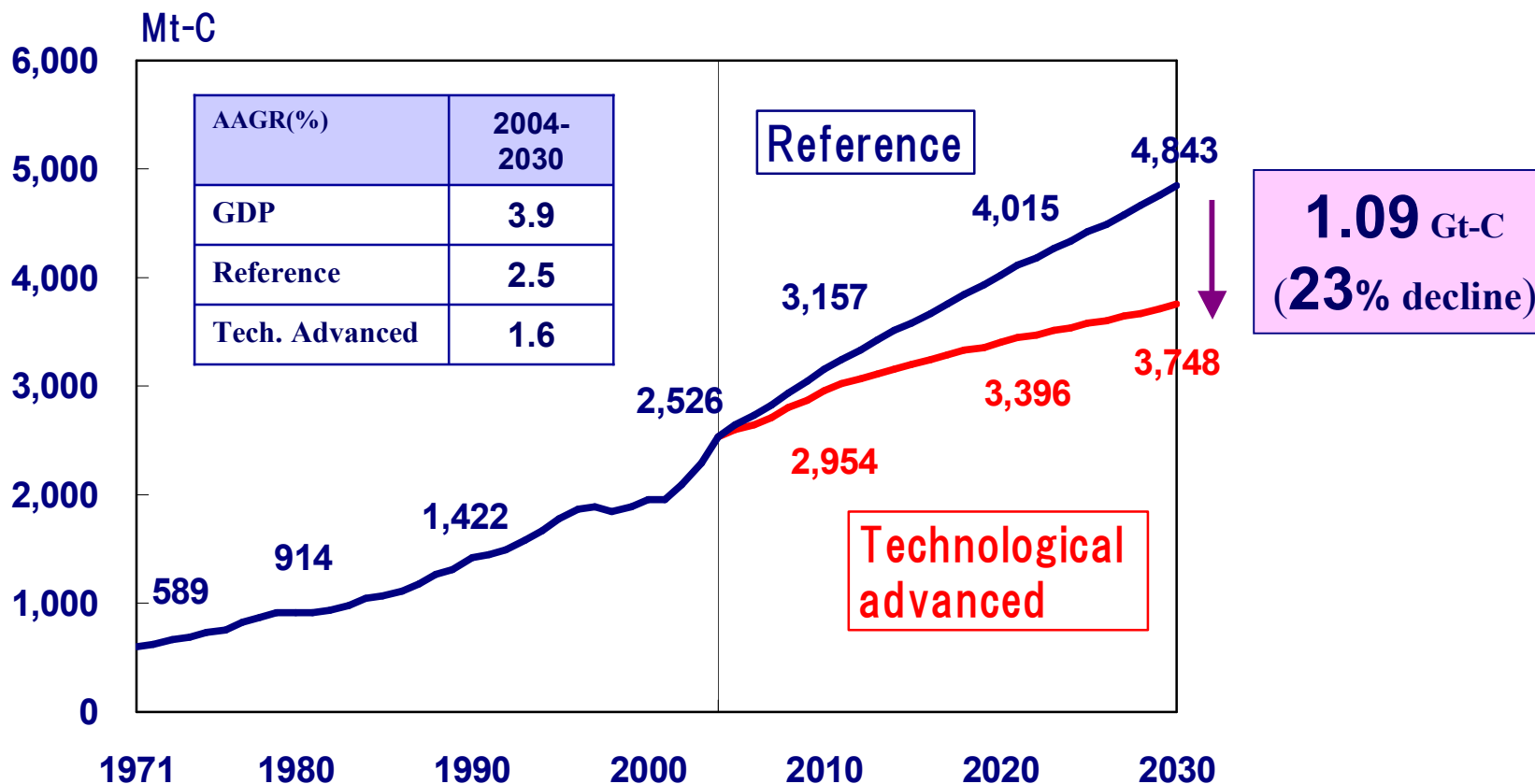
Gas Demand (Asia)



➤ In 2030, energy conservation in natural gas accomplishes about 9%(80 Mtoe), the scale of which is equal to 1.2 times of current LNG imports in Japan

➤ High efficient technology such as MACC(More Advanced Combined Cycle) etc. is expected to contribute largely to ensure gas demand and supply in Asia

