

**Supply and Demand Analysis on Petroleum Products and Crude Oils  
for  
Asia and the World**

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- Reference Case
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## Supply and Demand Analysis on Petroleum Products and Crude Oils for Asia and the World

### 1. Overview of the study

#### 1.1 Objectives

Petroleum demand in the Asia-Pacific countries keeps on growing, particularly in China with its significant economic development and in India where a demographic factor is also at work. As a result, the world petroleum supply and demand balance is becoming increasingly tight by the day, and being cited as one of the factors causing the recent soaring oil prices.

As numerous regulations surrounding petroleum industry are being relaxed in various countries including Japan, the pressure for squeezing the petroleum supply and demand is expected to ease to a certain degree if deregulation leads to an expanded worldwide petroleum product trade down the road. On the other hand, however, the differing pace with which the strengthening of the quality regulation as an air pollution control measure is being enforced in various countries is resulting in variations in the product quality to hamper a freer trade.

Under such worldwide circumstances, in order for a country such as Japan who has no choice but to depend on imports for almost all of its oil supplies to establish a firm footing and to ensure steady supplies of oil, it is extremely important to grasp the latest and accurate information about the petroleum supply and demand trends or supply availability of the world as well as the Asia-Pacific region through econometric approaches, and to perform a comprehensive analysis based on such knowledge.

This study has been conducted with an objective of developing and presenting a basic material with timely substance required for formulating future policy measures on oil and other energy issues by systematically examining and elucidating the changing international oil supply and demand situation through various simulative analyses. As an analytical tool for this purpose, the study has utilized an integrated econometric model developed in the past for estimating supply and demand of crude oils and petroleum products as well as petroleum trade flows for various countries of the world with a main focus on Asia, with necessary modifications and improvements provided to make the model more accurate and elaborate.

#### 1.2 Scope and methodology

To achieve the above-mentioned objective, the study has attempted to systematically and carefully investigate and collect energy data ranging from those concerning crude oils and petroleum products in the world to numerous related statistics, focusing on the Asia-Pacific countries that have strong ties with Japan, as a preparatory step before performing necessary analyses. At the same time, modifications were provided to a model for estimating supply/demand conditions for petroleum and other energy and to another model for simulating petroleum product production and trade flows, both of which had previously been developed for use in the annual "Study of the Petroleum Products Supply and Demand Trends Based on Econometric Models", based on the latest information and data on factors such as impact of economic conditions in the USA, China and other countries, environmental regulations in various countries, or crude

oil price trends, to make the models more accurate and elaborate before conducting the short- and long-term simulation analyses of the present study.

The study work proceeded with the following steps:

- (i) Collection and analysis of data concerning energy and petroleum supply and demand of the world, particularly of Asia;
- (ii) Collection and organization of information concerning long-term outlook for energy and petroleum supply and demand and energy (oil) policies of individual countries;
- (iii) Development and improvement of a model representing the world petroleum and energy demand and a model for computing petroleum refining and trade flows to be operated in conjunction with the former;
- (iv) Simulation studies to obtain petroleum products supply and demand pictures utilizing the above-mentioned models applied with a medium-term settings covering up to the 2010 ~ 2015 timeframe and based on a range of assumptions including economic growth, demographics, crude oil prices, refinery investments, various energy policies, and so on.
- (v) Analysis of the simulation results obtained in the above, including impact on oil industry and petroleum product trading flows as they relate to Japan.

### 1.3 Study implementation

This study was undertaken by the Institute of Energy Economics, Japan (IEEJ) on commission from the Ministry of Economy, Trade and Industry under the project title of “FY2005 Investigative Research on the Petroleum Industry (Study of Petroleum Product Supply and Demand Trend Based on Econometric Models)”.

Upon implementation of the study, the IEEJ organized a committee named "International Working Group (IWG)" enlisting participation of representatives from oil companies, trading firms, and others with business experience and knowledge in the matter of international petroleum trade, and held four committee meetings starting from December, 2005. Through these discussions, the IWG helped establish case settings for the econometric models, detailed investigation and review on the simulation results to improve the forecasting precision and ensure smooth implementation of the study as a whole.

In addition, a dedicated project team was formed within the Econometric Analysis and Demand Forecast Research Group of the IEEJ to engage in collection and analysis of the latest information and data concerning parameters such as environmental regulations in various countries including the USA, China, and India among others, crude oil price trends, and so on. At the same time, the team sought advice from academic experts to improve the analytical method and the existing models developed in the past.

## 2. Overview of the models

The main econometric model used to estimate the worldwide oil demand in this study is made up of two subsystem models, i.e.:

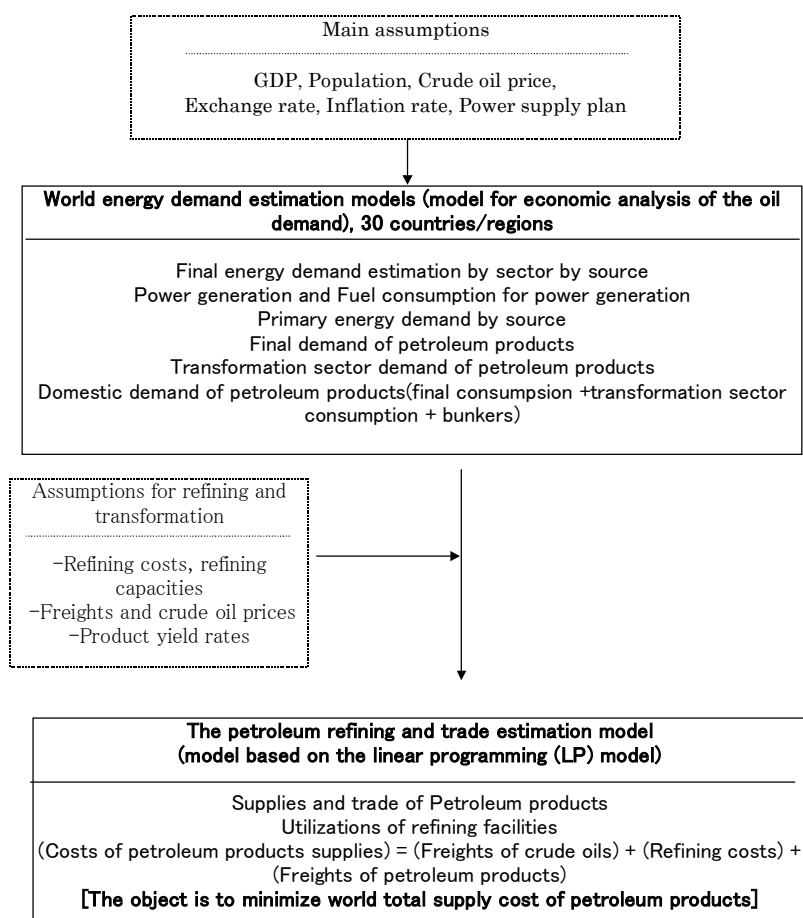
- (i) World Energy Demand Estimation Model
- (ii) World Petroleum Refining/Trade Flow Model: an LP (linear programming) model

In the following sections, general descriptions are given for each of the Worldwide Oil Demand Model and the two subsystem models.

### 2.1 Worldwide Oil Demand Model

The Worldwide Oil Demand Model is an integrated model comprising a World Energy Demand Estimation Model and a World Petroleum Refining/Trade Flow Model linked together, with an emphasis on Asian countries (see Figure 2.1.1). The main characteristic of such a configuration is that it functions as a comprehensive analytical tool capable of deriving a product-wise supply/demand balance for individual countries in a coherent manner, as well as analyzing petroleum trade flows between various countries, which is enabled by using a mathematical model representing a country's petroleum refining activity and supplying the model with the solutions of a demand estimation program as the preconditions to drive the model. While the model divides the world into 30 countries and regions, it is designed such that 18 main countries out of the 21 APEC member countries can be independently analyzed.

[Figure 2.1.1] Conceptual Diagram of the Worldwide Oil Demand Model



[Table 2.1.1] Area Division

1.	United States	16.	Japan
2.	Canada	17.	Hong Kong
3.	Mexico	18.	Taiwan
4.	Brazil	19.	South Korea
5.	Other Central & South American Countries	20.	Singapore
6.	United Kingdom	21.	Brunei
7.	Germany	22.	Indonesia
8.	France	23.	Malaysia
9.	Italy	24.	Philippines
10.	Other OECD countries in Europe	25.	Thailand
11.	Russia	26.	India
12.	Other non-OECD countries in Europe	27.	Vietnam
13.	Africa	28.	Other Asian countries
14.	Middle East	29.	Australia
15.	China	30.	New Zealand

## 2.2 Structure of the World Energy Demand Estimation Model

The World Energy Demand Estimation Model is an econometric analytical model consisting of an array of demand functions prepared for each energy source and demand sector according to the classification by the OECD/IEA Energy Balances data by countries, and is specially designed with a capability to obtain the petroleum demand estimates for each product.

While the structure of this model is not identical for all of the 30 countries and regions since the estimation formulas may vary with the characteristics of the energy supply/demand situation in the country or region of interest and also for other reasons, the model has a basic structure as shown in Figure 2.2.1.

In this model, the energy demand is estimated from the bottom upward, in that the computation is performed in order from the Final Consumption Sector to the Transformation Sector, and finally to the Primary Energy Supply Sector, balancing the estimated supply and demand at each sector.

