Energy Issues and Challenges in Asia

—Focusing on the Energy Security Issues —

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- **Summary**

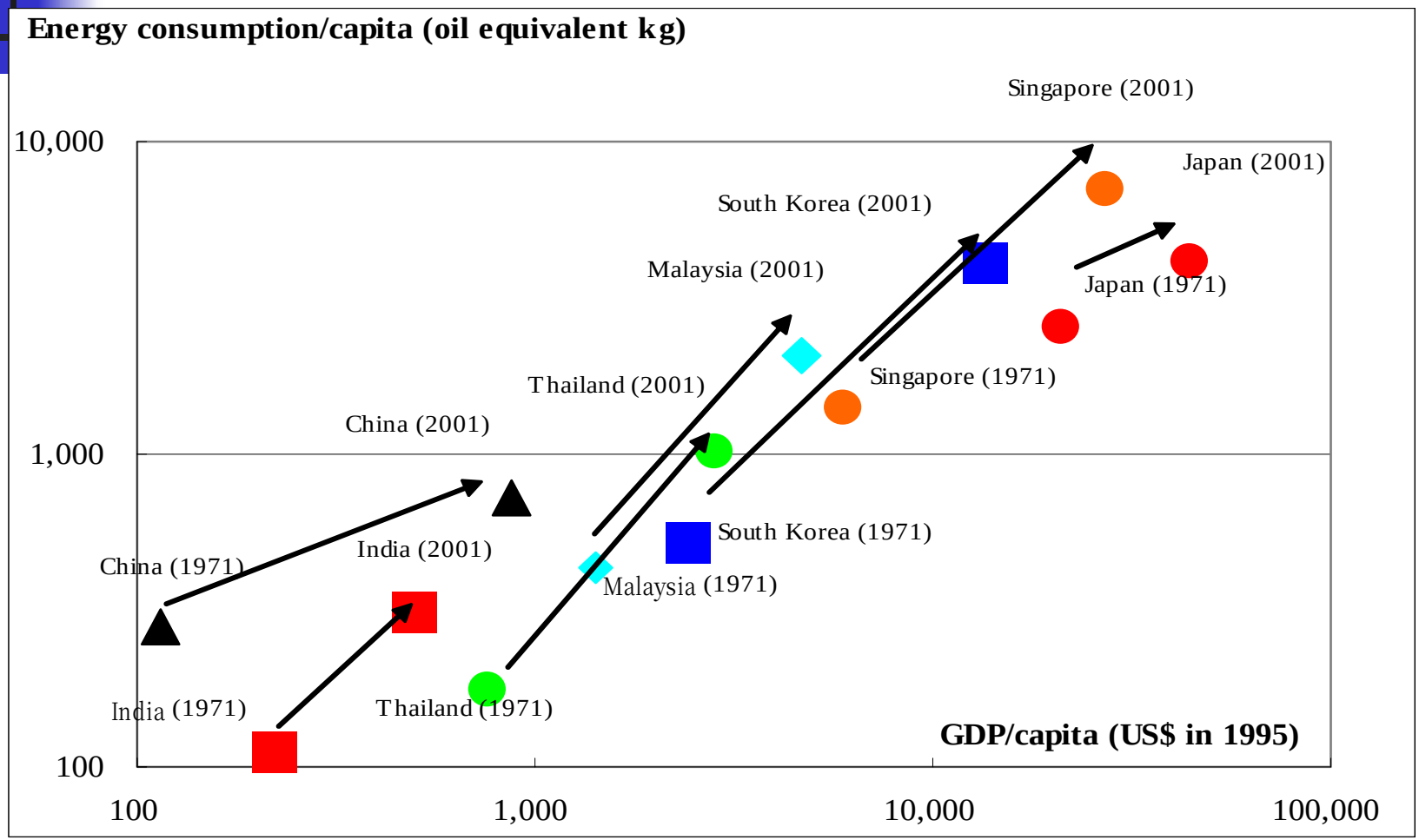
Economic Growth Trends in Major Asian Countries

(US$ billion in 1995 prices)

	1971	1980	1990	1995	2000	2001	Growth rate 1971-2001(%)
Japan	2,236	3,304	4,936	5,292	5,681	5,648	3.1
China	96	164	398	700	1,041	1,117	8.5
South Korea	79	149	342	489	620	639	7.2
Taiwan	39	87	186	262	347	339	7.5
Singapore	13	27	54	83	114	112	7.6
Indonesia	37	75	138	202	209	216	6.0
Malaysia	16	32	57	89	112	112	6.8
Philippines	33	56	67	74	88	91	3.4
Thailand	28	52	111	168	172	175	6.3
India	122	162	284	366	482	508	4.9
Total	2,699	4,107	6,572	7,725	8,866	8,957	4.1

Source: Prepared from data provided by IEEJ/EDMC

Relationship between Energy Consumption and GDP

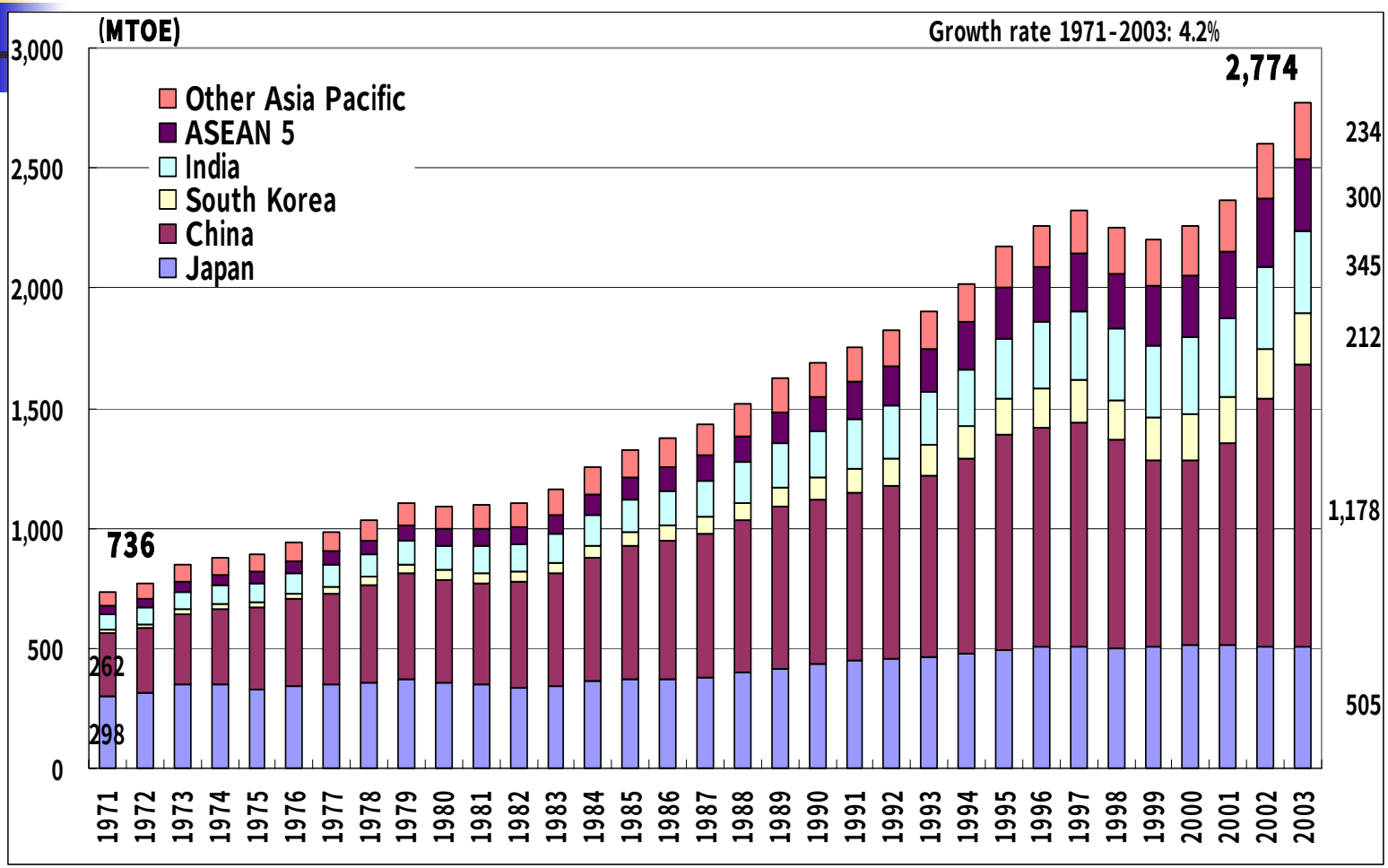


Source: Prepared from data provided by IEEJ/EDMC

Factor Analysis of Energy Consumption Increase by Economic Growth

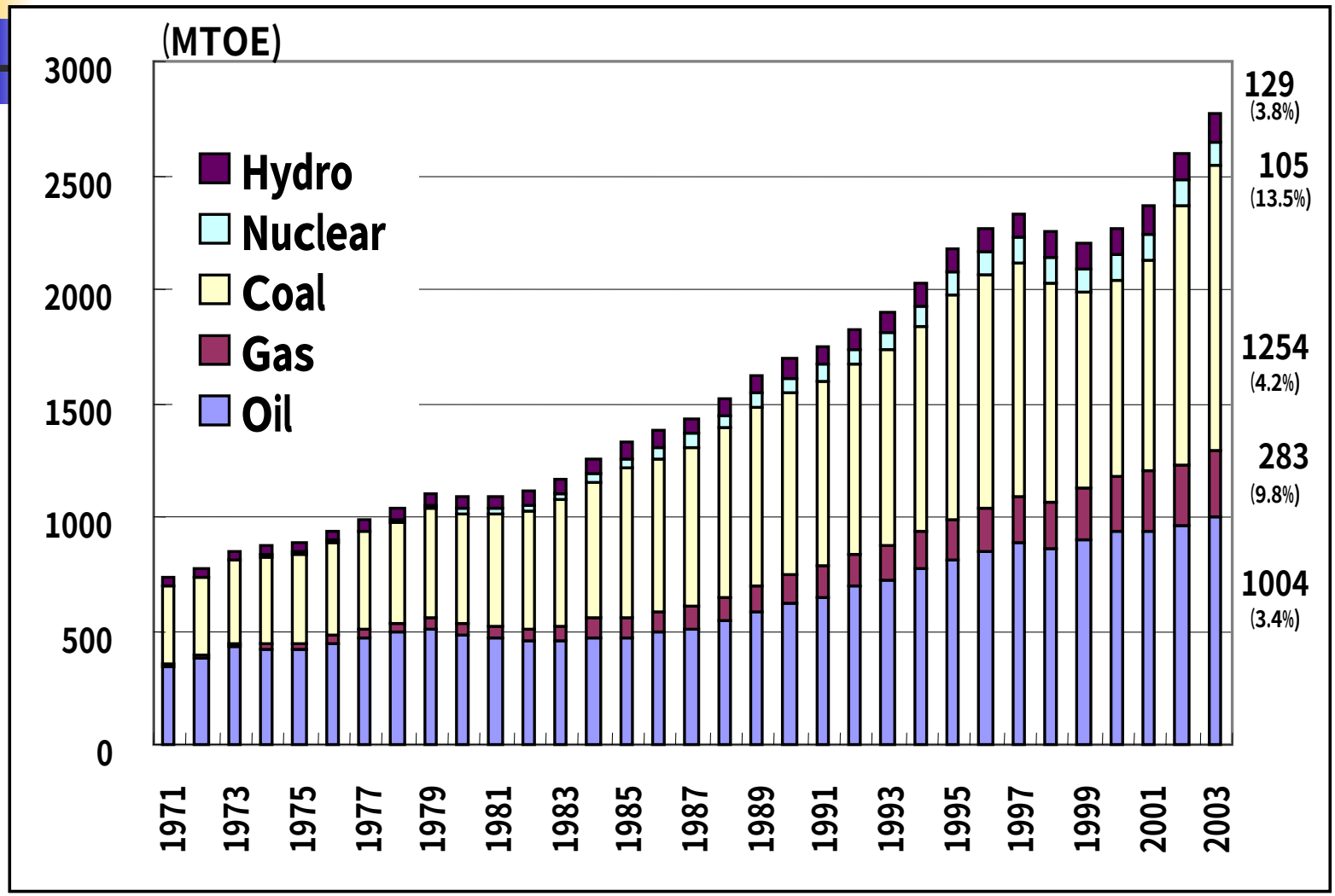
- Energy consumption increases in industrial sectors as an input factor by economic growth.
  - Percentage of the industrial sectors (high energy consumption industries) is high in Asia.
- The diffusion and use of energy consuming equipment increased due to economic growth; energy consumption of commercial and transportation sectors increased.
  - The increase of diffusion and use of equipment surpasses the efficiency improvement effect of equipment.
- In developing countries, the demand for conversion from conventional energies to commercial primary energies is generated by economic growth.