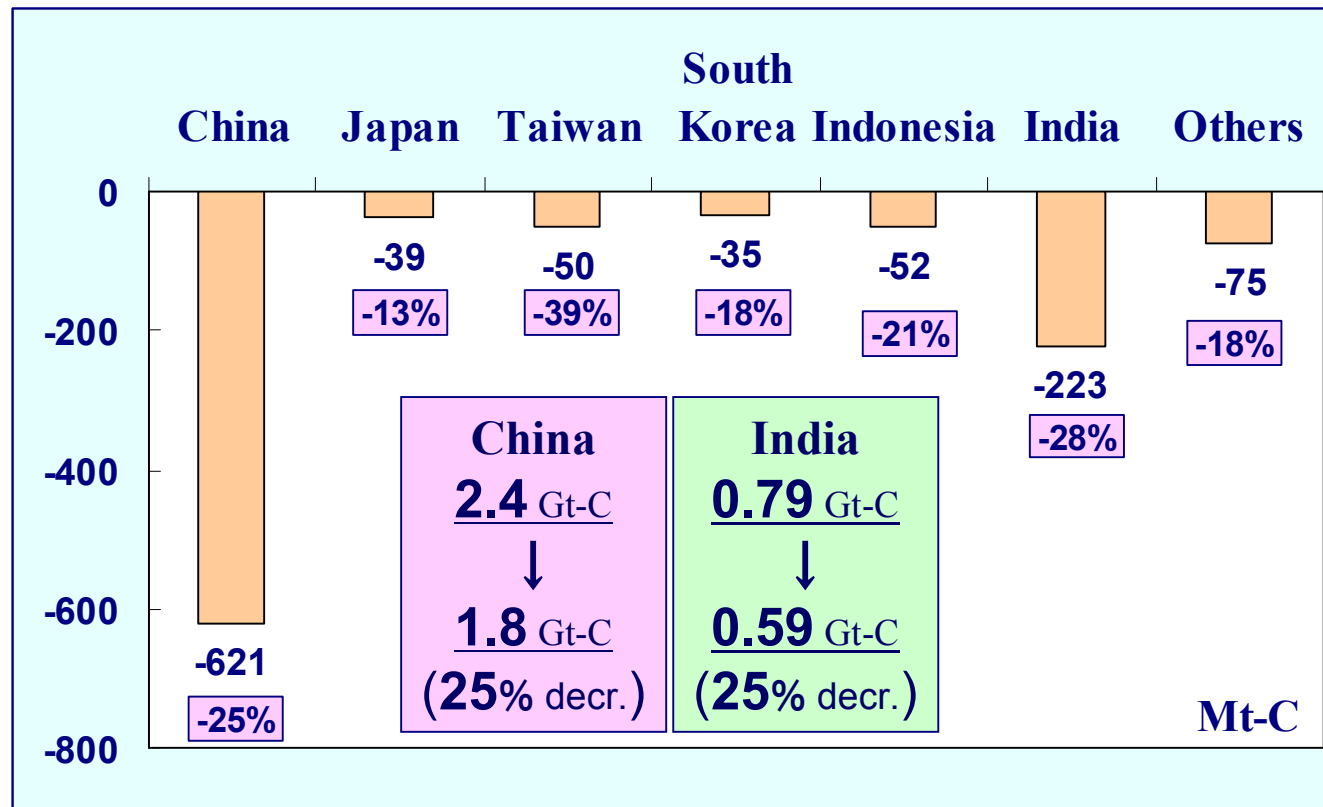
CO₂ Emissions (Asia)



In 2030, mitigation of CO₂ emissions achieves about 22%(1.09 Gt-C), roughly equivalent to the emissions of whole China or 3.2 times of Japan

CO₂ Emissions (Asia)

【 Change of CO₂ in 2030 】



- Thorough high efficient and environmentally compatible technology, CO₂ emissions is substantially mitigated in China and India
- CO₂ mitigation in China and India correspond to 1.8 times and 0.6 times of current Japan's emissions respectively

Decomposition analysis of CO₂ emissions

(Asia: excluding Japan)



Unit: Average annual growth rate, %

		1973-1990	1990-2004	2004-2030	
				Reference	Tech. Advanced
CO ₂ change	ΔC	6.5	6.0	2.3	1.2
Fuel Switching	$\Delta(C/E)$	▲ 0.3	▲ 0.7	▲ 0.1	▲ 0.5
Energy Conservation	$\Delta(E/Y)$	0.0	▲ 0.3	▲ 2.8	▲ 3.5
GDP Growth	ΔY	6.8	7.0	5.4	5.4

Decompose CO₂ emissions change into 3 parameters

$$C = (C/E) * (E/Y) * Y$$

$$\Delta C = \Delta(C/E) + \Delta(E/Y) + \Delta Y$$

Decarbonization Energy Conservation GDP Growth

Decomposition analysis of CO₂ emissions

【Average annual growth rate, %, 2004~2030】

		China		Japan		South Korea		India		Indonesia	
		Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced
CO ₂ Change	ΔC	2.4	1.3	▲ 0.5	▲ 1.1	1.6	0.8	3.7	2.3	3.8	2.8
	Fuel Switching $\Delta(C/E)$	▲ 0.4	▲ 0.8	▲ 0.5	▲ 0.7	▲ 0.2	▲ 0.5	▲ 0.4	▲ 0.8	0.2	0.1
	Energy Conservation $\Delta(E/Y)$	▲ 3.1	▲ 3.8	▲ 1.5	▲ 1.8	▲ 1.6	▲ 2.1	▲ 1.7	▲ 2.4	▲ 1.7	▲ 2.5
	GDP Growth ΔY	6.1		1.5		3.5		5.8		5.4	