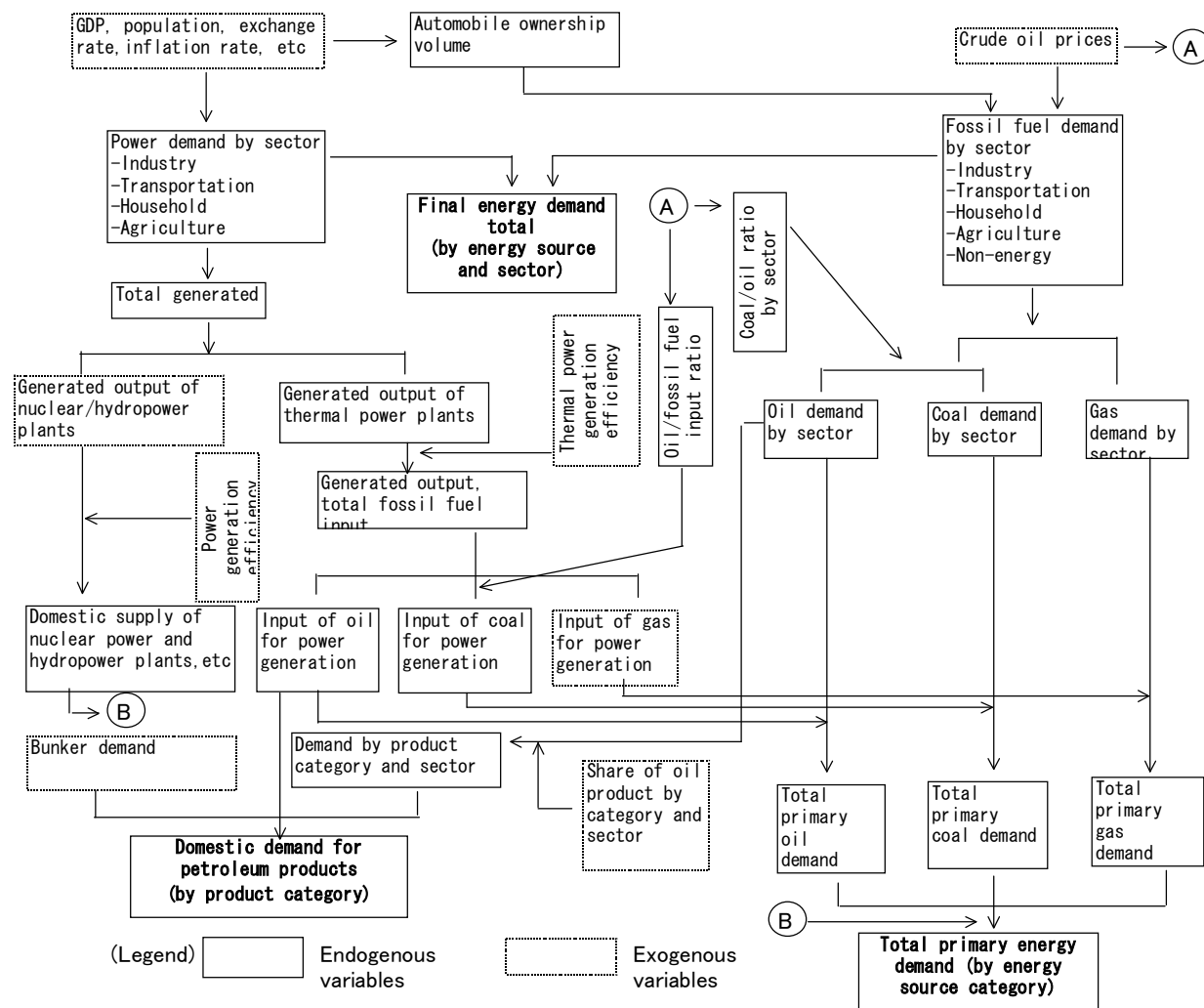
In addition to main exogenous variables given to the model including GDP, energy (oil) prices, and demographic data, variables concerning some of the primary energy supplies such as nuclear power, hydropower, geothermal power, or new energies are also given externally. The Final Energy Consumption Sector is broadly classified into Industrial Sector, Transportation Sector, Civil/Agriculture Sector, and Non-energy Sector, and constitutes the central part of the model.

In the Transformation Sector, the total output generated by electric utilities to meet the power demand resulting from the final consumption estimates is computed as a function of the final power demand.

Next, the output to be generated by thermal power plants fired by fossil fuels is obtained by subtracting from the total generated output the output of nuclear power, hydropower, geothermal power, and other power plants which are all externally given as primary energy. The input amount of fossil fuels is estimated from the average generating efficiency of thermal power plants, which is another exogenous variable given. The breakdown of output by type of fuel is either estimated from a share function or obtained by estimation of oil's share in the input and handling of natural gas as an exogenous variable. Lastly, the primary demand for fossil fuel in each source category is obtained by adding up the input for power generation and the demand in final consumption sectors.

Among the major exogenous variables, crude oil prices were determined in reference to the data presented in the “Annual Energy Outlook 2006” (AEO2006) published by the U.S. Department of Energy (EIA/DOE). For demographic data, input figures were determined in reference to the forecast by the United Nations, various national government projections, IEA forecasts and others.

[Figure 2.2.1] Energy Demand Estimation Model and Computation Flow



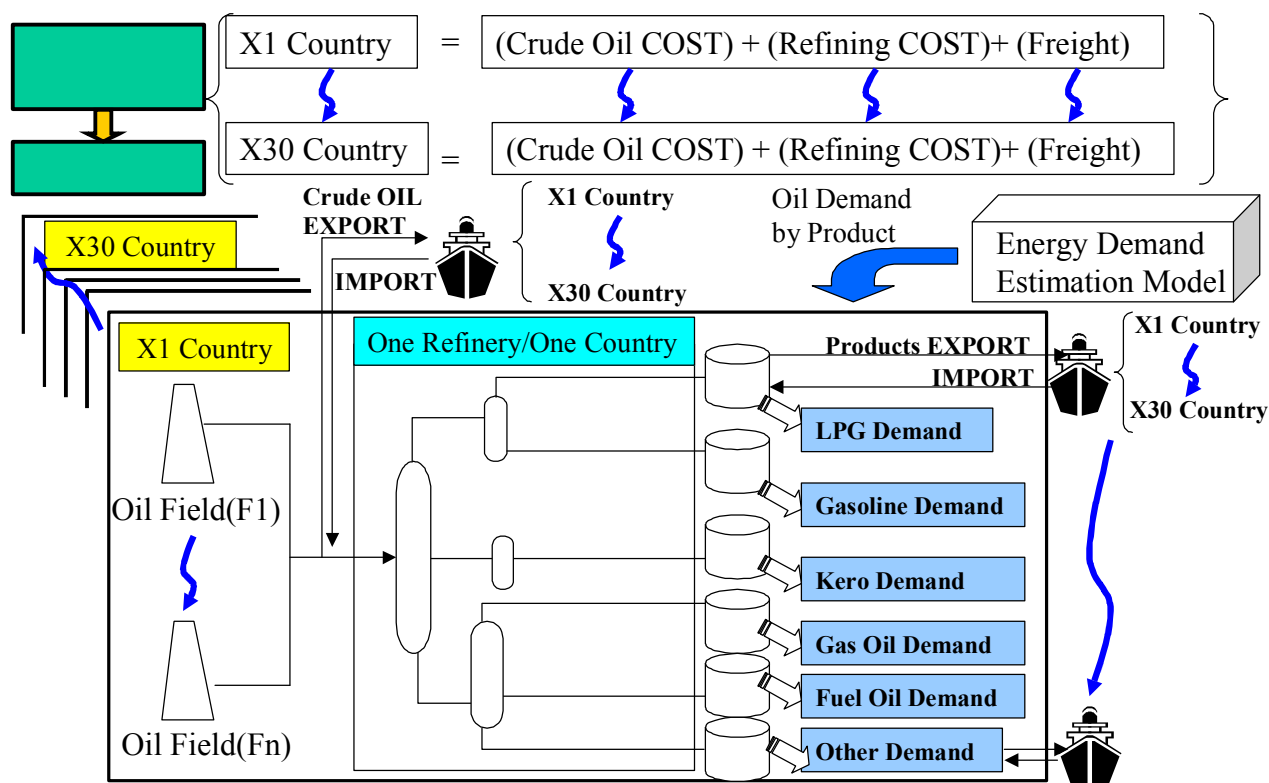
### 2.3 Structure of the Petroleum Refining/Trade Flow Model

#### 2.3.1 LP (linear programming) calculation in the Petroleum Refining/Trade Flow Model

The Petroleum Refining/Trade Flow Model covers 30 countries/regions that correspond with the subjects of the Energy Demand Estimation Model described above.

In the LP calculation performed in this flow model, as shown in Figure 2.3.1, an optimal solution is computed such that the overall cost including the chosen crude oils, processing cost and the product trade taken together becomes the lowest on a worldwide basis.

[Figure 2.3.1] Conceptual Diagram of LP Calculation for Petroleum Refining/Trade Flow Model



[Main parameter settings for the LP calculation]

- Seventy (70) types of crude oils, each set with product yield ratios and sulfur content;
- A refinery assigned for each of the 30 countries/regions, with CDU (crude distillation unit) and secondary unit capacities and operating costs data assigned for each country/region;
- Three levels of tanker freight rates (i.e., VLCC, LR, and MR) for transportation routes connecting the 30 countries/regions.

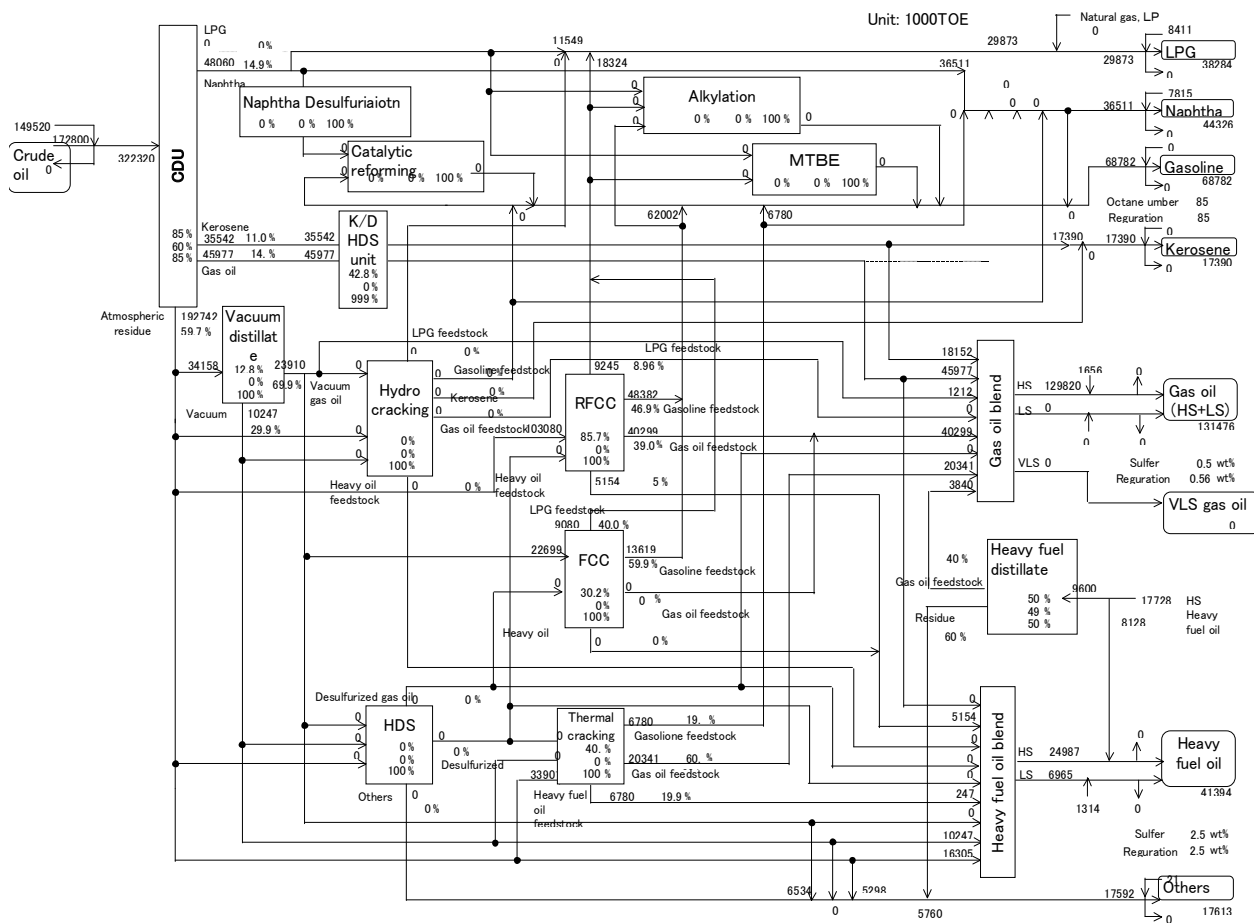
[Product quality standards]

- Gasoline octane restrictions set for each of the 30 countries/regions;
- For gas oil, demand is divided between automotive use and other uses (such as heating, etc.), each assigned with sulfur regulation for the country/region of interest. The algorithm of the LP model performed computations in such a way that the sulfur content falls below the respective regulated level with the lowest cost for the sum of crude oil processing (local production) and product trade (importation) taken together to meet the requirement;
- For fuel oils, production and trade were handled in two levels of sulfur content, i.e. LS (0.2%) and HS (3%).