Trend of Energy Consumption Increase in Asia (by Country)



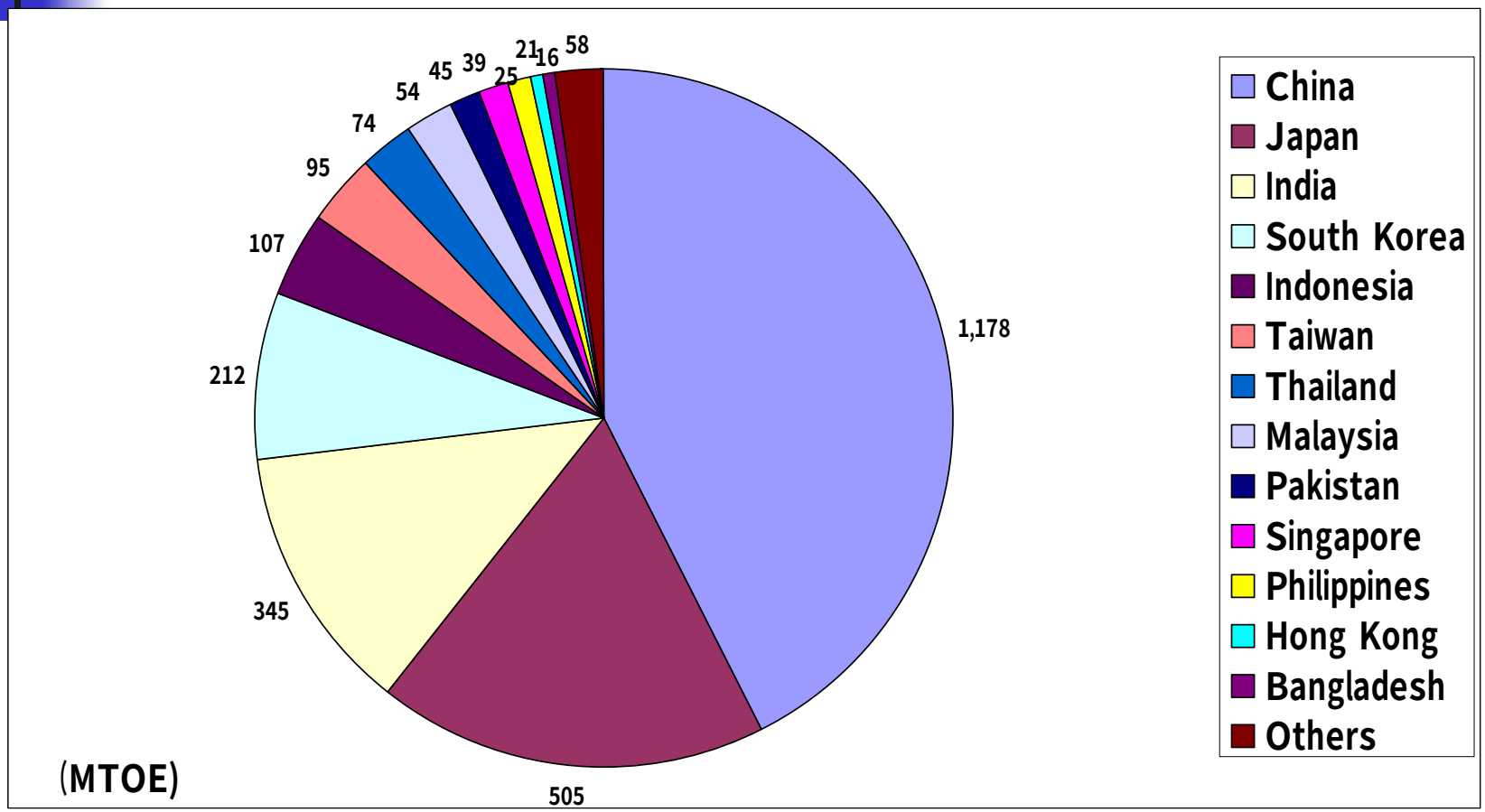
Source: Prepared from BP Statistics

Trend of Energy Consumption Increase in Asia (by Energy Source)



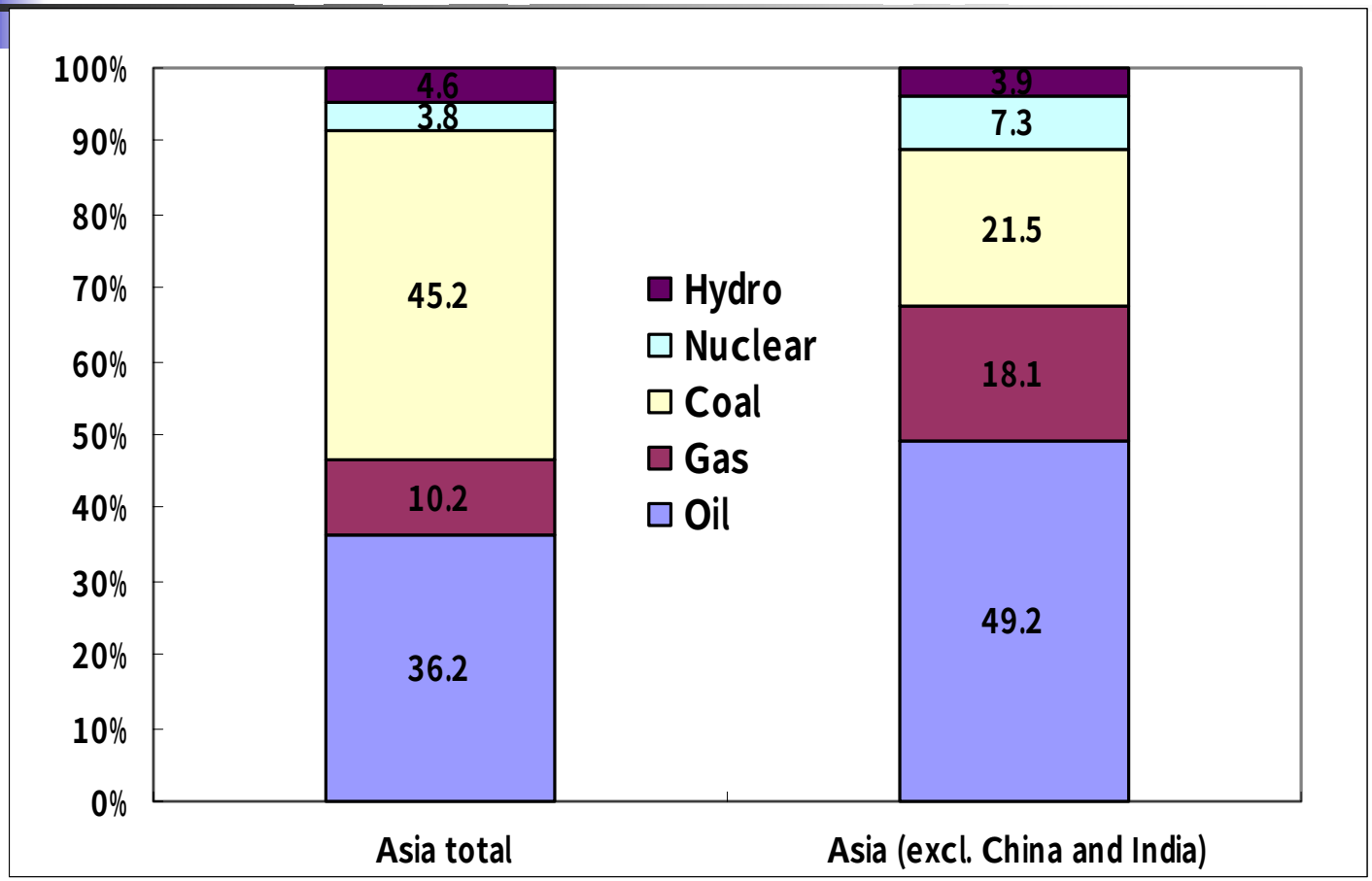
Source: Prepared from BP Statistics

Asian Energy Consumption by Country (2003)



Source: Prepared from BP Statistics

Asian Energy Consumption by Type (2003)



Source: Prepared from BP Statistics

Energy Intensity Trends in Asia

(Oil equivalent ton/1995 price: $US 1million)

	1971	1980	1990	1995	2000	2001
Japan	121	105	88	93	92	92
China	2,480	2,558	1,685	1,229	891	827
South Korea	215	278	271	302	308	305
Taiwan	272	328	259	248	240	262
Singapore	243	228	249	257	215	260
Indonesia	236	352	376	391	472	482
Malaysia	304	334	360	404	421	439
Philippines	256	236	277	339	373	355
Thailand	231	233	257	293	337	359
India	513	589	660	688	668	643
Asia average	236	244	239	260	257	257
OECD average	284	253	207	204	192	191
World average	347	330	295	282	264	263

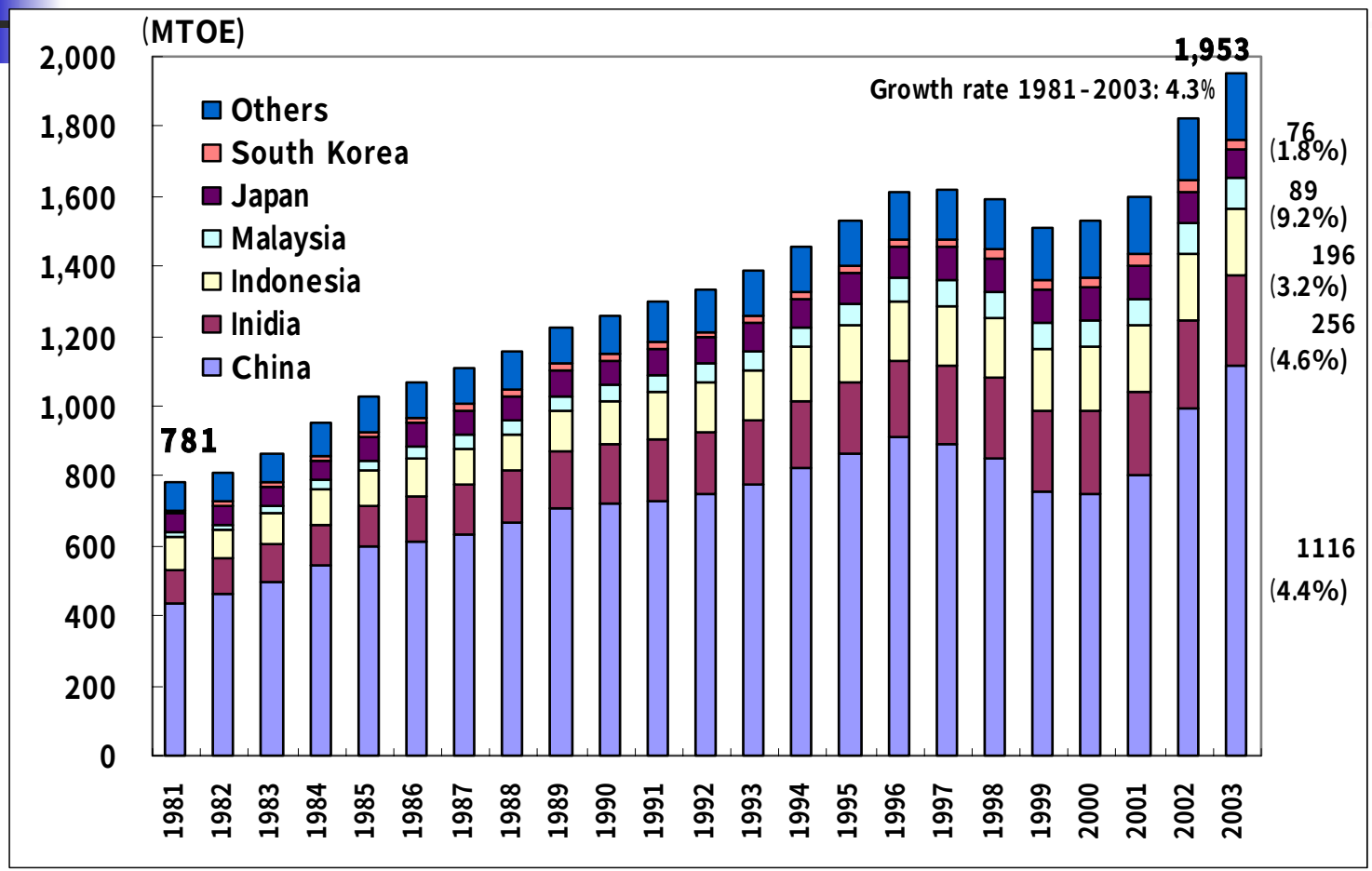
Source: Prepared from BP Statistics

Status of Fossil Fuel Resources in Asia (2003)

- Oil
  - Proven reserves：43.3 billion barrels (China, India, Indonesia, etc.)
  - Share in the world：3.8%, R/P：Approximately 17 years
- Gas
  - Proven reserves：10.9 trillion m^3 (Indonesia, Malaysia, China, etc.)
  - Share in the world：6.2%, R/P：Approximately 40 years
- Coal
  - Proven reserves：209.8 billion tons (China, India, Indonesia, etc.)
  - Share in the world：21.3%, R/P: Approximately 100 years

Source: Prepared from BP Statistics

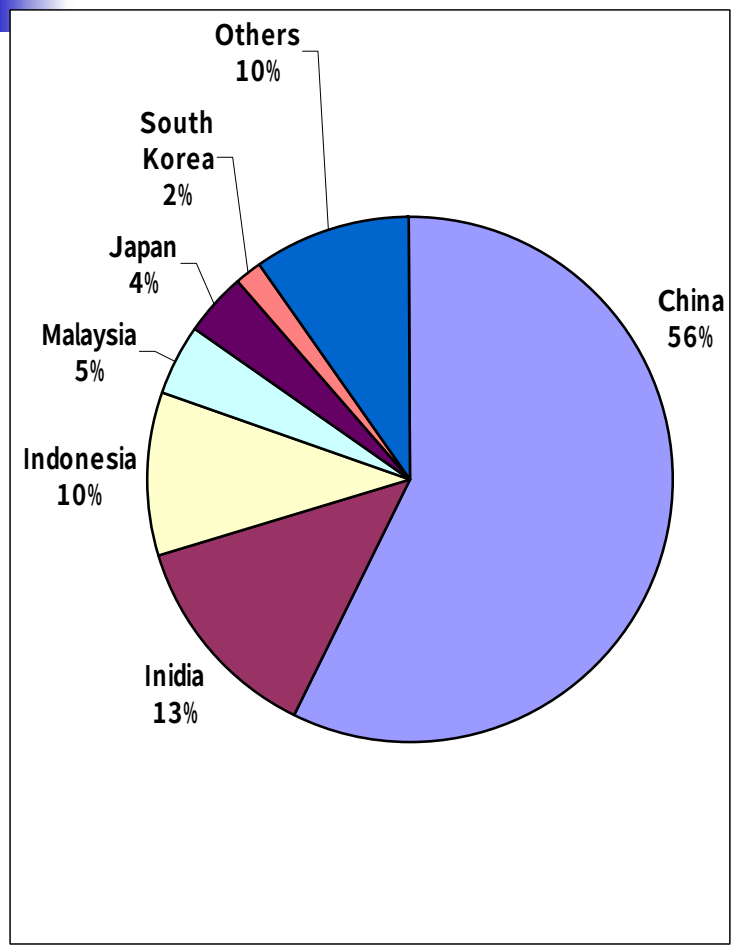
Energy Production Trend in Asia (by Country)