Malaysia		Philippines		Thailand		Vietnam		Asia(exc.Japan)	
Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced	Reference	Tech. Advanced
4.6	3.7	4.3	3.5	3.8	3.5	4.1	2.2	2.3	1.2
0.0	▲ 0.1	0.1	▲ 0.2	▲ 0.4	▲ 0.4	▲ 0.2	▲ 1.4	▲ 0.1	▲ 0.5
▲ 1.1	▲ 1.9	0.1	▲ 0.5	▲ 0.7	▲ 0.9	▲ 2.0	▲ 2.6	▲ 2.8	▲ 3.5
5.7		4.1		4.9		6.5		5.4	

Implications

< Assurance of Energy Security in Asia >

Import dependence rate of oil in Asia will sharply rise, reflecting on the stagnation of regional crude oil production and rapid oil demand growth based on boosting vehicle ownership in China and India. Furthermore, oil dependence of Asia on Middle East, which is more economically available, is forecast to increase. While it is naturally important for the individual countries to make efforts to secure their own energy supplies, there is also a possibility that excessive pursuit of the national interest by any single country could damage the energy security of the rest of the region. It is consequently becoming increasingly important for the issue to be treated as one in which all countries in the region have a common stake.

- Fuller exercise of bargaining power given their collective position as a massive regional consumer of oil, and strengthening of ties of dialogue and cooperation as equal partners with net oil producers.
- Construction of a shared reserve scheme for response to emergencies and effective use of the existing infrastructure to deal with short-term crises such as supply suspensions.
- Promotion of cooperative resource development and procurement inside and outside the region.
- Enhancement of regional partnership on effective use of surplus petroleum processing capacity and on enhancing quality standard.
- Ensuring security at Straits of Malacca and establishing emergency program including securing alternative transport route.
- Diversification of fuels with oil sands and bio-fuel etc.

<Response to Global Environmental Problems>

The trend of rapid increase in CO₂ emissions in China, India and other developing Asian countries underscores that a far larger overall cost-benefit would be delivered by mitigation of environmental load through transfer of technology to these countries. For our country, Japan, it is very important to contribute to improving those problems through doing the mentioned above, and to enforce domestic CO₂ mitigation measures in order to accomplish the Kyoto Protocol target.

China and other developing Asian countries have immense potential for energy conservation, and offer enormous margin for technical assistance through the Clean Development Mechanism (CDM) and other schemes; It is significant for the countries, which ratified the Kyoto Protocol, to implement CDM scheme in developing countries, considering of its “additionality” and “supplementality”.

For Japan, with its advanced energy conservation technologies in each sector, it is important to develop technology cooperation with developing countries in energy conservation and environmental preservation, and to share best practiced and best available technologies (BAT).

<Pursuit of Energy “Best Mix”>

Pursuit of the best energy mix is another agenda item to be tackled by each country in accordance with its circumstances as regards energy demand attributes, amount of resource reserves, level of technology, and economic merit. However, it is also vital to retain the perspective of optimizing the mix in the region as a whole, based on cooperation between the net consumers and net suppliers.

Coal: *In Asia, coal consumption is forecast to increase mainly by power sector. Since coal utilization entails a high environmental load, it is necessary to promote highly efficient and environmentally compatible use and develop “Clean Coal Technology”.*

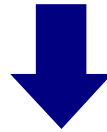
Gas: *Utilization of natural gas is also projected to expand in Asia, especially in the power and civil sectors. This points to a need for improvement of its economic feasibility. The Asia-Oceania region has a fully sufficient supply potential for natural gas into the long term, and the net consumer countries must collaborate in efforts to heighten the economic merit by exercise of stronger bargaining power, for example. At the same time, in view of a sharp increase in LNG demand in Western countries, it is also important to develop a future-oriented strategy for ensuring the security of gas supplies.*

Nuclear: *In Asia, because of the scarcity of domestic energy resources, nuclear power generation will play a major role in ensuring a stable supply of electricity and in overcoming environmental problems in the interests of the public. It is important that we should maintain and increase the share of nuclear power generation, seeing it as a core source of energy supply.*

Renewables: *Most renewables are produced domestically and moreover, they constitute an important option for combating global warming. We should ensure wider use of renewables by reinforcing the implementation of effective and efficient measures for promoting their use and by introducing policies in support of technological innovations.*

Conclusion

For Asia to simultaneously achieve its “3S” goals (security of supply; sustainability by solving global environmental problems; and stability of the market), each Asian country, in a manner that befits the energy supply-demand structure of the country and the prevailing state of economic development, should accelerate the decarbonization of energy supplies through diversification of energy supply sources, energy-conservation and a shift to alternative fuels and strengthen its efforts toward achieving the best energy mix.



In the context of these efforts, Japan will have a tremendous role to play in Asia, with its advantages in terms of technology, economic power and legislative design. Of pivotal importance in the context of Japan’s international energy strategy will be our efforts to further develop and utilize energy-saving and environmental preservation technologies, in which we already excel, as well as the technologies and know-how unique to Japan which is a leading country in the area of nuclear power generation. With these advanced energy-conservation and environmental technology, it is crucial for Japan to support the advancement of its economy through extensive use of its undepletable resource - its technology, and to contribute to Asian economy and environment.