To simplify computations, the model assumes that the refining activity in each country/region is integrated into one refinery location. Figure 2-3-2 illustrates a typical refinery model.



[Figure 2.3.2] Refinery Flow Model



### 2.3.2 Outline of the petroleum refining model

The refinery flow shown above includes all the major secondary refining units in addition to CDU. In particular, since the demand shift to lighter fractions is anticipated to accelerate in the future, three types of cracking units, i.e. hydrocracking, catalytic cracking, and thermal cracking were introduced into the model, with catalytic cracking further divided into FCC and R-FCC.

Concerning the capacity settings for each refining unit for each country/region, the *Oil & Gas Journal* forecasts by process type were used as a basis, with other references factored in. Particularly for Asia, field survey results were also taken into consideration to improve accuracy.

The operating costs for each type of refining unit was calculated from the unit consumption of utilities (fuel, electricity, steam, and hydrogen) and the chemicals required.



### 3. Case development and main assumptions

#### 3.1 Forecast target period

While simulated studies were performed for 2010, 2015, 2020, and 2030, detailed analysis was attempted basically for two forecast points of 2010 and 2015.

#### 3.2 Case settings

In the process of crude oil and petroleum product supply and demand forecast, various fluctuation factors come into play, thereby significantly affecting the results depending on the changes in the assumptions. Therefore, when considering a policy decision for the future, it is more important to accurately grasp the changes that are likely to occur in the future and to quantitatively analyze their possibility and impact than to discuss the results of a single forecast in isolation. In consideration of the above, in addition to a Reference Case which was established as the case having the highest probability, the following two cases identified with a high possibility as well as potential impact were established for the sensitivity analysis:

[Table 3.2.1] Case Settings Table

		Reference	Low Growth	India Expansion
Asian Economic Growth	Reference	○		○
	Low Growth		○	
India's Refining Capacity	Reference	○	○	
	Expansion			○

While a Reference Case was analyzed for 2010, 2015, 2020, and 2030, a Low Growth Case and an India Expansion Case were analyzed only for 2015. Explanations on the cases follow:

➤ Reference Case:

Set as the case where economic growth, crude oil prices, and refining capacity in respective countries are expected to move along the most probable trend line until 2030;

➤ Low Growth Case:

Growth after 2011 to slow by 0.5% for Japan/Korea, 1.0% for rest of Asia from Reference Case

A case with lower economic growth rates than the Reference Case and hence with a slower oil demand growth. More specifically, Asian economic growth after 2011 is set at a rate lower than Reference Case by 0.5 percentage point for Japan and Korea, the two OECD member nations, and by 1.0 percentage point for the rest of Asia.

➤ India Expansion Case:

The 2015 Indian refining capacity: 500,000 b/d over the 2015 Reference Case capacity

A case with an accelerated expansion of crude processing (atmospheric distillation) capacity for India. In 1999, the first private sector refinery was brought on stream to augment the domestic refining capacity in India, and India has been in a net exporting position for petroleum products since 2001. Since India's influence on the petroleum product supply/demand balance in Asia is considered to continue in the coming years, an alternative case with the 2015 Indian CDU capacity set at a value

500,000 barrels per day (b/d) higher than that in Reference Case was examined to see its impact on the Asian petroleum product supply/demand balance.

### 3.3 GDP growth rates forecast

The Gross Domestic Product (GDP) growth rates were set at levels shown in the accompanying tables that were prepared based on the Asia Development Bank (ADB) forecasts, announced plans by national governments, and information from the field studies (see Tables 3.3.1, 3.3.2, and 3.3.3):

[Table 3.3.1] GDP Growth Rates in Asian Countries (Reference Case), average annual growth %

GDP Growth,%	1980/1971	1990/1980	2003/1990	2010/2003	2015/2010	2020/2015	2030/2020
China	6.1	9.3	9.7	8.2	6.6	6.6	5.1
Japan	4.4	3.9	1.3	1.7	1.1	1.1	0.9
Hong Kong	9.6	6.4	3.9	5.3	3.3	3.3	3.3
Taiwan	9.2	7.9	5.3	4.6	4.0	3.4	2.6
Korea	7.1	8.7	5.7	4.5	3.7	3.3	2.9
Singapore	9.2	7.2	5.9	5.1	3.8	3.6	4.0
Brunei	8.0	0.0	1.7	2.6	5.9	2.4	3.7
Indonesia	8.0	6.4	6.9	5.2	4.5	4.5	4.0
Malaysia	8.1	6.0	8.1	5.4	5.0	5.0	4.5
Philippines	6.0	1.7	3.3	4.1	4.2	4.2	4.0
Thailand	7.1	7.8	4.5	5.5	5.0	5.0	4.8
India	3.1	5.8	5.6	6.4	6.0	6.0	5.3
Vietnam	1.3	5.2	7.4	7.2	6.8	6.3	6.0
Other Asia	4.6	2.5	6.6	6.4	6.1	6.1	4.9

Sources: World Bank WDI database for results, IEEJ estimates for forecasts

[Table 3.3.2] GDP Growth Rates in Asian Countries (Low Growth Case), average annual growth %

GDP Growth,%	Reference Case		Low Growth Case	
	2010/2003	2015/2010	2010/2003	2015/2010
China	8.2	6.6	8.2	5.6
Japan	1.7	1.1	1.7	0.6
Hong Kong	5.3	3.3	5.3	2.3
Taiwan	4.6	4.0	4.6	3.0
Korea	4.5	3.7	4.5	3.2
Singapore	5.1	3.8	5.1	2.8
Brunei	2.6	5.9	2.6	4.9
Indonesia	5.2	4.5	5.2	3.5
Malaysia	5.4	5.0	5.4	4.0
Philippines	4.1	4.2	4.1	3.2
Thailand	5.5	5.0	5.5	4.0
India	6.4	6.0	6.4	5.0
Vietnam	7.2	6.8	7.2	5.8
Other Asia	6.4	6.1	6.4	5.1

Sources: Same as Table 3.3.1

[Table 3.3.3] GDP Growth Rates in Non-Asian Countries, average annual growth %

GDP Growth, %	1980/1971	1990/1980	2003/1990	2010/2003	2015/2010	2020/2015	2030/2020
East Asia (excl. Japan)	7.2	7.7	7.1	6.4	5.4	5.3	4.4
East Asia	4.9	4.7	3.1	3.7	3.2	3.4	3.0
Asia	4.8	4.6	3.5	4.1	3.6	3.9	3.5
North America	3.3	3.2	3.0	3.2	2.8	2.8	2.7
Latin America	5.6	1.1	2.5	3.5	3.3	3.3	3.0
West Europe	3.0	2.4	2.0	2.2	2.2	2.2	2.1
East Europe	5.5	1.6	-1.4	6.4	6.6	3.7	2.9
Africa	3.8	1.6	2.4	4.2	4.0	3.9	3.7
Middle East	5.9	0.4	3.9	3.8	3.7	3.6	3.4
Oceania	2.7	2.9	3.5	2.9	2.9	2.8	2.6
Other World	8.0	0.0	1.7	2.6	5.9	2.4	3.7
World	3.8	3.0	2.7	3.3	3.1	3.1	2.9

Sources: World Bank WDI database for results, IEEJ estimates for forecasts

### 3.4 Crude oil prices

For the crude oil price assumptions, the data presented in the “*Annual Energy Outlook 2006*” (AEO2006) by U.S. DOE (EIA) for Reference Case were adopted.

In consideration of the present international oil situation that is becoming increasingly volatile for reasons such as stagnant upstream investments, the AEO2006 revised the projected long-term crude oil prices upward from those presented in the AEO2005 of last year. Namely, the price for WTI or an equivalent in 2025 has been raised by \$ 21 per barrel from \$33 per barrel in the AEO2005 projection to \$54 per barrel in the AEO2006.

[Table 3.4.1] Crude Oil Price Forecast in AEO2006

		2003	2004	2010	2020	2030	'04-'30†
AEO2006*	Reference (Light Crude) 2004 Prices	32	41	47	51	57	1.3
	Reference 2004 Prices	28	36	44	45	50	1.3
WEO2005**	Reference 2004 Prices		36	35	37	39	0.3
	Slow investment 2004 Prices		36	41	46	52	1.4
AEO2006	Reference (Light Crude) Nominal		41	53	75	107	3.8
	Reference Nominal		36	50	66	94	3.8
WEO2005	Reference Nominal		36	40	50	65	2.3
	Slow investment Nominal		36	47	63	86	3.4
GDP Deflator***			1.00	1.13	1.46	1.88	-

\*AEO2006: “*Annual Energy Outlook 2006*” (Early Release)

\*\*WEO2005: “*World Energy Outlook 2005*” by IEA

\*\*\*GNP deflator per AEO2006 trial calculation results

†Average annual rate of increase

The AEO2006 views on international oil markets in projecting crude oil prices:

- While USA, China, and other Asian nations drive oil demand, upstream investments in OPEC stagnates, tightening the international oil markets;
- World oil demand to expand from 82 million b/d in 2004 and 111 million b/d in 2025, to 118 million b/d in 2030 (shrank from 121 million b/d in 2025 forecast in AEO2005, due to the upward adjustment of crude prices);
- OPEC production to go from 31 million b/d in 2004 and 44 million b/d in 2025, to 47 million b/d in 2030 (reduced by 11 million b/d from 55 million b/d in 2025 forecast in AEO2005), bringing OPEC's share to 37% in 2004 and 40% in 2030;
- Non-OPEC production to trend from 52 million b/d in 2004 and 67 million b/d in 2025, to 71 million b/d in 2030 (rose by 2 million b/d from 65 million b/d in 2025 forecast in AEO2005).

3.5 Considerations for crude price increase and inflation

In the present study, crude price increase has been factored not only in the econometric model for estimating the energy demand but also in the LP model for examining the petroleum refining/trade flow. This was considered necessary since crude price hike in recent years have been acting as a cost pressure on overall petroleum refining business through inflated cost of materials or transportation, whose impact must be properly reflected in the exercise.