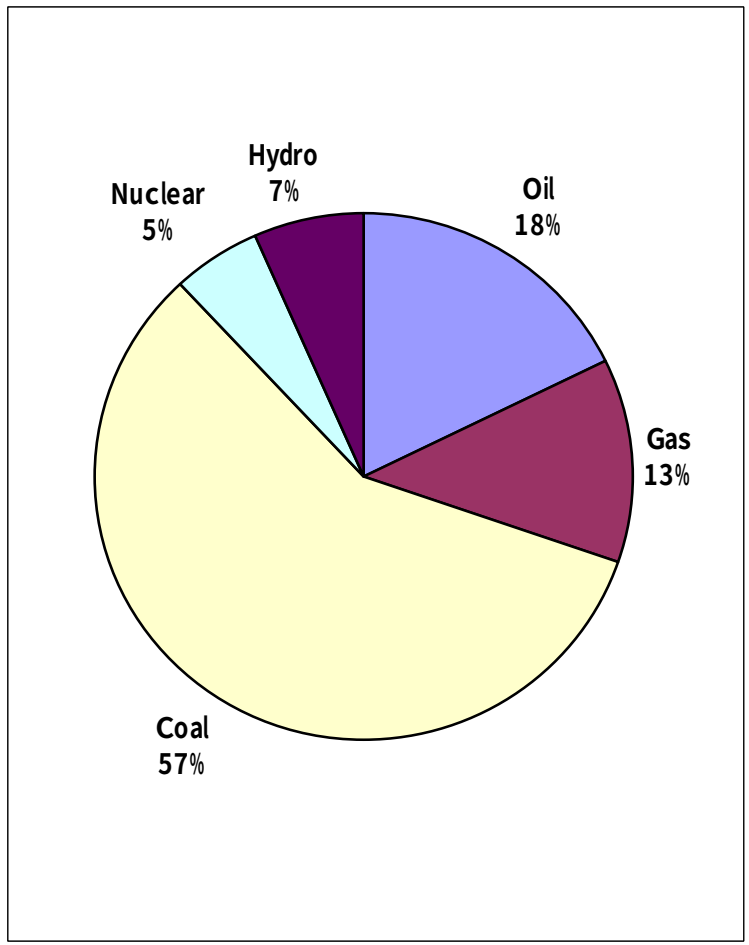
Source: Prepared from BP Statistics

Energy Production in Asia (2003)

(Share by country)

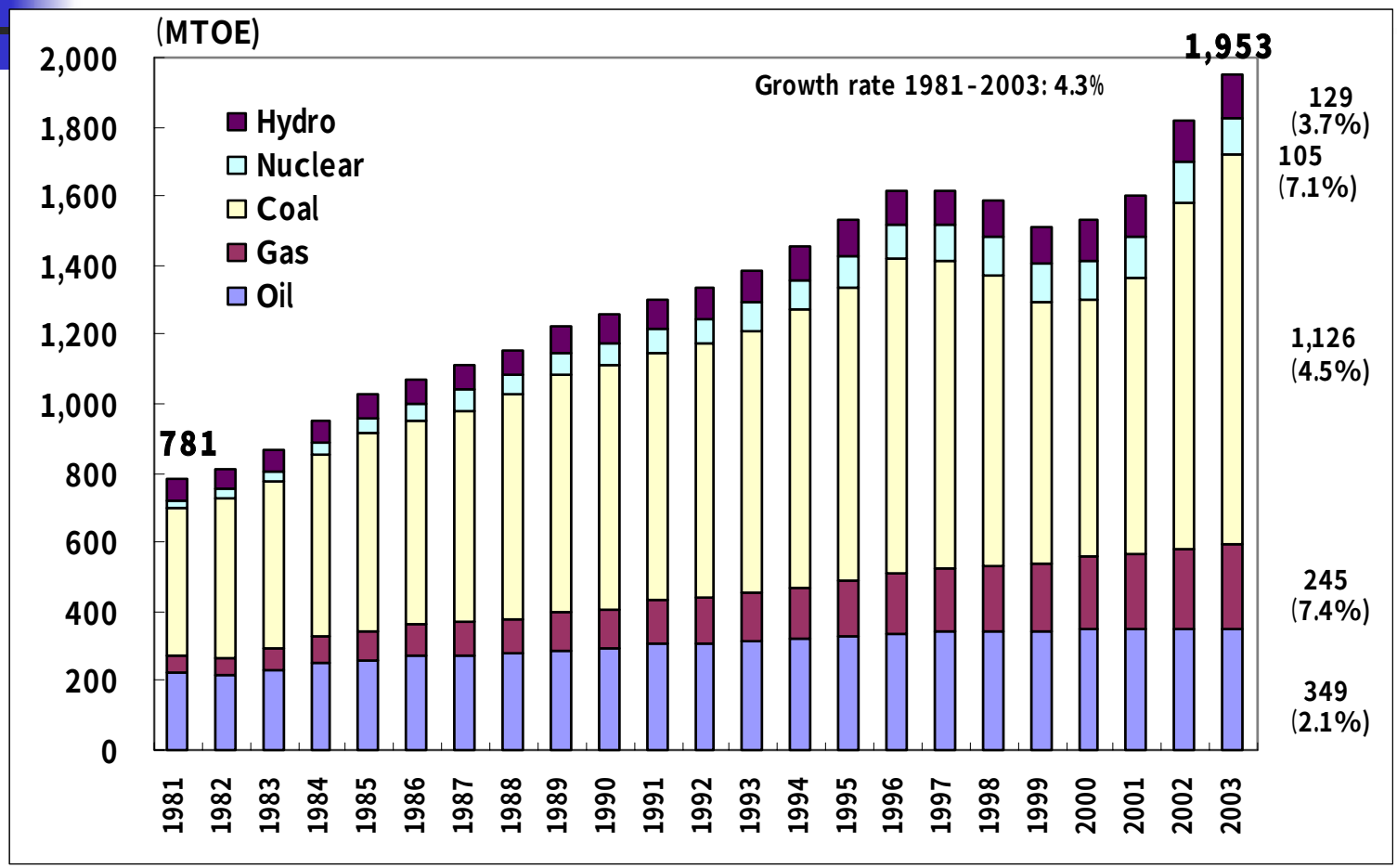


(Share by energy)



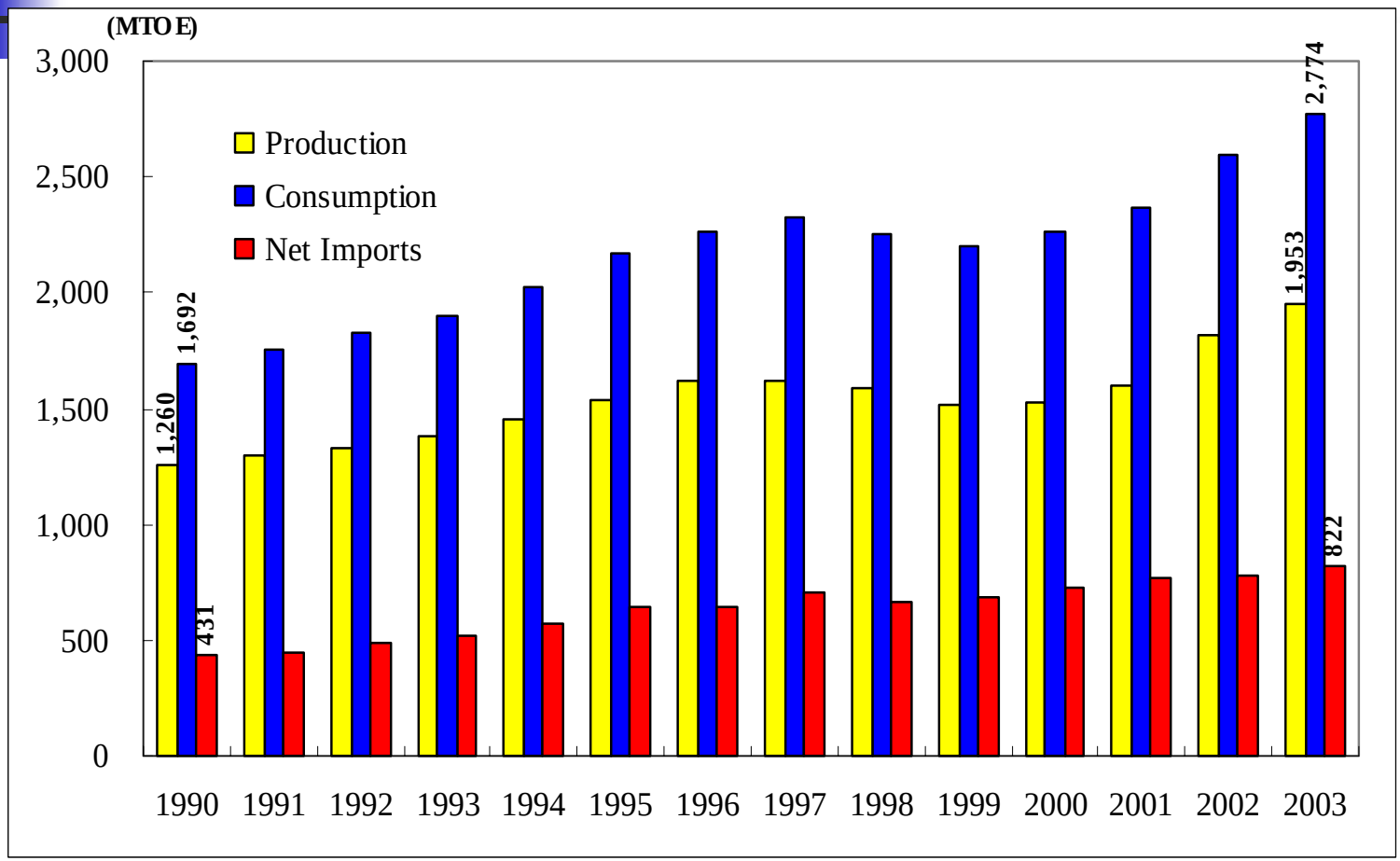
Source: Prepared from BP Statistics

Energy Production Trend in Asia (by Energy)