[Table 3.5.1] AEO2006 Forecasts on Crude Prices and GDP Deflators

Unit: \$/bbl	AEO2006				GDP Deflators
	Reference (Light Crude)	Reference	Reference (Light Crude)	Reference	
	2004 Prices		Nominal Prices		
2003	32	28			
2004	41	36	41	36	1.00
2010	47	44	53	50	1.13
2020	51	45	75	66	1.46
2030	57	50	107	94	1.88
Avg. Annual Increase, %					
2004-2030	1.3	1.3	3.8	3.8	4.4
2004-2010	2.3	3.4	4.4	5.6	2.1
2010-2020	0.8	0.2	3.5	2.8	2.6
2020-2030	1.1	1.1	3.6	3.6	2.6

Source: AEO2006: *Annual Energy Outlook 2006*

Accordingly, in setting the prices for the 70 grades of crude oil considered in the LP model, the rates of increase cited in the AEO2006 were applied to explicitly insert the inflationary factor into the model.

Likewise, it is also expected that the cost of petroleum refining business in general will rise in connection with the crude price hikes. This factor was also taken into account by deeming the rates of increase for the GDP deflator indicated in the AEO2006 as the rates of world inflation, and explicitly

incorporating it into the cost elements considered in the LP model, such as operation cost of refining units, cost of capacity expansions and constructions, crude oil freight, petroleum product freight, and so on.

### 3.6 Unconventional oil

Among unconventional hydrocarbon fuels, Canadian oilsands and Orinoco tar in Venezuela as crude oil substitutes were incorporated into the model as they are already in commercial production and being regularly traded. Other unconventional fuels, for which practical use has been established with an expected expansion in future supplies, include GTL, DME, or biofuels such as ethanol that are considered to gradually replace demand for petroleum as alternatives for use as fuel blending components or substitutes for LPG, domestic fuel (replacing kerosene) or transportation fuel (replacing gas oil) in the future. However, their supply availability would be limited at several percentage points of the world oil demand even in 2015, and even if it is obligated to mix a certain ratio of ethanol with gasoline in the policy of some of the foreign countries, there are cases where such mandates are not always implemented. Since the foregoing situation made it difficult to quantitatively forecast the future supplies of those unconventional fuels, it was decided not to capture them in the forecasting model in this study.

[Table 3.6.1] Projected Supplies of GTL (including DME) and Ethanol for Fuel Use

Unit: Millions of b/d

		Actual	Projection →				
		2004	2010	2015	2020	2030	
United States (50 states)	Ethanol	0.22	0.48	0.72	0.94	1.50	
Other North America	Ethanol	0.01	0.01	0.01	0.02	0.02	
Western Europe	Ethanol	0.03	0.05	0.07	0.10	0.14	
Asia	GTL	0.01	0.01	0.01	0.02	0.03	
	Ethanol	0.11	0.19	0.27	0.36	0.52	
	Total	0.12	0.21	0.28	0.38	0.56	
Middle East	GTL	0.00	0.18	0.68	0.98	1.73	
	Ethanol	0.00	0.00	0.00	0.00	0.00	
	Total	0.00	0.18	0.68	0.98	1.73	
Africa	GTL	0.13	0.16	0.21	0.30	0.54	
	Ethanol	0.00	0.00	0.00	0.00	0.00	
	Total	0.13	0.16	0.21	0.30	0.54	
South and Central America	Ethanol	0.26	0.45	0.63	0.85	1.21	
Total Production (Nonconventional) A		0.76	1.54	2.61	3.56	5.70	
Oil consumption B		Millions of b/d	76.98	84.75	93.27	102.12	122.24
A/B		%	0.99	1.81	2.79	3.49	4.66

Sources: GTL (including DME): Country-by-country plant construction plans; Ethanol: Prepared from *International Energy Outlook 2005*, *World Ethanol and Biofuel Report*, etc.

### 3.7 Results of the demand forecast (Primary Energy Consumption) by the model

As described before, the present study estimated the world energy demand for two cases, i.e. the Reference Case as the basis of comparison and the Low Growth Case for which a lower pace of growth was assumed for Asia.

Since the Low Growth Case is a case where assumptions were altered only for Asia, this section will exclusively deal with the results of the Reference Case forecast, leaving the discussion on the Low Growth Case to the later sections analyzing Asia.

## 3.7.1 Energy consumption trends:

As shown in Table 3.7.1, the world primary energy consumption is estimated at about 10,800 MTOE (million tons oil equivalent) in 2010 and about 16,000 MTOE in 2030, respectively representing 1.2 times and 1.7 times the 2003 figure of about 9,300 MTOE. In terms of an average annual growth rate, the above trend represents 2.2% for the period until 2010, and 2.0% for the 2011~2020 period, both rates being lower than the 1980's results of 2.4%.

With regard to the primary energy consumption make-up by region, a salient point is that the share of the Americas and OECD Europe combined is forecast to drop from 52.7% in 2003 to 41.5 % in 2030. Meanwhile, Asia's share is forecast to rise by 7.5 percentage point to 37.6% in 2030. Table 3.7.2 shows the primary energy consumption estimates for each of the 30 countries/regions.

[Table 3.7.1] Primary Energy Consumption Trends (including Combustible Renewables)

	Actual		Projection				AAGR					
	1980 (MTOE)	2003 (MTOE)	2010 (MTOE)	2015 (MTOE)	2020 (MTOE)	2030 (MTOE)	2003 /1980	2010 /2003	2015 /2010	2020 /2015	2030 /2020	2030 /2003
America	2,310	3,050	3,329	3,582	3,849	4,410	1.2	1.3	1.5	1.4	1.3	1.4
Western Europe	1,507	1,841	1,924	1,999	2,075	2,223	0.9	0.6	0.8	0.7	0.7	0.7
Former Soviet Union & Eastern Europe	130	731	817	897	948	1,015	7.8	1.6	1.9	1.1	0.7	1.2
Asia	1,060	2,788	3,611	4,152	4,747	5,990	4.3	3.8	2.8	2.7	2.4	2.9
Oceania	80	130	146	159	173	203	2.2	1.7	1.7	1.7	1.6	1.7
Others	267	734	968	1,184	1,440	2,110	4.5	4.0	4.1	4.0	3.9	4.0
Total	5,354	9,274	10,795	11,974	13,232	15,951	2.4	2.2	2.1	2.0	1.9	2.0
	Share of total (%)						Share change (%)					
	1980 (%)	2003 (%)	2010 (%)	2015 (%)	2020 (%)	2030 (%)	2003 -1980	2010 -2003	2015 -2010	2020 -2015	2030 -2020	2030 -2003
America	43.1	32.9	30.8	29.9	29.1	27.6	-10.3	-2.0	-0.9	-0.8	-1.4	-5.2
Western Europe	28.2	19.8	17.8	16.7	15.7	13.9	-8.3	-2.0	-1.1	-1.0	-1.7	-5.9
Former Soviet Union	2.4	7.9	7.6	7.5	7.2	6.4	5.5	-0.3	-0.1	-0.3	-0.8	-1.5
Asia	19.8	30.1	33.5	34.7	35.9	37.6	10.3	3.4	1.2	1.2	1.7	7.5
Oceania	1.5	1.4	1.4	1.3	1.3	1.3	-0.1	0.0	0.0	0.0	0.0	-0.1
Others	5.0	7.9	9.0	9.9	10.9	13.2	2.9	1.1	0.9	1.0	2.4	5.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

Note: Combustible Renewables are counted only for OECD nations.



[Table 3.7.2] World Primary Energy Consumption by Country/Region

	Actual		Projection				AAGR					
	1980 (MTOE)	2003 (MTOE)	2010 (MTOE)	2015 (MTOE)	2020 (MTOE)	2030 (MTOE)	2003 /1980	2010 /2003	2015 /2010	2020 /2015	2030 /2020	2030 /2003
USA	1,812	2,281	2,428	2,575	2,727	3,023	1.0	0.9	1.2	1.2	1.0	1.0
Canada	193	261	282	296	310	333	1.3	1.1	1.0	0.9	0.7	0.9
Mexico	90	152	177	198	223	277	2.3	2.2	2.3	2.4	2.2	2.2
Chile	74	143	178	206	238	316	2.9	3.1	3.0	2.9	2.9	3.0
Other S. & Cent.America	141	214	265	306	351	462	1.8	3.1	2.9	2.8	2.8	2.9
United Kingdom	201	232	240	243	246	253	0.6	0.5	0.3	0.2	0.3	0.3
Germany	360	347	339	340	341	349	-0.2	-0.3	0.1	0.1	0.2	0.0
France	194	271	284	290	297	309	1.5	0.6	0.5	0.4	0.4	0.5
Italy	132	181	182	190	199	212	1.4	0.1	0.9	0.9	0.6	0.6
Other Western Europe	620	810	879	935	992	1,100	1.2	1.2	1.2	1.2	1.0	1.1
FSU	0	634	704	775	821	878	-	1.5	1.9	1.2	0.7	1.2
Other Eastern Europe	130	98	113	122	127	137	-1.2	2.1	1.6	0.7	0.8	1.3
Africa	133	287	299	338	384	489	3.4	0.6	2.5	2.6	2.4	2.0
Middle East	131	445	666	842	1,050	1,616	5.4	6.0	4.8	4.5	4.4	4.9
China	419	1,190	1,672	1,927	2,206	2,710	4.6	5.0	2.9	2.7	2.1	3.1
Japan	346	517	541	552	558	557	1.8	0.6	0.4	0.2	0.0	0.3
Hong Kong	5	16	18	20	21	25	5.0	1.5	1.5	1.5	1.6	1.5
Taiwan	28	97	115	131	149	185	5.5	2.4	2.7	2.5	2.2	2.4
South Korea	41	205	237	265	290	335	7.2	2.1	2.3	1.8	1.4	1.8
Singapore	6	22	29	33	38	51	5.9	3.9	2.7	2.7	2.9	3.1
Brunei	3	3	3	4	5	6	0.0	3.2	4.3	4.3	2.1	3.2
Indonesia	26	113	152	185	227	347	6.5	4.3	4.0	4.2	4.3	4.2
Malaysia	11	64	111	137	157	196	8.1	8.2	4.2	2.9	2.2	4.2
Philippines	13	32	45	55	68	98	3.8	4.9	4.4	4.1	3.8	4.3
Thailand	12	74	100	124	153	230	8.2	4.4	4.4	4.4	4.1	4.3
India	95	342	427	511	607	848	5.7	3.2	3.6	3.5	3.4	3.4
Vietnam	4	21	28	37	48	80	7.2	4.1	6.0	5.3	5.3	5.1
Other Asia	49	90	133	171	218	324	2.7	5.7	5.2	5.0	4.0	4.8
Australia	70	113	126	138	150	175	2.1	1.6	1.8	1.7	1.6	1.7
New Zealand	9	17	20	22	24	28	2.8	2.3	1.4	1.7	1.4	1.7
America	2,310	3,050	3,329	3,582	3,849	4,410	1.2	1.3	1.5	1.4	1.4	1.4
Western Europe	1,507	1,841	1,924	1,999	2,075	2,223	0.9	0.6	0.8	0.7	0.7	0.7
Former Soviet Union & Eastern Europe	130	731	817	897	948	1,015	7.8	1.6	1.9	1.1	0.7	1.2
Asia	1,060	2,788	3,611	4,152	4,747	5,990	4.3	3.8	2.8	2.7	2.4	2.9
Oceania	80	130	146	159	173	203	2.2	1.7	1.7	1.7	1.6	1.7
Others	265	732	965	1,180	1,435	2,104	4.5	4.0	4.1	4.0	3.9	4.0
Total	5,351	9,272	10,792	11,970	13,227	15,945	2.4	2.2	2.1	2.0	1.9	2.0

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

Note: Combustible Renewables are counted only for OECD nations.

## &lt;Primary Energy Consumption by Energy Source&gt;

In terms of the world primary energy consumption breakdown by energy source, in 2003, oil's share was the largest at 38.5%, followed by 27.0% for coal, 22.5% for natural gas, 2.4% for hydropower, and 7.1% for nuclear energy.

In comparison with the 2003 picture, shares for oil and nuclear energy in 2010 are projected to drop by 1.5 percentage point and 0.2 percentage point respectively, while natural gas is to rise by 0.6 percentage point. For 2030, the share distribution is forecast to become 37.2% for oil, 26.5% for coal, 25.6% for natural gas, 2.3% for hydropower, and 5.3% for nuclear energy. The recent trend in switching away from an oil-centered mix to coal and natural gas and the diversification of energy sources is forecast to continue until 2030.

[Table 3.7.3] World Primary Energy Consumption Breakdown by Source

	History		Projections				AAGR					
	1980 (MTOE)	2003 (MTOE)	2010 (MTOE)	2015 (MTOE)	2020 (MTOE)	2030 (MTOE)	2003 /1980	2010 /2002	2015 /2010	2020 /2015	2030 /2020	2030 /2003
Coal	1,460	2,508	2,977	3,270	3,543	4,226	2.38	2.48	1.90	1.62	1.78	1.95
Oil	2,556	3,576	3,997	4,432	4,896	5,939	1.47	1.60	2.09	2.01	1.95	1.90
Natural Gas	922	2,086	2,491	2,852	3,265	4,084	3.61	2.57	2.74	2.74	2.26	2.52
Nuclear	167	663	752	780	811	850	6.17	1.81	0.76	0.77	0.47	0.92
Hydro	131	220	268	291	318	361	2.27	2.86	1.65	1.79	1.29	1.86
Other Renewable	12	51	88	114	149	214	6.27	8.30	5.29	5.39	3.69	5.48
Combustible Renewable & Waste	338	479	534	549	564	586	1.53	1.56	0.56	0.52	0.38	0.75
World total	5,354	9,274	10,795	11,974	13,232	15,951	2.42	2.19	2.09	2.02	1.89	2.03
	Share of total						Share change					
	1980 (%)	2003 (%)	2010 (%)	2015 (%)	2020 (%)	2030 (%)	2002 -1980	2010 -2002	2015 -2010	2020 -2015	2030 -2020	2030 -2003
Coal	27.3	27.0	27.6	27.3	26.8	26.5	-0.2	0.5	-0.3	-0.5	-0.3	-0.6
Oil	47.7	38.6	37.0	37.0	37.0	37.2	-9.2	-1.5	0.0	0.0	0.2	-1.3
Natural Gas	17.2	22.5	23.1	23.8	24.7	25.6	5.3	0.6	0.7	0.9	0.9	3.1
Nuclear	3.1	7.1	7.0	6.5	6.1	5.3	4.0	-0.2	-0.4	-0.4	-0.8	-1.8
Hydro	2.4	2.4	2.5	2.4	2.4	2.3	-0.1	0.1	-0.1	0.0	-0.1	-0.1
Other Renewable	0.2	0.5	0.8	1.0	1.1	1.3	0.3	0.3	0.1	0.2	0.2	0.8
Combustible Renewable & Waste	6.3	1.8	4.9	4.6	4.3	3.7	-4.5	3.1	-0.4	-0.3	-0.6	1.9
World total	104.4	100.0	102.9	102.6	102.4	101.9	-4.4	2.9	-0.3	-0.3	-0.4	2.0

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

When fossil fuels are ranked in the order of abundance of reserves, coal comes first, followed by natural gas and then oil. In terms of environmental quality, i.e. less emissions of CO<sub>2</sub> per unit calorific value, however, the order is natural gas, oil, and coal. With regard to oil, the general tendency since the two oil crises in the 1970s has been to suppress consumption for reasons such as concerns over its limited reserve or numerous uncertainties involved in supply stability. This study has reaffirmed that oil's share in the primary energy supply is projected to decline further in continuation of the above trend.

Table 3.7.4 presents the trend in primary energy consumption by region and by energy source.

A point worthy of note for the Americas is that its share of coal is relatively low compared to that of oil. For 2003, coal's share was 19.3% and oil was 42.8%. In 2030 coal is forecast to slightly increase its share to 20.4% whereas oil would shrink to 40.9%. For natural gas, while its share in 2003 was 23.7%, it is forecast to go up to 25.3% in 2030.

Europe is noted for its relatively high share of nuclear power. In 2003, nuclear power accounted for 13.9% of the primary energy consumption, although it is forecast to decline to 9.7% in 2030. Oil's share would go along with a similar downward trend from 37.5% in 2003 to 33.8% in 2030, while natural gas would gain its share going from 23.7% to 25.3% in the same timeframe.

The former Soviet Union/East Europe is characterized by its high share of natural gas that accounts for almost half of the primary energy consumption, where nuclear power remains at a low share compared with its OECD counterpart. While the 2003 data showed a breakdown with 46.9% for natural gas, 22.4% for oil, 19.0% for coal, 6.4% for nuclear power, and 2.3% for hydropower and others, forecast for 2030 indicated that natural gas and oil would somewhat increase their shares, while coal and nuclear power as well as others lose ground.

Concerning the total Asian energy consumption viewed from the 2003 breakdown by source, it shows a higher coal dependency than any other regions of the world with its share of 46.4%, while oil accounts for 36.2%, natural gas 10.4%, nuclear 4.4%, and hydropower and others 2.3%. In the 2030 forecast, coal and oil are estimated to lose their shares, while natural gas with its share of 15.7% to enjoy an increase along with nuclear power.

[Table 3.7.4] Primary Energy Consumption Trends by Region and Source

	History		Projections						AAGR		
	2003 (MTOE)	Share (%)	2010 (MTOE)	Share (%)	2020 (MTOE)	Share (%)	2030 (MTOE)	Share (%)	2010 /2003	2020 /2010	2030 /2020
Americas	3,050	100.0%	3,329	100.0%	3,849	100.0%	4,410	100.0%	1.26	1.46	1.37
Coal	588	19.3%	621	18.7%	697	18.1%	900	20.4%	0.79	1.16	2.58
Oil	1,305	42.8%	1,404	42.2%	1,605	41.7%	1,804	40.9%	1.04	1.35	1.18
Natural Gas	724	23.7%	806	24.2%	996	25.9%	1,114	25.3%	1.53	2.15	1.12
Nuclear	233	7.6%	250	7.5%	266	6.9%	267	6.1%	1.00	0.64	0.04
Hydro & Others	199	6.5%	248	7.5%	284	7.4%	324	7.3%	3.19	1.36	1.30
Western Europe	1,841	100.0%	1,924	100.0%	2,075	100.0%	2,223	100.0%	0.63	0.76	0.69
Coal	332	18.0%	318	16.5%	317	15.3%	318	14.3%	-0.60	-0.04	0.03
Oil	691	37.5%	684	35.6%	723	34.8%	751	33.8%	-0.13	0.55	0.38
Natural Gas	429	23.3%	496	25.8%	598	28.8%	698	31.4%	2.07	1.90	1.56
Nuclear	256	13.9%	255	13.3%	228	11.0%	217	9.7%	-0.03	-1.12	-0.50
Hydro & Others	134	7.3%	170	8.8%	209	10.1%	239	10.8%	3.51	2.05	1.37
Former Soviet Union & Eastern Europe	731	100.0%	817	100.0%	948	100.0%	1,015	100.0%	1.59	1.50	0.69
Coal	139	19.0%	154	18.9%	175	18.5%	170	16.8%	1.55	1.26	-0.28
Oil	164	22.4%	177	21.6%	205	21.6%	213	21.0%	1.07	1.48	0.39
Natural Gas	365	49.9%	415	50.9%	494	52.1%	556	54.8%	1.85	1.75	1.19
Nuclear	47	6.4%	51	6.2%	51	5.4%	52	5.1%	1.16	0.12	0.06
Hydro & Others	17	2.3%	20	2.4%	23	2.4%	25	2.4%	2.44	1.49	0.88
Asia	2,788	111.0%	3,611	108.6%	4,747	106.6%	5,990	105.1%	3.77	2.77	2.35
Coal	1,294	46.4%	1,650	45.7%	2,016	42.5%	2,345	39.1%	3.53	2.02	1.52
Oil	1,009	36.2%	1,232	34.1%	1,654	34.8%	2,179	36.4%	2.89	2.98	2.80
Natural Gas	290	10.4%	425	11.8%	651	13.7%	937	15.7%	5.61	4.36	3.72
Nuclear	123	4.4%	191	5.3%	259	5.5%	308	5.1%	6.52	3.09	1.73
Hydro & Others	379	13.6%	425	11.8%	482	10.2%	529	8.8%	1.66	1.27	0.93
Oceania	130	100.0%	146	100.0%	173	100.0%	203	100.0%	1.72	1.71	1.58
Coal	50	38.3%	50	34.3%	56	32.3%	61	30.2%	0.10	1.11	0.90
Oil	43	32.9%	48	32.7%	58	33.2%	66	32.7%	1.64	1.86	1.43
Natural Gas	26	20.0%	33	22.3%	41	23.4%	50	24.4%	3.29	2.22	2.01
Nuclear	0	0.0%	0	0.0%	0	0.0%	0	0.0%	-	-	-
Hydro & Others	11	8.8%	16	10.8%	19	11.1%	26	12.7%	4.68	2.03	2.92
Others	734	100.3%	968	100.0%	1,440	100.0%	2,110	100.0%	4.03	4.05	3.90
Coal	106	14.4%	183	18.9%	282	19.6%	432	20.4%	8.14	4.45	4.34
Oil	364	49.6%	452	46.6%	652	45.3%	926	43.9%	3.12	3.75	3.56
Natural Gas	252	34.2%	317	32.8%	486	33.7%	728	34.5%	3.38	4.34	4.14
Nuclear	5	0.7%	5	0.5%	6	0.4%	6	0.3%	0.18	2.45	0.00
Hydro & Others	10	1.4%	12	1.2%	13	0.9%	19	0.9%	1.88	1.26	3.51
Total	9,274	103.3%	10,795	102.9%	13,232	102.4%	15,951	101.9%	2.19	2.06	1.89
Coal	2,508	27.0%	2,977	27.6%	3,543	26.8%	4,226	26.5%	2.48	1.76	1.78
Oil	3,576	38.6%	3,997	37.0%	4,896	37.0%	5,939	37.2%	1.60	2.05	1.95
Natural Gas	2,086	22.5%	2,491	23.1%	3,265	24.7%	4,084	25.6%	2.57	2.74	2.26
Nuclear	663	7.1%	752	7.0%	811	6.1%	850	5.3%	1.81	0.76	0.47
Hydro & Others	750	8.1%	891	8.3%	1,030	7.8%	1,161	7.3%	2.49	1.47	1.20