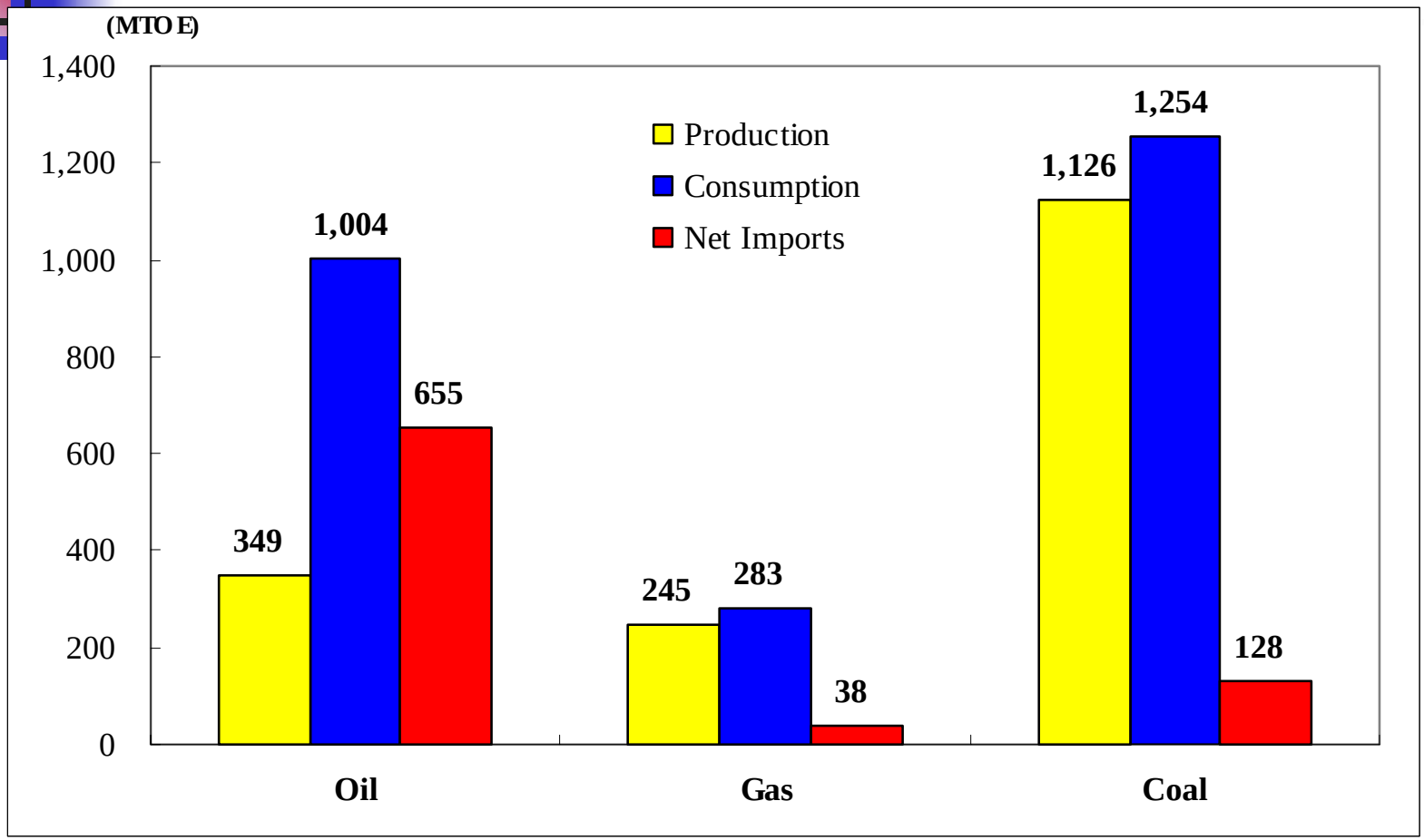
Source: Prepared from BP Statistics

Primary Energy Supply-Demand Balance in Asia



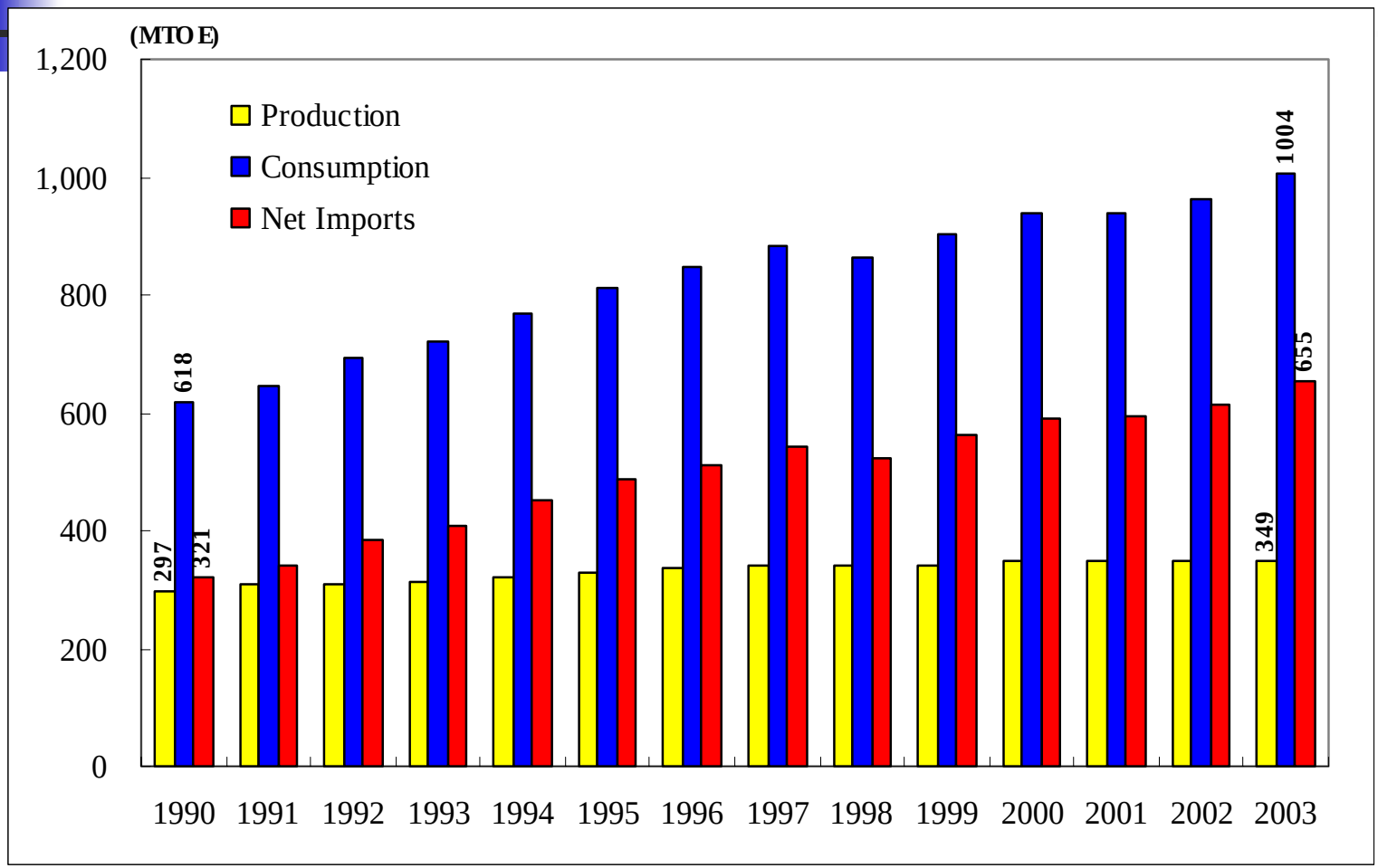
Source: Prepared from BP Statistics

Asian Supply-Demand Balance by Energy (2003)



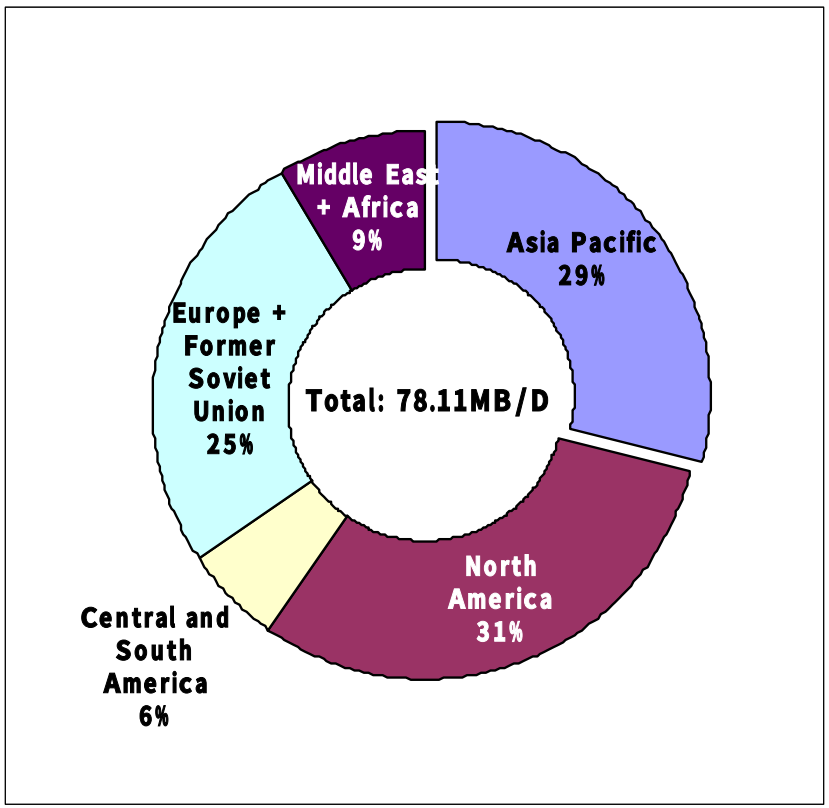
Source: Prepared from BP Statistics

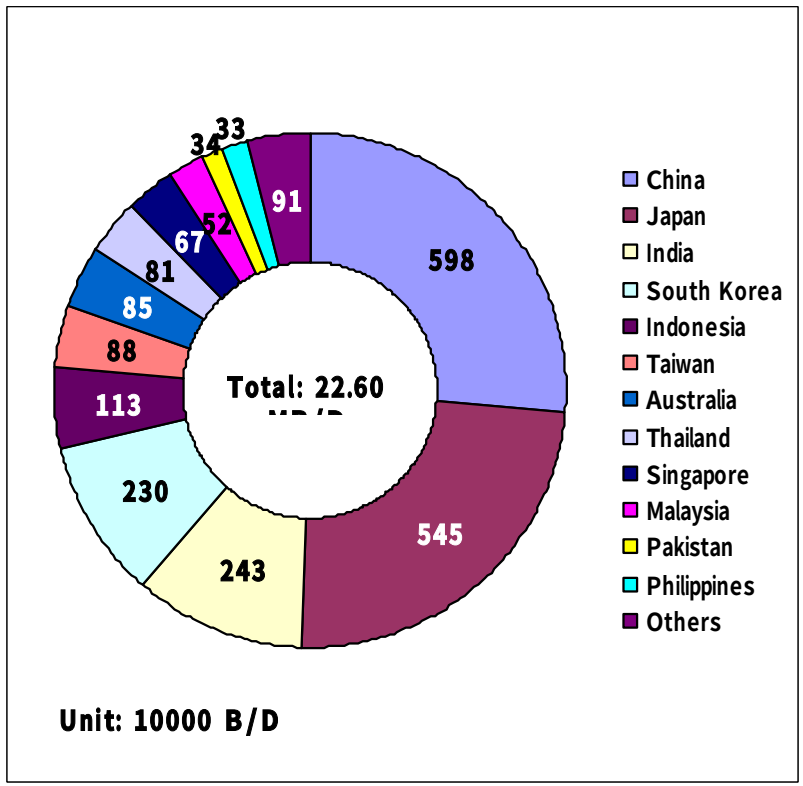
Trend of Oil Supply-Demand Balance in Asia



Source: Prepared from BP Statistics

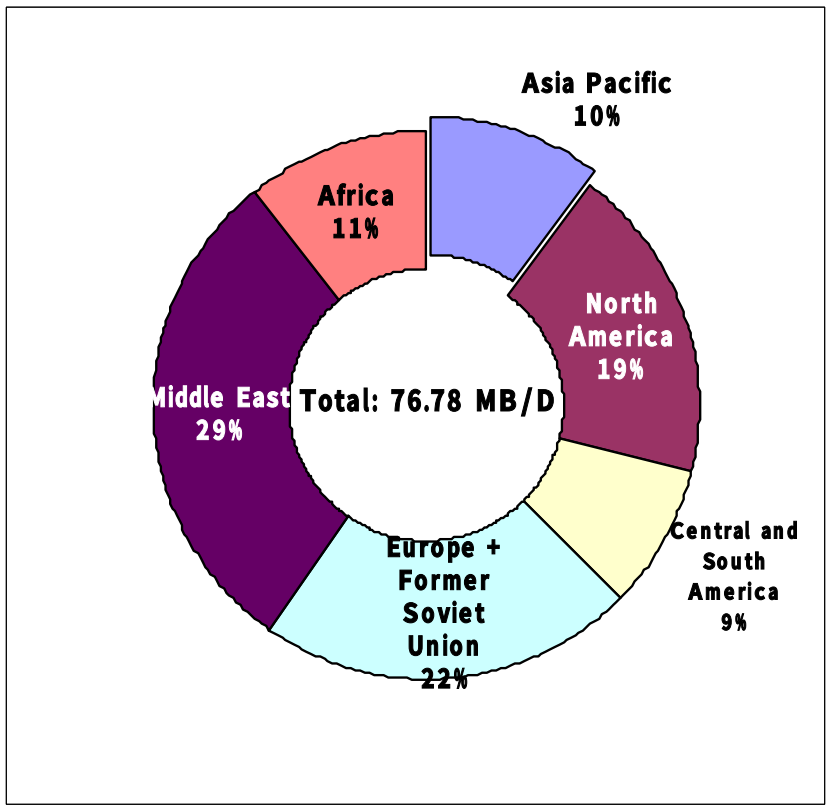
Asian Oil Consumption by Country (2003)

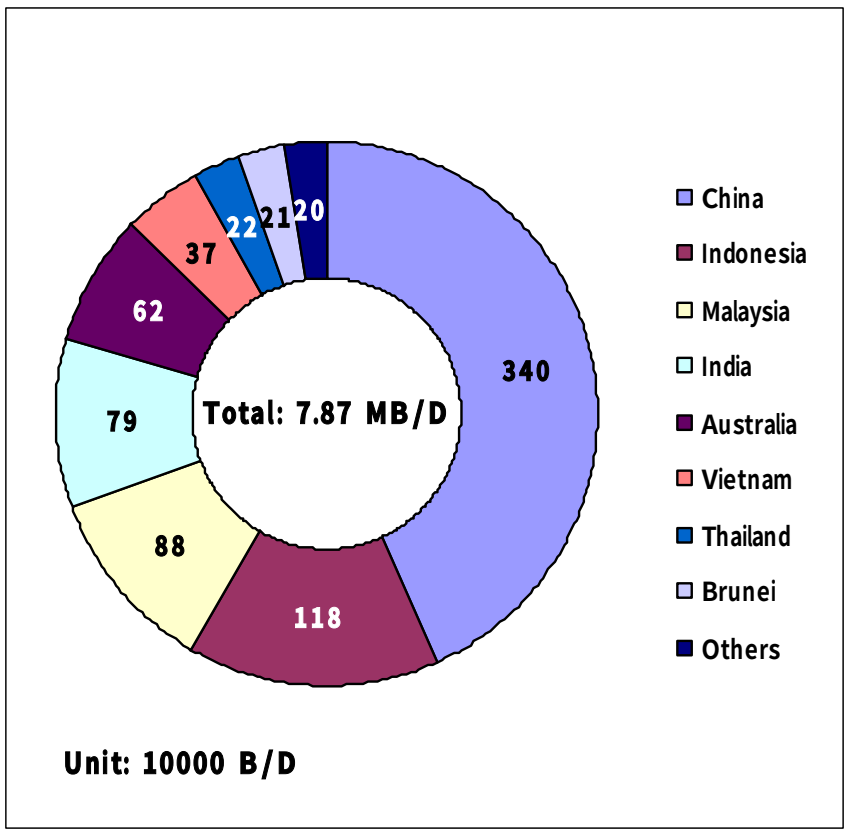




Source: BP Statistics

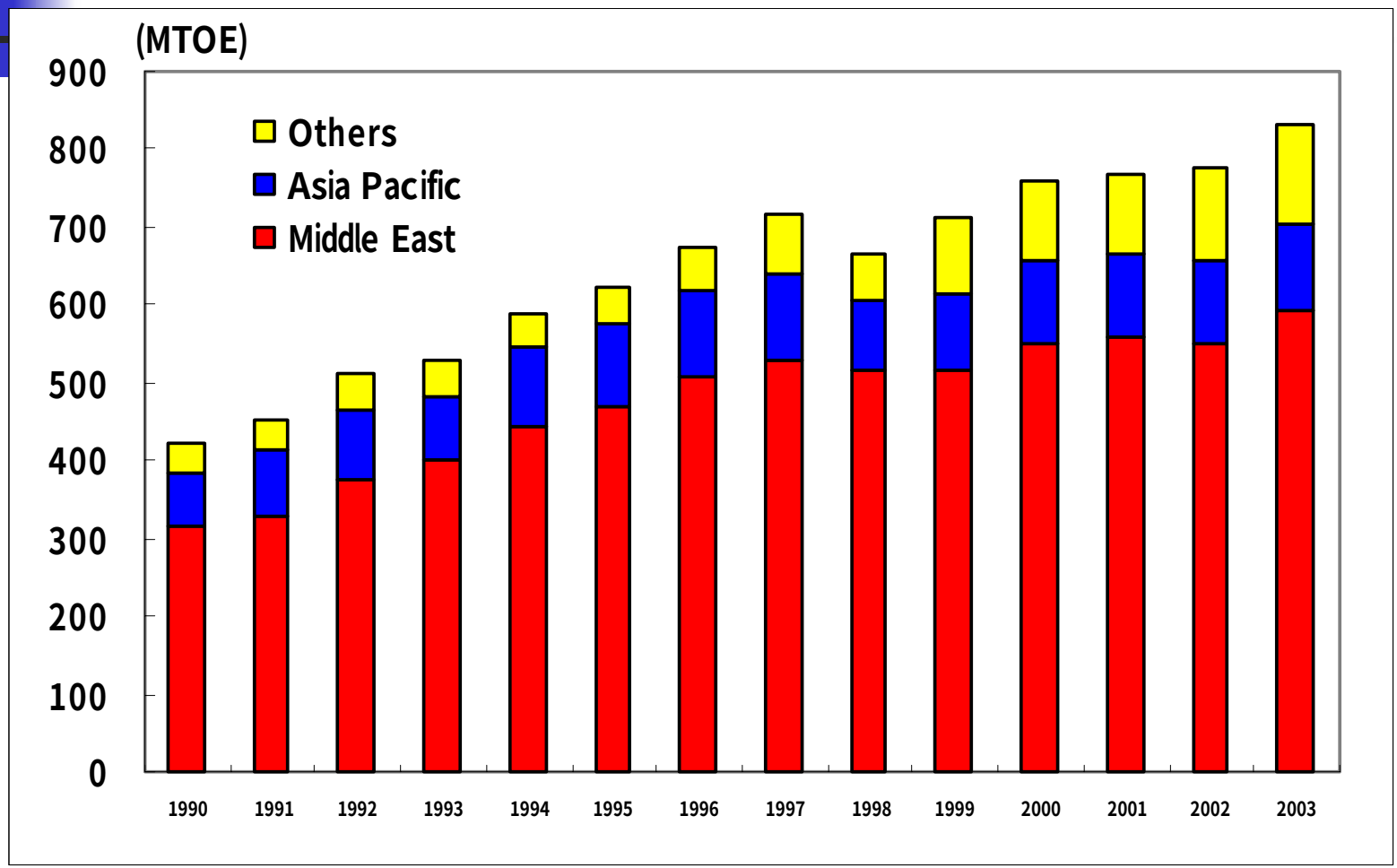
Asian Oil Production by Country (2003)





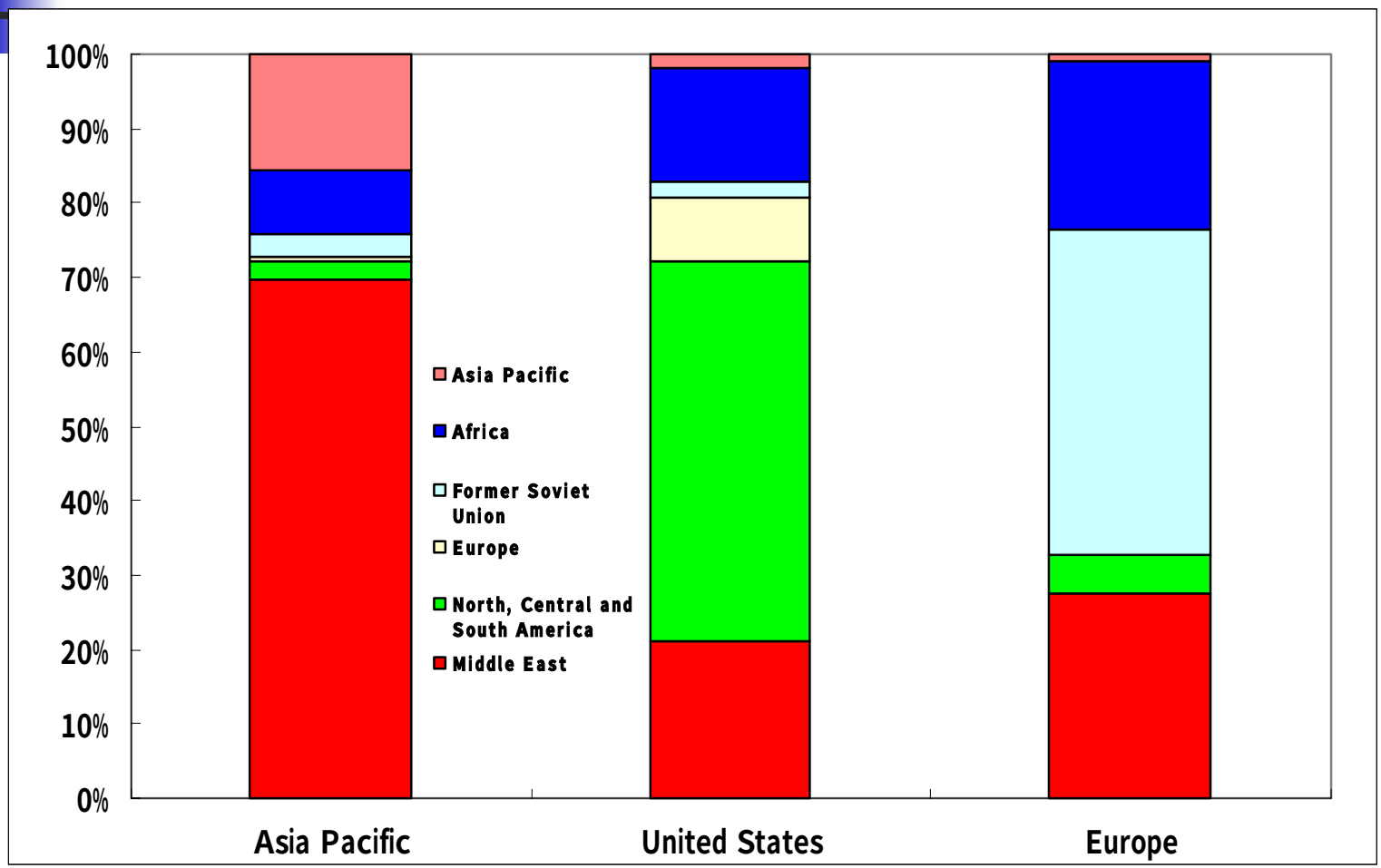
Source: BP Statistics

Oil Import Trend in Asia



Source: Prepared from BP Statistics

Major Regions' Dependence on Oil Imports from Middle East



Source: Prepared from BP Statistics

Summary of Asian Energy Supply and Demand

- Energy demand has greatly increased in line with the vigorous economic growth.
- Energy production does not catch up with demand increase and net imports are expanding.
- This trend is outstanding in oil.
- The gap between energy supply and demand increasing due to economic growth is mainly covered by the increase of oil imports (oil from the Middle East).

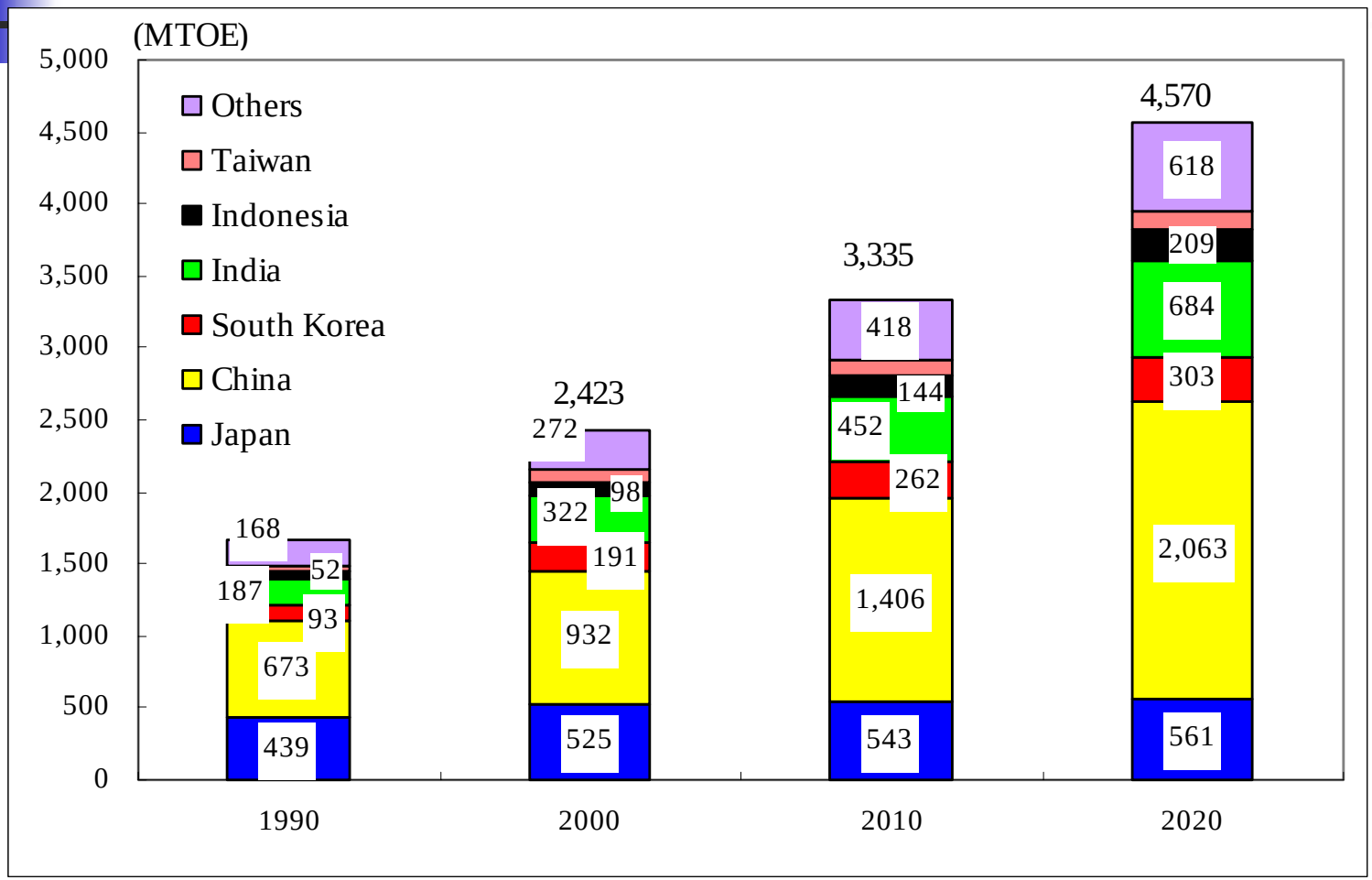
Source: Prepared from BP Statistics

Asian Economic Growth Outlook

	Actual		Projected		Annual average growth rate (%)			
	1990年	2000年	2010年	2020年	2000/1990	2010/2000	2020/2010	2020/2000
Asia	**6,869** (25.9)	**9,361** (27.3)	**12,905** (28.7)	**17,805** (30.4)	3.1	3.3	3.3	3.3
China	**398** (1.5)	**1,042** (3.0)	**2,200** (4.9)	**4,184** (7.1)	10.1	7.8	6.6	7.2
Japan	**4,936** (18.6)	**5,688** (16.6)	**6,595** (14.7)	**7,373** (12.6)	1.4	1.5	1.1	1.3
India	**284** (1.1)	**482** (1.4)	**841** (1.9)	**1,436** (2.5)	5.4	5.7	5.5	5.6
Other Asia	**1,251** (4.7)	**2,149** (6.3)	**3,269** (7.3)	**4,813** (8.2)	5.6	4.3	3.9	4.1
OECD total	**21,792** (82.2)	**27,671** (80.8)	**34,729** (77.3)	**42,780** (73.0)	2.4	2.3	2.1	2.2
Non-OECD total	**4,712** (17.8)	**6,580** (19.2)	**10,173** (22.7)	**15,791** (27.0)	3.4	4.5	4.5	4.5
World's total	**26,505** (100.0)	**34,251** (100.0)	**44,901** (100.0)	**58,570** (100.0)	2.6	2.7	2.7	2.7