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

Table 3.7.5 below summarizes Asia's primary oil demand trends:

[Table 3.7.5] Primary Oil Demand Trends in Asia

Unit: Million tons	2003	2010	2015	2020	2030	Change %		AAGR %	
						03~15	15~30	15/03	15/30
China	255	361	449	554	789	194	340	4.8%	3.8%
Hong Kong	13	15	16	18	22	3	6	1.7%	2.1%
Taiwan	46	49	51	55	62	5	11	0.9%	1.3%
South Korea	111	115	123	129	140	12	17	0.9%	0.9%
Singapore	36	44	50	57	74	14	24	2.8%	2.6%
Brunei	1	1	1	1	1	0	0	0.0%	0.0%
Indonesia	63	82	95	109	144	32	49	3.5%	2.8%
Malaysia	25	36	43	49	62	18	19	4.6%	2.5%
Philippines	16	18	23	28	43	7	20	3.1%	4.3%
Thailand	38	51	62	74	107	24	45	4.2%	3.7%
Vietnam	11	15	19	25	44	8	25	4.7%	5.8%
East Asia (ex. Japan)	615	787	932	1,099	1,488	317	556	3.5%	3.2%
Japan	259	247	245	240	230	-14	-15	-0.5%	-0.4%
India	119	150	182	218	311	63	129	3.6%	3.6%
Other Asia	31	41	52	66	95	21	43	4.4%	4.1%
Asia Total	1,024	1,225	1,411	1,623	2,124	387	713	2.7%	2.8%

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

### 3.7.2 GDP intensity of primary energy consumption:

The 2003 worldwide average for the GDP intensity of primary energy consumption was identified at 0.27 toe (tons of oil equivalent) per thousand dollars, as shown in Table 3.7.6. The GDP intensity is forecast to take a downtrend in coming years, marking 0.25 in 2010 and 0.23 in 2030.

Looking at the 2003 GDP intensity picture by region, the former Soviet Union/East Europe was the highest at 1.60, followed by 0.30 for Asia, 0.27 for Oceania, and 0.23 for the Americas. In 2030, this picture is projected to become 0.65 for the former Soviet Union/East Europe, 0.24 for Asia, 0.20 for Oceania, and 0.16 for the Americas.

Compared with the 2003 results, the GDP intensity in 2030 is forecast to fall by 0.06~0.07 percentage point for Europe and the Americas, 0.9 percentage point for the former Soviet Union/East Europe, and 0.06 percentage point for Asia.

[Table 3.7.6] GDP Intensity of Primary Energy Consumption

	History		Projections			AAGR			
	1980	2003	2010	2020	2030	2003	2010	2020	2030
	TOE/000 \$		TOE/000 \$			/1980	/2003	/2010	/2020
Americas	0.340	0.234	0.204	0.177	0.155	-0.106	-0.030	-0.027	-0.022
Western Europe	0.269	0.201	0.181	0.157	0.136	-0.068	-0.021	-0.024	-0.020
Former Soviet Union & Eastern Europe	0.277	1.595	1.153	0.807	0.650	1.318	-0.443	-0.345	-0.157
Asia	0.277	0.299	0.293	0.266	0.239	0.021	-0.006	-0.026	-0.027
Oceania	0.337	0.266	0.244	0.219	0.198	-0.071	-0.021	-0.025	-0.021
Others	0.273	0.452	0.455	0.467	0.485	0.179	0.003	0.012	0.018
Total	0.299	0.272	0.253	0.229	0.208	-0.027	-0.019	-0.024	-0.021

Sources: *Handbook of Energy & Economic Statistics in Japan 2006* for results, IEEJ estimates for forecast

## 3.7.3 GDP elasticity of primary energy consumption:

The GDP elasticity, which is a measure of the primary energy consumption growth per GDP growth rate, world average for the 1980~2003 period was 0.9. The simulation results indicate that the GDP elasticity would become 0.67, 0.67, and 0.66 for the periods of 2003~2010, 2010~2020, and 2020~2030, respectively (see Table 3.7.7).

[Table 3.7.7] GDP Elasticity of Primary Energy Consumption

	History	Projections			Change		
	2003 /1980 (A)	2010 /2002 (B)	2020 /2010 (C)	2030 /2020 (D)	(B) - (A)	(C) - (B)	(D) - (C)
Americas	0.423	0.386	0.504	0.503	-0.037	0.119	-0.001
Western Europe	0.406	0.286	0.342	0.330	-0.120	0.056	-0.012
Former Soviet Union & Eastern Europe	-79.232	0.248	0.289	0.239	79.480	0.041	-0.050
Asia	1.084	0.929	0.740	0.678	-0.154	-0.189	-0.061
Oceania	0.671	0.582	0.604	0.601	-0.089	0.023	-0.003
Others	2.012	1.027	1.071	1.110	-0.985	0.044	0.039
Total	0.851	0.668	0.669	0.659	-0.183	0.001	-0.010

Sources: *Handbook of Energy & Economic Statistics in Japan 2006* for results, IEEJ estimates for forecast

In terms of the GDP elasticity distribution by region, the figures for the 1980~2003 period were 1.08 for Asia, 0.42 for the Americas, and 0.41 for OECD Europe, whereas Asia is forecast to go down to about 0.68 through 2020~2030. However, as in the case with the 1980's, the average GDP elasticity for the Americas and Europe up to 2030 would still be lower than that of Asia. Therefore, it is expected that the energy consumption in Asia will continue in parallel with its economic expansion and at a pace slightly below the GDP growth, thereby significantly affecting the world energy markets.

## 3.7.4 (Reference) GDP Outlook Data:

[Table 3.7.8] GDP Outlook by Region

	History		Projections			AAGR			
	1980	2003	2010	2020	2030	2003 /1980	2010 /2003	2020 /2010	2030 /2020
	Unit: Billion \$								
Americas	6,799	13,047	16,331	21,736	28,424	6,248	3,284	5,405	6,688
Western Europe	5,604	9,139	10,644	13,256	16,317	3,535	1,505	2,612	3,061
Former Soviet Union & Eastern Europe	469	458	709	1,174	1,563	-10	250	465	389
Asia	3,820	9,338	12,332	17,818	25,054	5,518	2,994	5,486	7,236
Oceania	236	489	600	793	1,027	253	110	193	235
Others	978	1,625	2,127	3,083	4,353	647	503	955	1,271
Total	17,907	34,097	42,743	57,860	76,738	16,190	8,647	15,116	18,879

Sources: Same as Table 3.7.7

[Table 3.7.9] Per Capita GDP Outlook by Region

Unit: Billion \$

	History		Projections			AAGR			
	1980	2003	2010	2020	2030	2003 /1980	2010 /2003	2020 /2010	2030 /2020
Americas	11.4	15.5	17.9	21.7	26.5	4.2	2.4	3.8	4.7
Western Europe	11.9	17.3	19.7	24.0	29.2	5.5	2.4	4.3	5.2
Former Soviet Union & Eastern Europe	2.4	2.3	3.7	6.4	8.9	-0.1	1.4	2.7	2.6
Asia	1.6	2.7	3.3	4.3	5.7	1.1	0.6	1.0	1.3
Oceania	13.3	20.5	23.4	28.3	34.1	7.2	2.9	4.9	5.8
Others	1.7	1.6	1.8	2.1	2.6	-0.2	0.2	0.4	0.4
Total	4.2	5.6	6.5	7.9	9.7	1.4	0.9	1.4	1.7

Sources: *Handbook of Energy & Economic Statistics in Japan 2006* for results, IEEJ estimates for forecast

## 4. Petroleum Product Supply/Demand Analysis for Asia (for 2010 and 2015)

## 4.1 Petroleum Product Demand Forecast for Asia

## 4.1.1 Reference Case:

The world oil demand is projected to increase by 7.77 million b/d or by an average annual rate of 1.4% over the 2003~2010 period, whereas the demand in Asia (including Japan) is forecast to rise by 4.43 million b/d (2.7% annually) and East Asia (excluding Japan) by 3.80 million b/d. As a result, Asia is forecast to account for about 57% of the amount of increase in the world demand, with East Asia claiming 49% out of the above figure. This trend would continue unchanged over the 2010~2015 period, with Asia accounting for 45% of the worldwide demand increase, or 35% in the case of East Asia, which would bring Asia into the center stage of the world oil demand.

The petroleum product demand in East Asia (excluding Japan), helped by a robust economic expansion, is forecast to grow by an average annual rate of 3.8% over the 2003~2010 period. Thereafter, also during the period from 2010 to 2015, driven by sustained petroleum consumption particularly with China in the back, the petroleum product demand in East Asia (excluding Japan) is forecast to increase at an annual rate of 3.4%.

As for the demand projection by country, petroleum consumption in China (excluding Hong Kong) is forecast to increase from 5.30 million b/d in 2003 to 7.72 million b/d in 2010, and 9.56 million b/d in 2030; while India's consumption would grow from 2.48 million b/d in 2003 to 3.14 million b/d in 2010 and 3.78 million b/d in 2030.

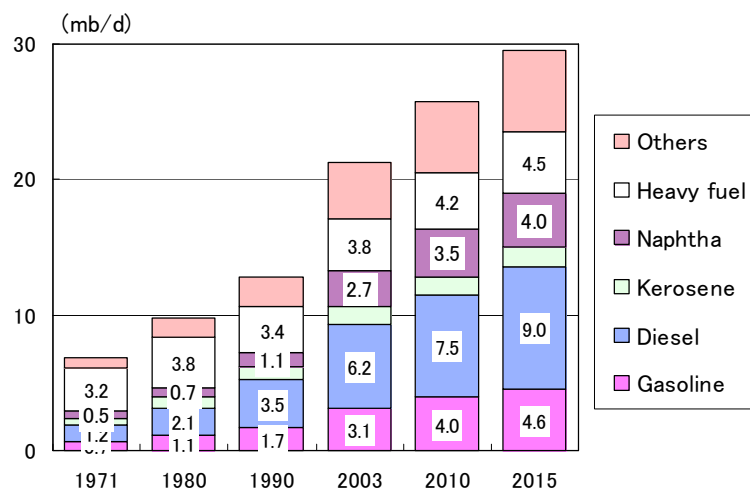
[Table 4.1.1] Trend of Petroleum Demand in Asia

Unit : Thousand of B/D	2003	2010	2015	Change Thousand of B/D			AAGR %	
				03~10	10~15	03~15	10/03	10/15
China	5,304	7,723	9,555	2,419	1,832	4,251	5.5	4.3
Hong Kong	279	310	339	31	29	60	1.5	1.8
Taiwan	949	1,020	1,060	71	40	111	1.0	0.8
Korea	2,313	2,399	2,560	86	161	247	0.5	1.3
Singapore	742	909	1,036	167	128	294	2.9	2.7
Brunei	12	14	16	1	2	3	1.5	2.7
Indonesia	1,320	1,708	1,973	388	264	653	3.8	2.9
malaysia	514	740	889	227	149	375	5.4	3.7
Philippines	328	378	474	50	95	146	2.1	4.6
Thailand	785	1,070	1,289	285	219	504	4.5	3.8
Vietnam	222	300	393	78	93	172	4.4	5.6
East Asia (excl.Japan)	12,766	16,570	19,583	3,803	3,013	6,817	3.8	3.4
Japan	5,389	5,136	5,097	-253	-39	-292	-0.7	-0.2
India	2,483	3,135	3,784	652	649	1,301	3.4	3.8
Other Asia	635	863	1,092	227	229	457	4.5	4.8
Asia Total	20,794	25,703	29,556	4,909	3,853	8,761	3.1	2.8
Total World	76,980	84,750	93,268	7,770	8,518	16,288	1.4	1.9
Asia (%)	27.0	30.3	31.7	63.2	45.2	53.8	← Share of World Total	
East Asia(excl.Japan)(%)	16.6	19.6	21.0	48.9	35.4	41.9		
Refining Capacity in Asia	20,794	25,126	29,059	4,332	3,933	8,265	2.7	3.0

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

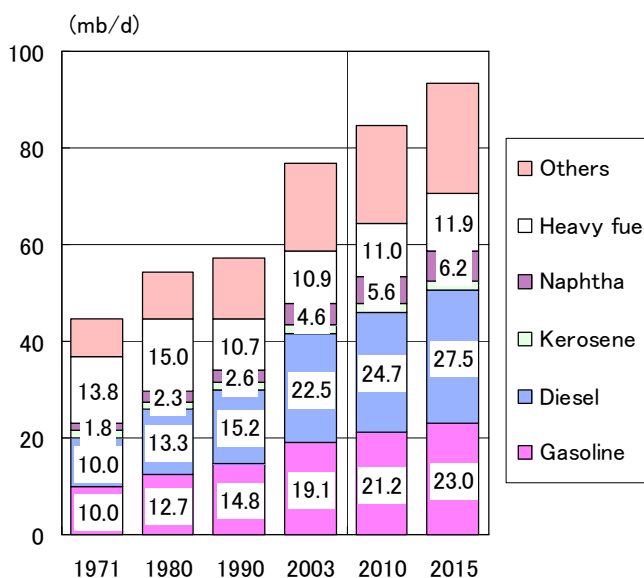
With regard to the Asian petroleum consumption by product, against the backdrop of an ever expanding motorization, consumption of gas (diesel) oil and gasoline is forecast to increase by average annual rates of 3.1% and 3.3%, respectively, for the period from 2003 to 2015, surpassing the average growth rate of 2.8% projected for the total petroleum consumption for the same period. As a consequence of this trend, gas oil's share in the Asian petroleum consumption would rise from 29% in 2003 to 31% in 2015, and gasoline's share from 15% in 2003 to 16% in 2015.

[Figure 4.1.1] Petroleum Consumption Outlook by Product (Asia)



Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

[Figure 4.1.2] Petroleum Consumption Outlook by Product (World)



Sources: Same as Figure 4.1.1



[Table 4.1.2] Petroleum Consumption Outlook by Product Share (Asia and World)

<u>Asia</u>				<u>World</u>			
	1971	2003	2015		1971	2003	2015
Gasoline	10%	15%	16%	Gasoline	23%	25%	25%
Gas Oil	17%	29%	31%	Gas Oil	23%	29%	30%
Kerosene	8%	6%	5%	Kerosene	3%	2%	2%
Naphtha	8%	13%	14%	Naphtha	4%	6%	7%
Fuel Oil	46%	18%	15%	Fuel Oil	31%	14%	13%
Other	12%	20%	20%	Other	17%	24%	24%
Total	100%	100%	100%	Total	100%	100%	100%

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecast

[Table 4.1.3] Petroleum Consumption Outlook by Product Growth Rate (Asia and World)

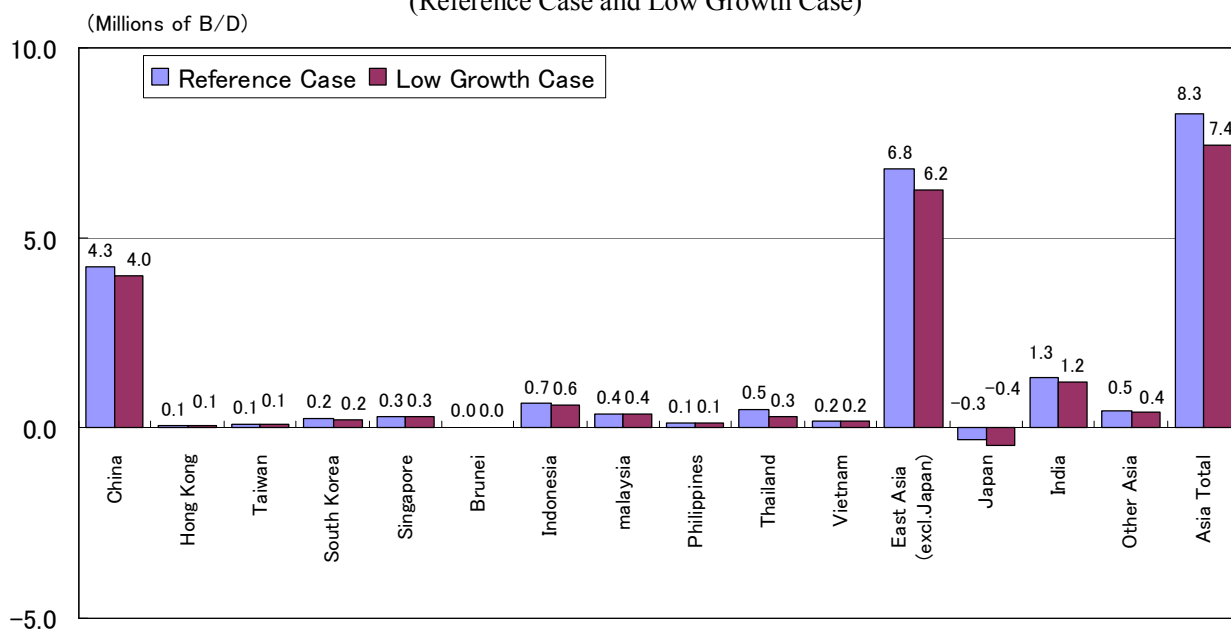
<u>Asia</u>			<u>World</u>		
	1971-2003	2003-2015		1971-2003	2003-2015
Gasoline	4.8%	3.3%	Gasoline	2.0%	1.6%
Gas Oil	5.4%	3.1%	Gas Oil	2.6%	1.7%
Kerosene	2.6%	1.0%	Kerosene	0.9%	1.1%
Naphtha	5.2%	3.4%	Naphtha	3.0%	2.6%
Fuel Oil	0.6%	1.0%	Fuel Oil	-0.7%	0.7%
Other	5.3%	3.1%	Other	2.8%	1.8%
Total	3.6%	2.8%	Total	1.7%	1.6%

Sources: Same as Figure 4.1.2

#### 4.1.2 Low Growth Case:

In this case, in which Asian economic growth after 2011 is set at a rate lower than the Reference Case by 1.0 percentage point (0.5 percentage point for Japan and Korea as the OECD member nations), the 2015 demand for petroleum products would be about 900,000 b/d less than in the Reference Case forecast for Asia total, and about 600,000 b/d less in the case of East Asia (excluding Japan). In terms of specific countries, China's demand would fall by 300,000 b/d and India by 100,000 b/d.

[Figure 4.1.3] Asian Petroleum Product Demand Growth during 2003~2015  
 (Reference Case and Low Growth Case)



Source: IEEJ estimates

## 4.2 Refining capacity analysis for Asia and the world

## 4.2.1 Refining capacity in Asia:

Table 4.2.1 presents an outlook for crude oil refining capacity development in Asia through 2015. The refining capacity data used in this study are not the results of computation using the Petroleum Refining/Trade Flow Model, but rather exogenous variables established referring to known construction/expansion projects and the outcome of field surveys on petroleum enterprises in respective countries.

[Table 4.2.1] Outlook for Crude Oil Refining Capacity in Asia

Unit: '000 b/d	CDU Capacity			Growth	
Country/Region	2003	2010	2015	'03~'10	'10~'15
China	5,619	8,446	10,158	2,827	1,712
Taiwan	1,220	1,220	1,820	0	600
Korea	2,750	2,735	2,735	-15	0
Singapore	1,337	1,337	1,337	0	0
Brunei	9	9	9	0	0
Indonesia	993	1,093	1,360	100	267
Malaysia	516	545	695	29	151
Philippines	333	333	333	0	0
Thailand	703	761	982	58	221
Vietnam	0	148	242	148	94
East Asia (excl. Japan)	13,479	16,626	19,671	3,146	3,045
Japan	4,703	4,672	4,672	-31	0
India	2,135	3,316	3,972	1,181	656
Other Asia	477	512	744	35	232
Asia Total	20,794	25,126	29,059	4,332	3,933

Sources: IEEJ compilation based on the following:

2003 results: *Oil & Gas Journal*/Dec 19,2005

2010 estimates:

Figures for Asian CDU capacity in 2010 have been prepared based on various references as well as information obtained by interviewing oil companies in the relevant countries. For secondary refining units, the forecast incorporated plans for nationwide implementation of the Euro 3 standards in China after 2007 and the same in India after 2010, and assumed expansion into the secondary refining unit configuration (particularly with respect to desulfurization-related units) that is comparable to Europe of today, along with a similar consideration for neighboring countries as well.

2015 estimates:

Figures through 2015 concerning China and India were set on the basis of currently known plans, while for other countries it was assumed that the overall refining capacity would expand in line with the demand increase. No increase, however, was assumed for the Philippines, Singapore, and Brunei.

By adding up current expansion plans for the respective countries, the crude oil refining capacity in East Asia can be projected to increase by 3.92 million b/d over the years 2003 through 2010. For the scale of capacity expansions after 2010 up to 2015, this study has estimated 3.93 million b/d. Although many of the construction plans leading up to 2015 are not definitive as yet, the above estimate was made by identifying plans with high prospects for actualization based on local information collected in the countries in question, and also by taking an assumption that capacity would be increased in line with the rate of demand growth in the respective regions. For the secondary refining unit, assumption was also made that capacity would be expanded to meet the fuel oil quality regulations in respective countries/regions.

#### 4.2.2 Refining capacity of the world:

Table 3.2.2, together with Figures 3.2.1 and 3.2.2 present an outlook for the crude oil refining capacity of the world, including Asia, through 2015. While Asia had 20.79 million b/d of the crude oil refining capacity in 2003, which exceeded that of North America, it is forecast to add an additional 8.27 million b/d through 2015, accounting for 49% of the total capacity expansion for the world projected at 16.84 million b/d.