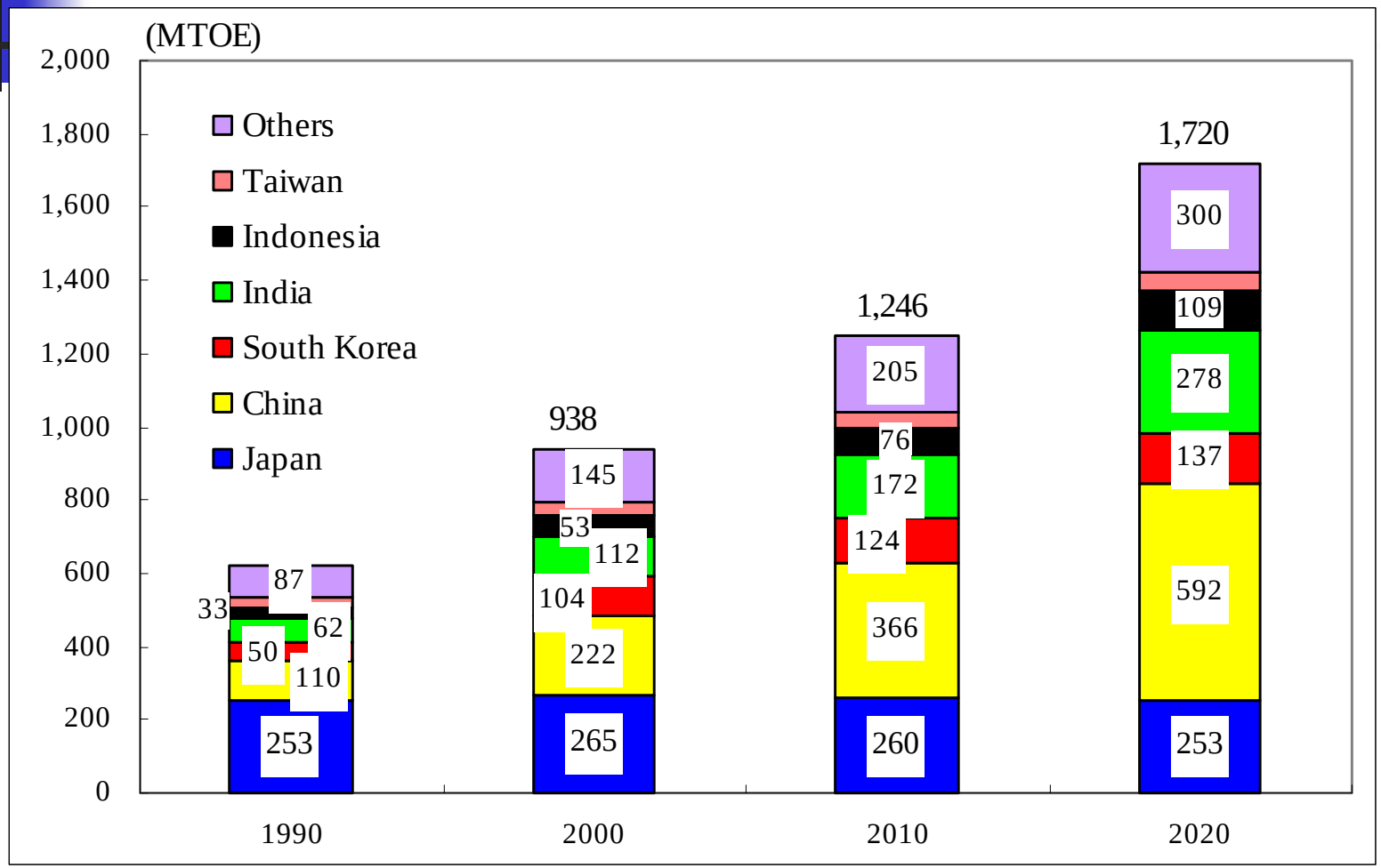
Source: IEEJ "Asia/World Energy Outlook," March 2004

Asian Energy Supply and Demand Outlook



Source: IEEJ "Asia/World Energy Outlook," March 2004

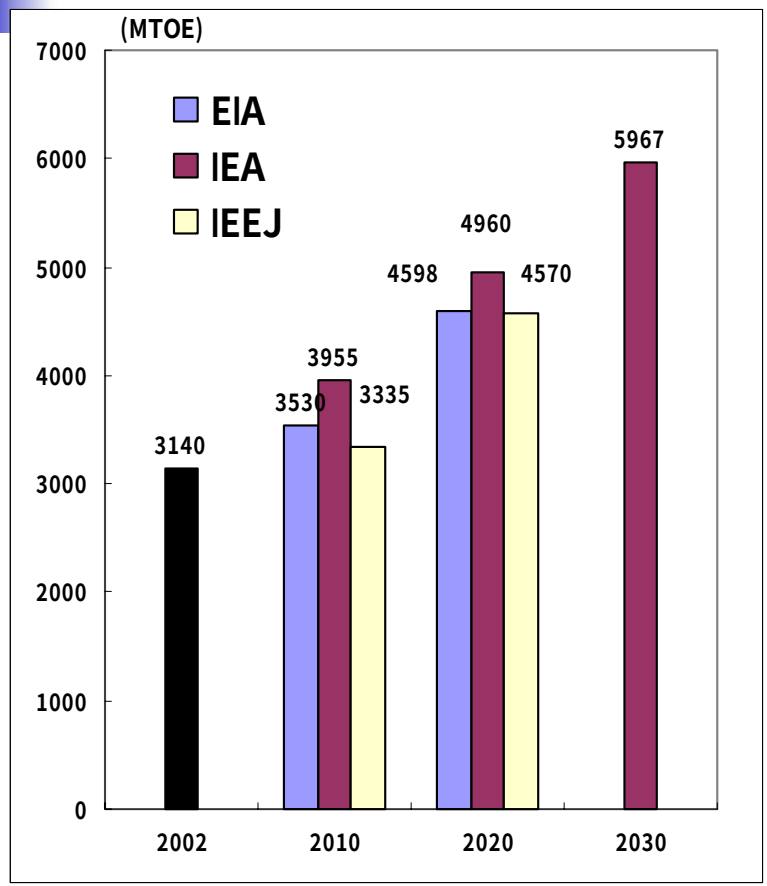
Asian Oil Supply and Demand Outlook



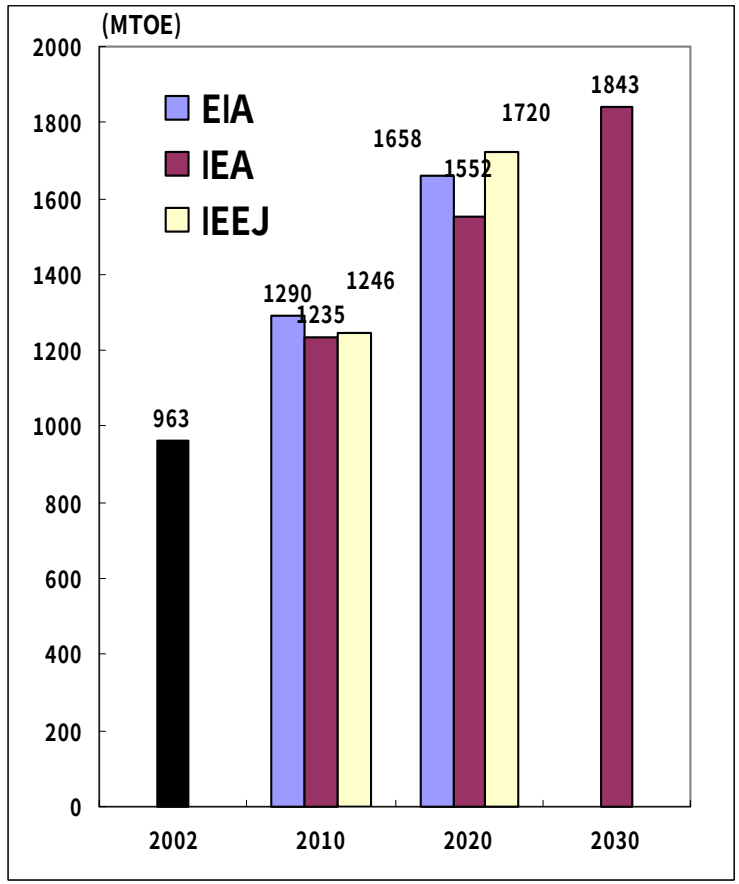
Source: IEEJ "Asia/World Energy Outlook," March 2004

Comparison of Long-Term Outlook for Asia

Demand for primary energy



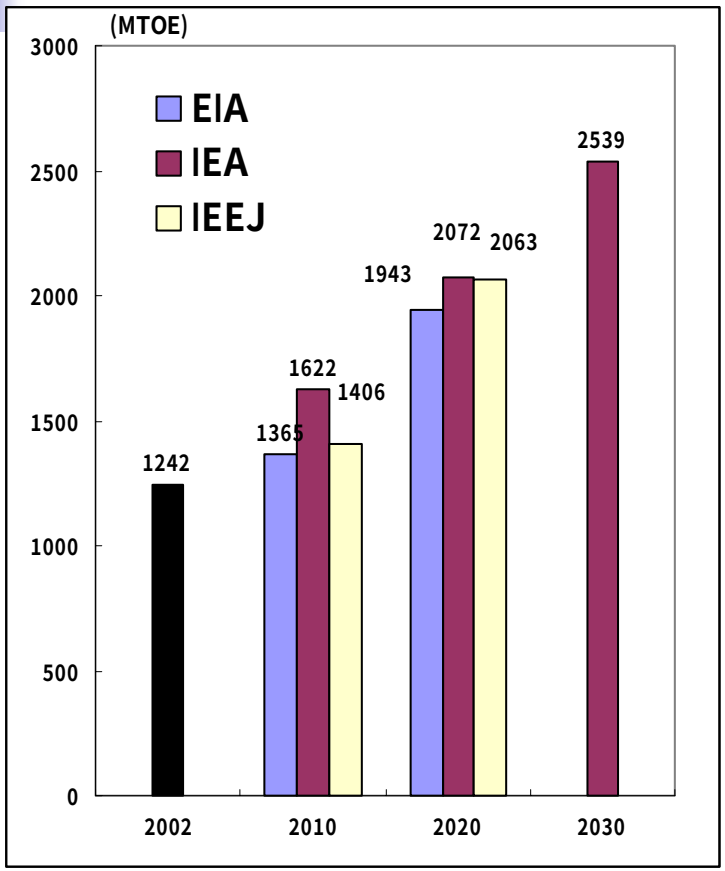
Demand for oil



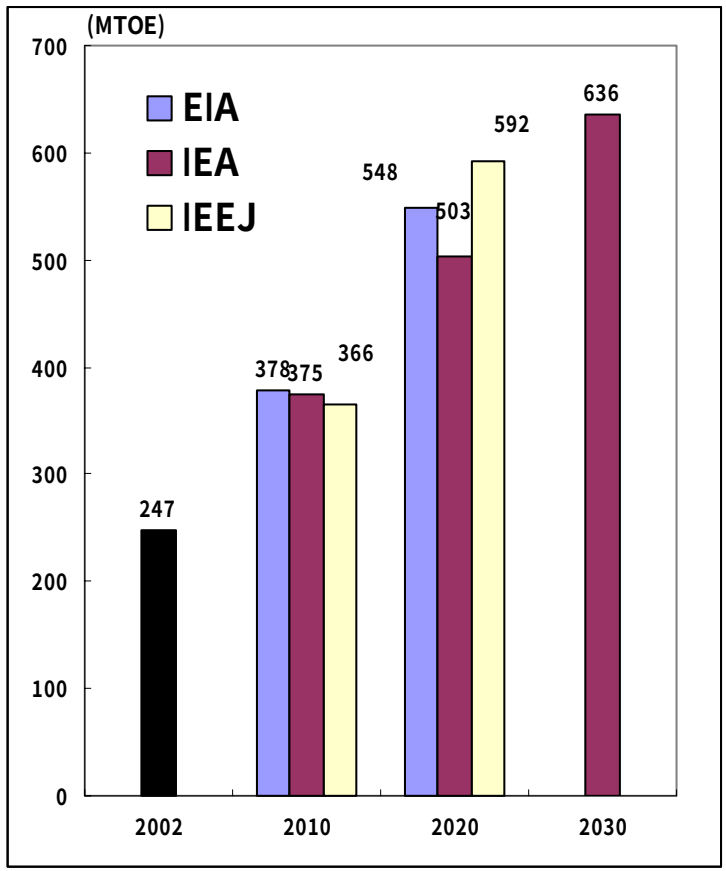
Source: IEEJ "Asia/World Energy Outlook," March 2004; IEA "World Energy Outlook 2004," and EIA "International Energy Outlook 2004"

Comparison of Long-Term Outlook for China

Demand for primary energy



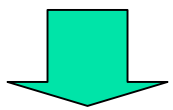
Demand for oil



Source: IEEJ "Asia/World Energy Outlook," March 2004; IEA "World Energy Outlook 2004," and EIA "International Energy Outlook 2004"

Increasing Interest in Energy Security Issues

- **Recognition of the importance of energy security for sustainable development (security of energy supply at stable and reasonable prices)**

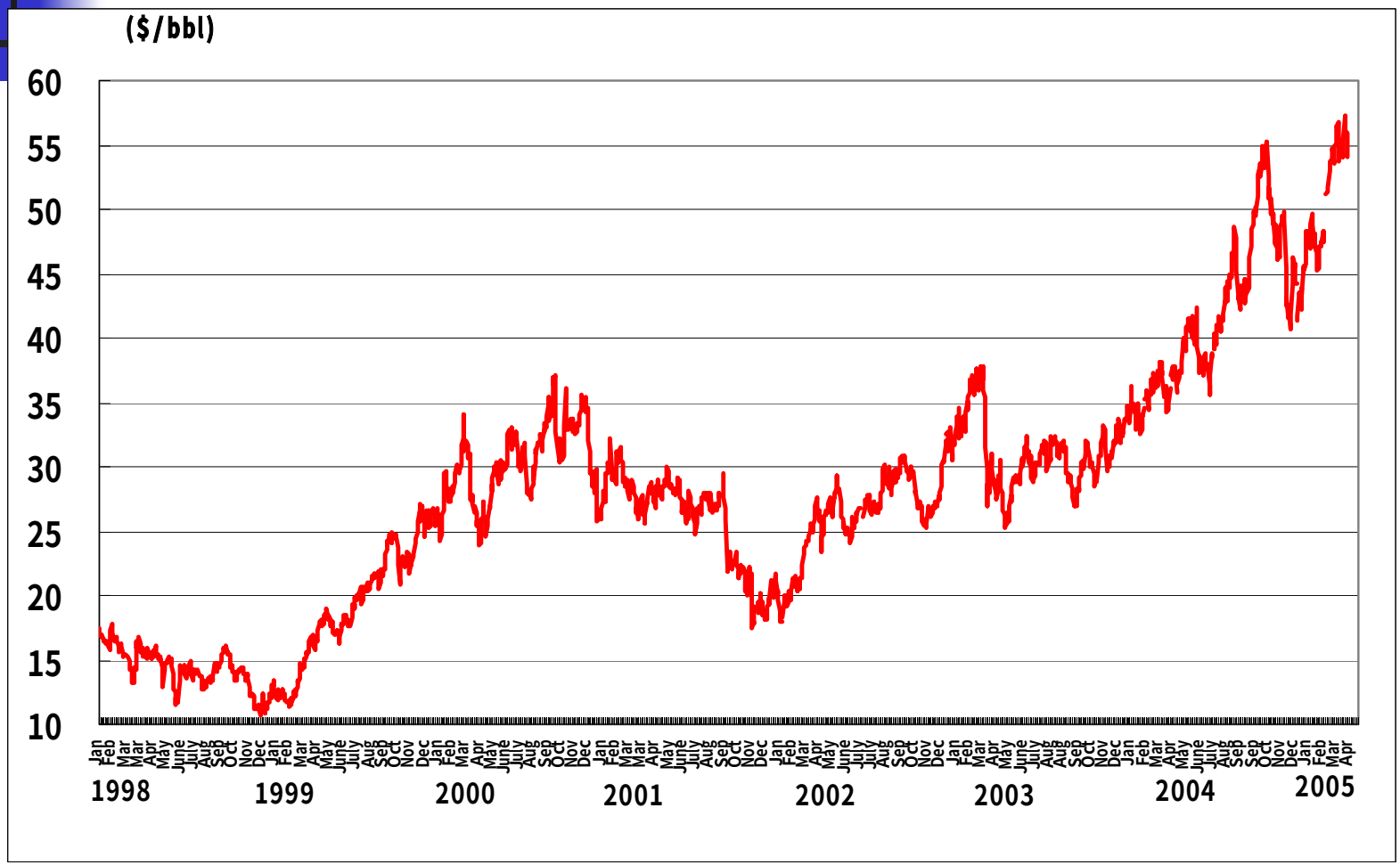


- **Expected further increase in import dependency**
- **Recent elevation of energy prices and increase in volatility**
- **Increasing interest in energy security elevated by the terror attacks of 9-11**
- **Increase in anxiety about the tensions in the Middle East and interference with supply (increase in geographic risk factor)**

Possible Energy Security Risks

- **Contingent risks**
  - Political and military risks in major energy supplying countries and regions (wars, revolutions, etc.)
  - Outbreak of a serious accident in energy supply chains
  - Panic behavior by consumers
- **Structural risks**
  - Export ban by suppliers with political intent
  - Demonstration of market power by major suppliers
  - Tight supply and demand situation due to lack of investment or radical demand increase
  - Chronic and long standing insufficiency of energy due to resource constraints
  - Side effect of market liberalization and environmental regulations
  - Increasing price volatility

Recent Elevation of WTI Crude Oil Futures Prices



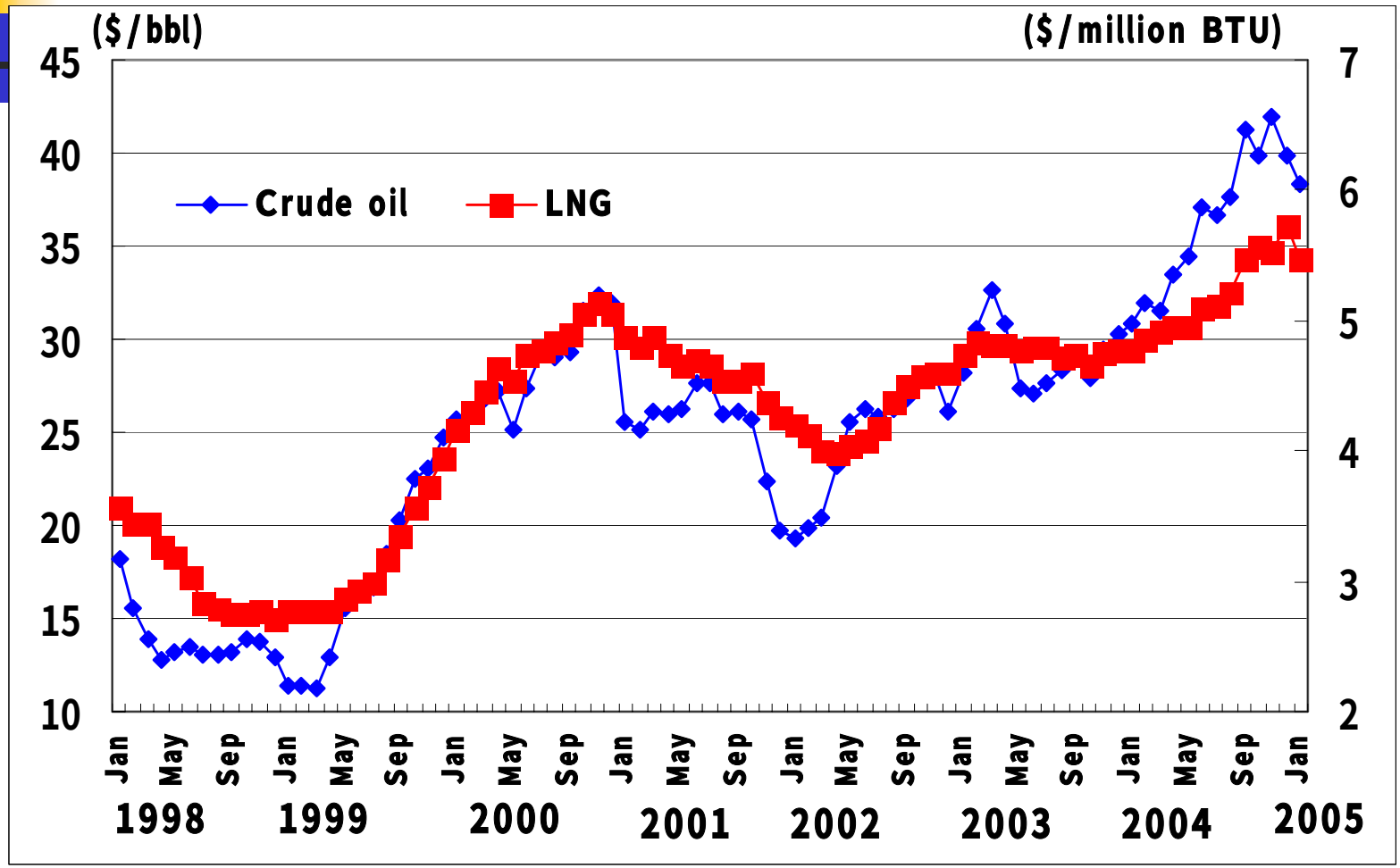
Source: Prepared by IEEJ from various sources

Impact on the Economy Due to the Elevation in Crude Oil Prices

	China	NIES				ASEAN 4				Total of Asian 9 countries	India
		South Korea	Taiwan	Hong Kong	Singapore	Thailand	Indonesia	Malaysia	Philippines		
GDP (nominal), US$ million	1,270,660	546,934	281,961	159,943	88,274	126,905	172,971	94,910	77,954	2,820,511	449,872
Net oil imports, US$ million	14,754	19,296	6,487	2,962	5,458	1,520	-312	-1,866	2,789	51,089	13,277
Net crude oil imports	11,461	19,200	6,752	0	7,381	2,511	-2,011	-1,856	2,220	45,659	9,409
Net oil product imports	3,293	96	-265	2,962	-1,923	-991	1,699	-10	569	5,429	3,868
Share of oil imports in GDP	1.2%	3.5%	2.3%	1.9%	6.2%	1.2%	-0.2%	-2.0%	3.6%	1.8%	3.0%
Increase of net oil imports by $10/bbl increase	5,404	7,068	2,376	1,085	1,999	639	-114	-683	1,022	18,796	6,445
Income transfer effect	-0.4%	-1.3%	-0.8%	-0.7%	-2.3%	-0.5%	0.1%	0.7%	-1.3%	-0.7%	-1.4%

Source: Prepared by IEEJ from various sources

Asian LNG Prices Going Up with Crude Oil Prices

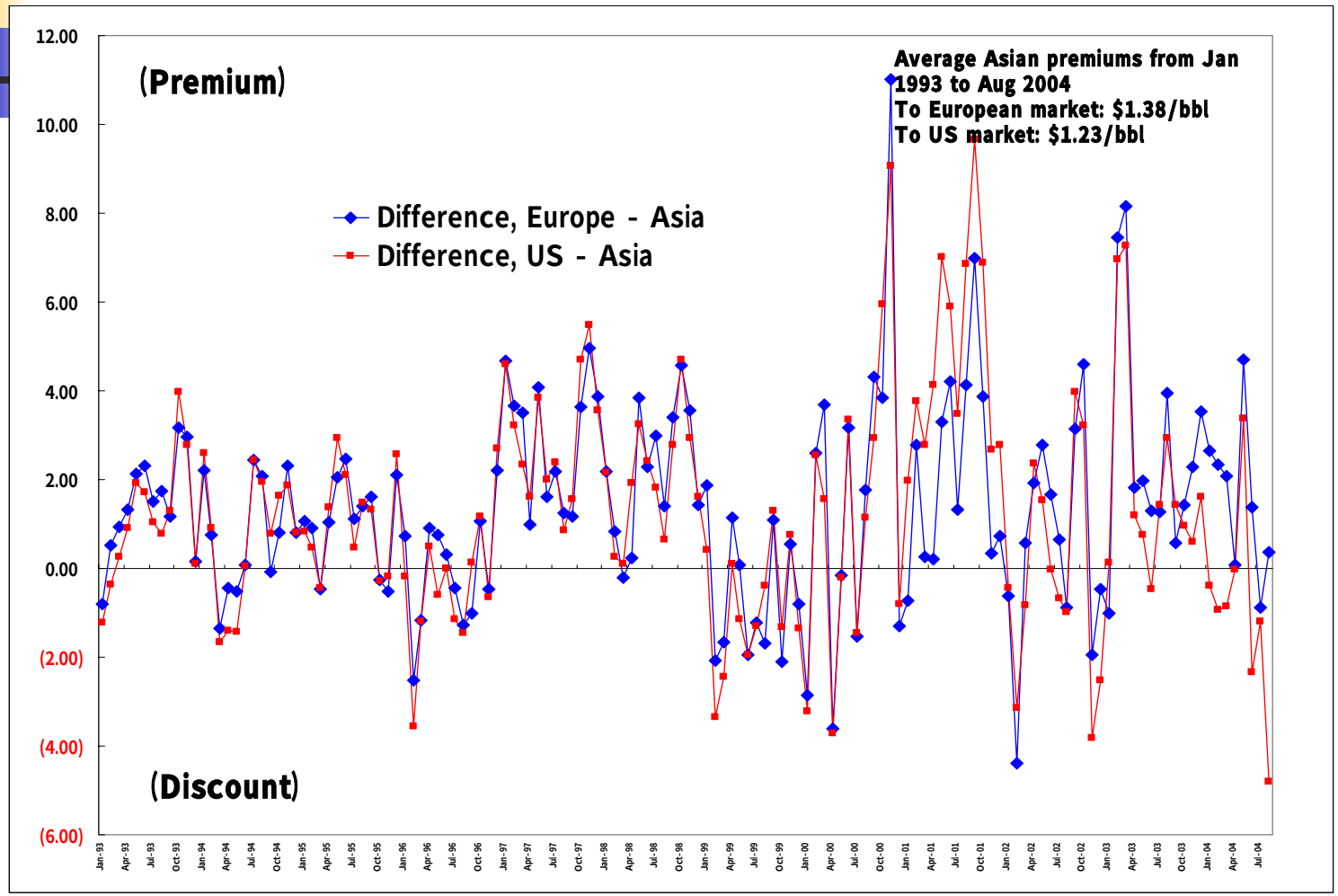


Source: Prepared by IEEJ from various sources

Delay in Development of Asian Energy Market

- Asian energy industries under strict regulations and control according to policies that put much weight on stable supply
- Supply structure characterized by high dependence on the Middle East and suppliers' market power
- Lack of index crude oil or price index that represents Asian market
- Delay in the development of trade of flexible and fluid materials including crude oil, products, or gas
- Major players also aim for stable supply and the the environment is less competitive than Europe.
- Along with the recent liberalization and deregulation of the energy market, the situation is gradually changing; some efforts are being strengthened to procure oil and gas under more flexible and competitive conditions.

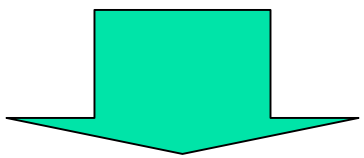
Asian Premium in Crude Oil Prices



Source: Prepared by IEEJ from various sources

Increase of Environmental Load in Asia along with Energy Development and Use

- High coal dependency
- Significant increase in energy consumption and inefficiency in energy consumption and use
- Priority to economic growth and relatively low environmental consciousness



- Worsening pollution problems such as air pollution
- Global warming is gradually emerging as a long-term issue in Asia, too

Energy Security Measures Implemented in Asia

- Restrictive energy (oil) import measures
  - Development of alternative energies
  - Promotion of energy-saving activities
- Measures for stable energy (oil) imports
  - Diversification of import sources
  - Reinforcement of the relationship with oil producing countries
- Measures to increase capacity for emergency situations
  - Reinforcement of oil stockpiling systems
- Promotion of regional cooperation in energy

Advantages of Developing and Promoting the Use of Natural Gas

- Rich potential resources existing within the region
- Many projects to develop potential resources (LNG and P/L) are under review or in progress
- Development and diffusion of the technology for highly efficient use (CCGT)
- Superiority as a clean energy

→However, there are some problems in achieving prices competitive with other energies, developing large scale infrastructure to promote use, etc.

Promotion of Coal Use

- **Vast amounts and high production capacity (China is the world's no. 2 producer)**
- **Australian coal can be used in the Asia Pacific region (world's no. 3); high supply stability**
- **Price competitiveness compared to other fossil fuels**

→Major energy selected in countries in Northeast Asia as fuel for base load power

→The problem is relatively high environmental load (emission of SOx, NOx, and CO_2).

→The key is the introduction and promotion of diffusion of clean coal technology.

Development of Nuclear Power Generation in Asia

- In Europe, nuclear power generation is declining.
- However, in Japan, South Korea, China, and other parts of Asia, nuclear power plants are being constructed, although there are constraints such as an upsurge in protest campaigns because of the following:
  - Nuclear is a semi-domestic energy.
  - It is an important source for diversified power sources.
  - It can be a large scale base load power source.
  - It can serve as an important measure for reducing CO_2 emissions.
  - Lately, development is accelerating in China, maybe in order to deal with power shortages.

Promotion of Domestic Oil Development

- State-owned oil companies are the major players. (China: CNPC, SINOPEC, CNOOC; Indonesia: Pertamina; India: ONGC; Malaysia: Petronas, etc.)
- Introduction of foreign investments from majors and others is necessary for introducing development funds and advanced technology.
- Introduction of foreign investments by the open door policy for onshore/offshore areas in China, inventive policy on frontier area development in Indonesia, and new exploration and licensing policy in India, etc.
- However, in reality, oil production in Asia is not expected to increase dramatically; it will most likely remain unchanged or increase slightly.

Advantages of Promoting Energy Saving

- **Directly reduces energy demand (imports)**
- **Reduces environmental loads**
- **Also strengthens economic competitiveness**

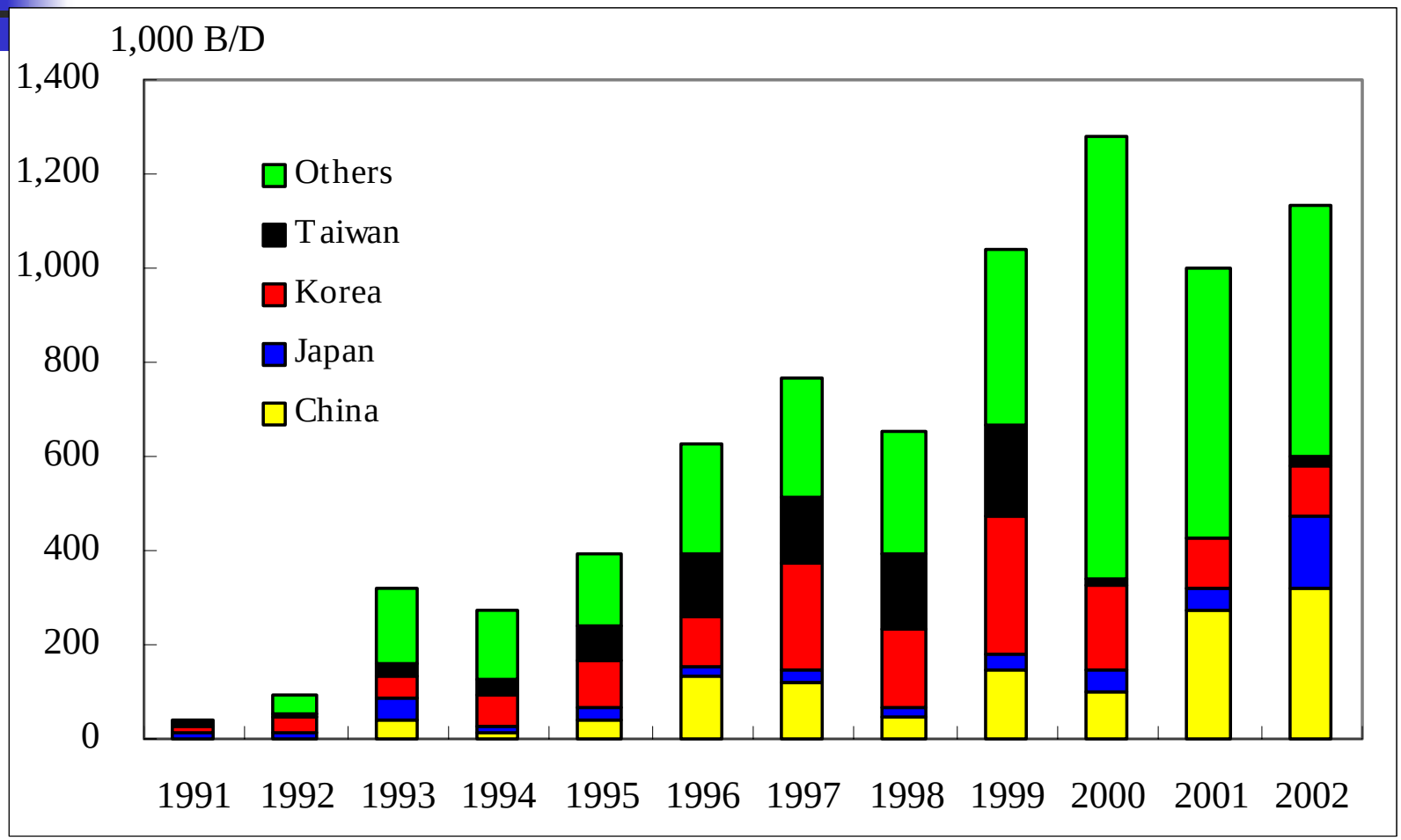
→Energy saving is a priority policy for all countries; some countries have set long-term energy-saving goals.

→However, energy saving is difficult due to the income effect; from a macroscopic viewpoint, energy consumption efficiency of most countries will remain unchanged or might even get worse.

Diversification of Import Sources

- Reduces the risks of excessive dependence on one import source or partner (stop of supply of that specific source, weakness in bargaining power, etc.).
- The problem is the availability of the crude oil to be diversified and economy of import (production and export capacity of the oil producing countries, crude oil quality, trade cost, configuration of importer's refining equipment, etc.).
- Under such a situation, imports of African crude oil increased greatly.
- There are other new alternative sources, too (Sakhalin, East Siberia, Caspian Sea, etc.) .
- However, considering the massive increase of imports and spare production capacity in the future, most imports will come from the Middle East, and there will be limitations on diversity.

Increasing Asia's Crude Oil Imports from Africa



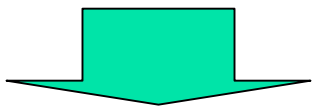
Source: Blackwell "World Oil Trade"

Relationship Reinforcement with the Middle East and Major Oil Producing Countries

- Approaches to build a strategic relationship
  - Mutual visits of VIPs with the Middle East, Russia, etc.
  - Cooperation and agreement in the field of economy and energy
- Reinforcement of mutual investment relationship (in energy fields)
  - Investment in the upstream sector of the Middle East, Russia, etc., by Asian countries
  - Investment in the downstream sector of Asian countries (China, South Korea, etc.) by Middle Eastern countries

Asian Countries' Investment in Foreign Upstream Sector

- Reinforcement of access to foreign resources (dealing with the stagnation in domestic production and the increase in imports)
- Utilization of manpower, technology, and accumulated knowledge of state-owned oil companies
- Utilization of huge market and political power



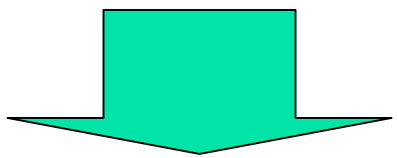
- Intensifying foreign investment in China majors
  - CNPC is making very aggressive investments in Iraq, Kazakhstan, Venezuela, Sudan, etc.
  - The important strategic regions are the Middle East-North Africa, Central Asia-Russia, and South America (CNPC).
  - Latecomers such as SINOPEC, CNOOC, and SINOCHEM are also actively working.
- Also, Petronas of Malaysia and ONGC of India are actively running businesses: The former already has operations in 10 or more countries, and its revenue from foreign operations is 30% of total revenue.

Acceptance of Capital Investments to the Domestic Downstream Oil Sector by Oil Producing Countries

- The introduction of capital investments by oil producing countries to the domestic downstream oil sector is advantageous in that stable crude oil supplies can be expected.
- The oil producing countries also have advantages in securing customers to sell their oil.
  - Saudi Aramco made an equity investment when the refining and sales departments of the Philippines' state-owned PNOC were privatized.
  - Saudi Aramco's capital participation in South Korea's S-Oil
  - Abu. Dhabi IPIC's capital participation in South Korea's Hyundai Petrochemical
  - Saudi Aramco's capital participation to Japan's Showa Shell
- In addition, China and other countries drew up joint oil refinery construction and capital participation plans with oil producing countries.
- These plans do not give special incentives to oil producing countries but are worked out solely placing emphasis on the economy under the progress of market liberalization and deregulation.

Diversification of Oil Trade Routes

- Due to the projected increase in ship traffic in the future, the traffic through the Straits of Malacca will become evermore heavy.
- Various problems including accidental and environmental risks



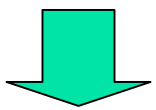
- In order to address these problems, several plans were plotted: an oil pipeline from Russia and the one across the Malay Peninsula
- One of the largest bottlenecks is the economy of the project.

Current Status of the Oil Stockpiling System in Asia

- Currently, only Japan and South Korea have and directly control a national oil stockpiling system for emergency situations.
- Countries that impose a stockpiling obligation on oil companies are Japan, South Korea, Taiwan, Thailand, Indonesia, Philippines, and others.
- Although oil companies have oil stocks for their normal operations, they are likely to reduce it for cost cutbacks.
- In such oil producing countries as Malaysia and Indonesia, their underground resources may be regarded as the “stock.”
- However, in accordance with the growing interest in oil supply security, there are new efforts for oil stockpiling systems.

Efforts toward the Reinforcement of Oil Stockpiling System in Asia

- **Countries recognized the defects (low stockpiling level, shortage of emergency stock, defects in international cooperative system, etc.) in their stockpiling system and are making efforts toward the reinforcement of the system.**



- **South Korea: A national stockpiling reinforcement plan is underway; the country joined IEA in April 2001.**
- **Taiwan: After the passage of the Petroleum Administration Law in October 2001, it started to build national stocks.**
- **China: Specified the development of a national stock system in its 10th five-year plan.**
- **Stockpiling is also being considered by Thailand, the Philippines, etc.**

Summary of Development State of Asian Policies

- Based on growing interest in energy security issues, each country is aggressively studying and implementing policies.
- According to the factors including status of energy resources and development phase and status of energy industries, various measures will be taken.
- In general, individual efforts by respective countries contribute to not only their own countries but also the reinforcement of energy security for the whole region.
- If the countries' individual efforts become excessively exclusive, tension and confrontation may be caused among countries and become a factor that worsens energy security

⇒Importance of regional cooperation on energy

Importance of Energy Cooperation for Asia

- Creating an awareness that energy security problems are problems common to all Asian countries
- Effects to be expected from cooperation
  - Optimum utilization of existing resources and assets, capital, technology, know-how, and infrastructure
  - Improvement of bargaining power with suppliers
  - Through the formation of a regional energy market:
    - Market efficiency increases
    - New business opportunity is created
  - Reinforcement of political and economic relationships through energy cooperation

Energy Cooperation in Asia (ASEAN+3)

- In September 2002, an energy ministers meeting of ASEAN+3 countries was held before the IEF in Osaka.
- Aiming to promote further cooperation, the Hiranuma Initiative was agreed upon regarding ① an emergency network, ② oil stockpiling, ③ oil markets (Asia premium), and ④ expansion of natural gas use.
- In order to follow up on the Hiranuma Initiative, forums were established to study the above issues. Each forum discussed its own agenda.
- In June 2004, an energy ministers meeting of ASEAN+3 countries was held in Manila, Philippines, during which the ASEAN+3 Energy Partnership was agreed upon.

Energy Cooperation in Asia (Northeast Asia)

- Presently, most intergovernmental talks are held between two countries, e.g., Japan and China, Japan and South Korea (multilateral frameworks are the issue to be solved in the future).
- Between Japan and South Korea, energy is one of the important issues in the discussions on an FTA.
- At the commercial and research institute level, discussions and exchanges of opinions are conducted by holding international conferences, seminars, etc.
- As actual business, efforts aiming to realize mutually complementary relationships are observed.
  - Japanese companies' commissioned refinement business in China
  - Swap transactions of LNG among Japan, South Korea, and Taiwan
- Constraints due to the existence of various political tension and confrontational structure

Energy Cooperation in Asia (ASEAN)

- **Review of the ASEAN Petroleum Security Agreement (APSA)**
  - **Emergency oil interchange system agreed in 1986 among ASEAN countries**
  - **However, many think that this agreement is less specific on how it is activated, and there is no history of activation.**
  - **After consideration of future import expansion of ASEAN, the review of APSA was proposed and currently it is under review.**
- **In addition, a large scale infrastructure plan covering the whole ASEAN region is underway.**
  - **Trans ASEAN Gas Pipeline (TAGP) plan**
  - **Trans ASEAN Power Grid (TAPG) plan**

Energy Cooperation between Consumption Countries in Asia and Major Oil Producing Countries

- For Asian countries, energy supply security (security for sufficient amount at reasonable prices) is important.
- For oil producing countries, to realize stable economic development; security of stable, sufficient oil; and gas sales channels and export revenue (energy demand security) is important.
- For sustainable development of both parties, all need to recognize the relationships of interdependence, promote dialogue about their common problems for pursuing profit, and reinforce economic relationships.

Significance and Implications of Policy Development

- The pursuit of energy security by each country basically contributes to the improvement of security not only of it but also of the region and the world.
- However, excessively exclusive pursuit of security may result in increasing tension within the region and impair overall security.
- Importance of energy cooperation to complement and strengthen each country's efforts
- The important task is to achieve cooperation with Asian countries to the extent possible, applying our rich experience and know-how and based on cost-effectiveness and strategic importance.
- The construction and development of future international energy strategies is a very important task for our country.