[Table 4.2.2] Refining Capacity of the World

Unit: '000 b/d	CDU Capacity			Growth	
	2003	2010	2015	'03~'10	'10~'15
North America	18,686	19,354	20,714	668	1,360
USA	16,698	17,265	18,519	567	1,254
Canada	1,988	2,089	2,195	101	106
Latin America	8,403	9,413	10,268	1,010	856
Mexico	1,684	1,684	1,874	0	190
Brazil	1,914	2,161	2,568	247	407
Others	4,805	5,567	5,826	762	259
Europe OECD	14,920	15,350	15,785	430	435
UK	1,817	1,877	1,940	60	63
Germany	2,289	2,428	2,427	139	-1
France	1,951	1,979	2,018	28	39
Italy	2,313	2,324	2,299	11	-25
Others	6,548	6,741	7,101	193	360
Europe non-OECD	10,323	10,247	10,607	-76	360
Russia	5,435	5,341	5,636	-95	295
Others	4,887	4,906	4,971	19	65
Africa	3,224	3,551	3,848	328	297
Middle East	6,462	8,020	9,331	1,559	1,311
Asia	20,794	25,126	29,059	4,332	3,933
Japan	4,703	4,672	4,672	-31	0
China	5,619	8,446	10,158	2,827	1,712
Taiwan	1,220	1,220	1,820	0	600
Korea	2,750	2,735	2,735	-15	0
Singapore	1,337	1,337	1,337	0	0
Brunei	9	9	9	0	0
Indonesia	993	1,093	1,360	100	267
Malaysia	516	545	695	29	151
Philippines	333	333	333	0	0
Thailand	703	761	982	58	221

	Vietnam	0	148	242	148	94
	India	2,135	3,316	3,972	1,181	656
	Others	477	512	744	35	232
Oceania		859	805	900	-53	95
	Australia	755	702	782	-53	81
	New Zealand	104	104	118	0	14
Total World		83,670	91,867	100,514	8,197	8,647

Sources: IEEJ compilation based on the following:

2003 results: *Oil & Gas Journal*/Dec 19,2005

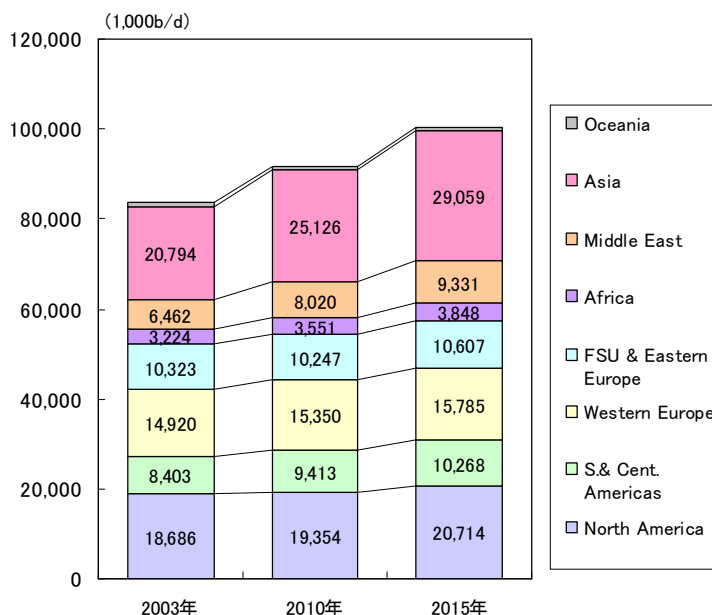
2010 estimates:

Figures for Asian CDU capacity in 2010 have been prepared based on various references as well as information obtained by interviewing oil companies in the relevant countries. For secondary refining units, the forecast incorporated plans for nationwide implementation of the Euro 3 standards in China after 2007 and the same in India after 2010, and assumed expansion into the secondary refining unit configuration (particularly with respect to desulfurization-related units) that is comparable to Europe of today, along with a similar consideration for neighboring countries as well.

2015 estimates:

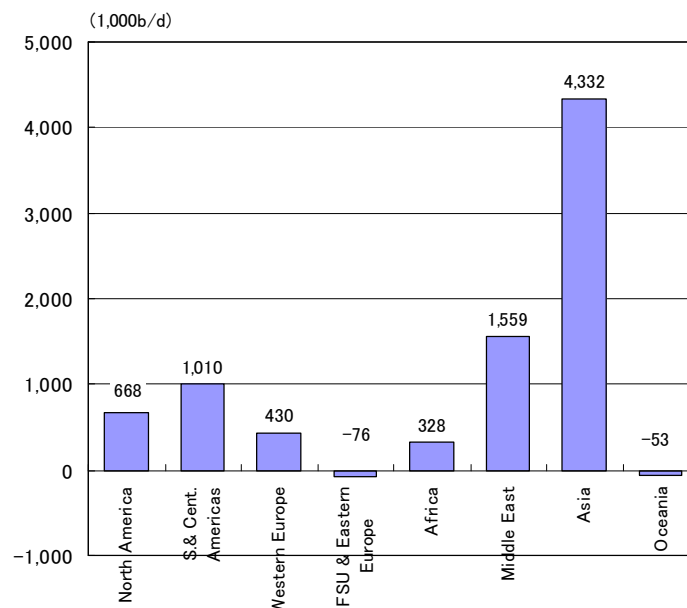
Figures through 2015 concerning China and India were set on the basis of currently known plans, while for other countries it was assumed that the overall refining capacity would expand in line with the demand increase. No increase, however, was assumed for the Philippines, Singapore, and Brunei.

[Figure 4.2.1] World Refining Capacity Outlook by Region



Sources: Same as Table 4.2.2

[Figure 4.2.2] World Refining Capacity Expansion 2003 thru 2010



Sources: Same as Table 4.2.2

#### 4.2.3 Refining capacity in China:

##### (a) CNPC/PetroChina Group:

Based on field surveys and other available references, refining capacity expansion in the CNPC/PetroChina Group through 2010 is estimated to be 30.50 million tons/year, or 610,000 b/d. Among the plans identified, Dalian Petrochemical Company and Liaoyang Petrochemical Fiber Company are expected to expand their crude refining capacity to process Russian crude oils, and Dushanzi Petrochemical Branch Company is also likely to expand its capacity with the Kazakhstan crude in mind.

[Table 4.2.3] CDU Expansion Plans in CNPC/PetroChina Group

CNPC: PetroChina Company	Added Capacity		Planned Completion
	'000 TPA	'000 b/d	
Dalian Petrochemical	10,000	200	2005
West-Pacific Petrochemical	2,000	40	2005
Jinxi Refining & Chemical Complex	4,500	90	2005
Dushanzi Petrochemical	10,000	200	2008
Liaoyang Petrochemical Fiber	3,000	60	2006
Jilin Chemical Industries	1,000	20	2010
<b>Total</b>	<b>30,500</b>	<b>610</b>	

Sources: Field survey, Tōzai Bōeki Tsūshinsha *Petroleum & Petrochemical Industries in China 2005*, etc.

(b) SINOPEC Group:

According to the results of various investigations, refining capacity expansion in the SINOPEC Group through 2010 is estimated to be 69.80 million tons/year, or 1,396,000 b/d.

[Table 4.2.4] CDU Expansion Plans in SINOPEC Group

SINOPEC: China Petrochemical Corp.	Added Capacity		Planned Completion
	'000 TPA	'000 b/d	
Maoming Refining & Chemical	5,000	100	2006
SINOPEC Tianjin	9,000	180	2010
SINOPEC Jinling	2,500	50	2005
Zhenhai Refining & Chemical	6,000	120	2005
Sinopec/ExxonMobil/Aramco JV	8,000	160	2008
Qingdao Refining & Chemical	10,000	200	2008
SINOPEC Luoyang	2,000	40	2006
SINOPEC Wuhan	4,000	80	2006
SINOPEC Changling	5,000	100	2006
SINOPEC Guangzhou	10,300	206	2008
SINOPEC Guangxi Oil Products	8,000	160	2008
Total	69,800	1,396	

Sources: Field survey, Tōzai Bōeki Tsūshinsha *Petroleum & Petrochemical Industries in China 2005*, etc.

(c) CNOOC:

Expansion plans by CNOOC up to 2010 includes construction of a new refinery with a capacity of 1.2 million tons/year, or 240,000 b/d.

[Table 4.2.5] CDU Expansion Plans by CNOOC

CNOOC: China National Offshore Oil Corp.	Added Capacity		Planned Completion
	'000 TPA	'000 b/d	
Huizhou: CNOOC/Shell JV	12,000	240	2007
Total	12,000	240	

Sources: Same as Table 4.2.4

(d) Refining capacity in China (Summary):

Based on the findings from interviews with Chinese oil companies as well as other information, and after putting together facility construction and/or expansion plans whose completion dates are generally known, it was estimated that crude refining capacity belonging to China's major oil companies will increase from about 5.6 million b/d at present to 7.85 million b/d by 2010. Concerning small to medium scale independent refiners, interviews were conducted again in this

year's study, and it was established that the aggregated CDU capacity owned by those enterprises having crude oil import quota/license would be 600,000 b/d, as was the case with last year's survey. For those enterprises grouped as "asphalt plants", who import straight-run fuel oil and process it into gas oil and asphalt as they do not have the crude oil import quota/license, their fuel oil processing capacity was determined at 400,000 b/d.

As a result of the aforementioned exercise, it was established that the total estimated CDU capacity in China in 2010 would be 8.45 million b/d after adding 600,000 b/d as the estimated CDU capacity owned by independent refiners.

[Table 4.2.6] CDU Expansion Plans in China (Summary)

	Existing Capacity		Added Capacity		Total	
	'000 TPA	'000 b/d	'000 TPA	'000 b/d	'000 TPA	'000 b/d
CNPC/PetroChina	116,800	2,336	30,500	610	152,300	3,046
SINOPEC	163,200	3,264	69,800	1,396	259,500	5,190
CNOOC	0	0	12,000	240	12,000	240
Total Major Oil Companies	280,000	5,600	112,300	2,246	392,300	7,846
Independent Refiners (CDU)	28,800	600	0	0	28,800	600
Total	308,800	6,200	112,300	2,246	421,100	8,446

Sources: Field survey, Tōzai Bōeki Tsūshinsha *Petroleum & Petrochemical Industries in China 2005*, etc.

#### 4.2.4 Refining capacity in India:

Available information indicates that CDU capacity expansion programs in India up to 2010 include a total of 305,000 b/d by national oil companies, and for private sector companies, 600,000 b/d planned by Reliance Industries as well as 156,000 b/d by Essar Oil. Consequently, the total CDU capacity in India is expected to increase from 2,255,000 b/d to 3,316,000 b/d by 2010.

[Table 4.2.7] CDU Expansion Plans in India up to 2010

Entity	Site	Added Capacity		Planned Completion
		'000 TPA	'000 b/d	
Public Sector Total		15,250	305	
BPCL	Bina	6,250	125	2007
HPCL	Bhatinda	9,000	180	2009
Private Sector Total		40,800	756	
Reliance	Jamnagar	33,000	600	2008
Essar		7,800	156	2006
Total Expansion		56,050	1,061	

Source: Various surveys



[Table 4.2.8] Estimated CDU Capacity in India as of 2010

2004 Capacity	Expansion	2010 Capacity
2,255,000 b/d	1,061,000 b/d	3,316,000 b/d

Source: Various surveys

4.3 Petroleum product supply/demand balances in Asia

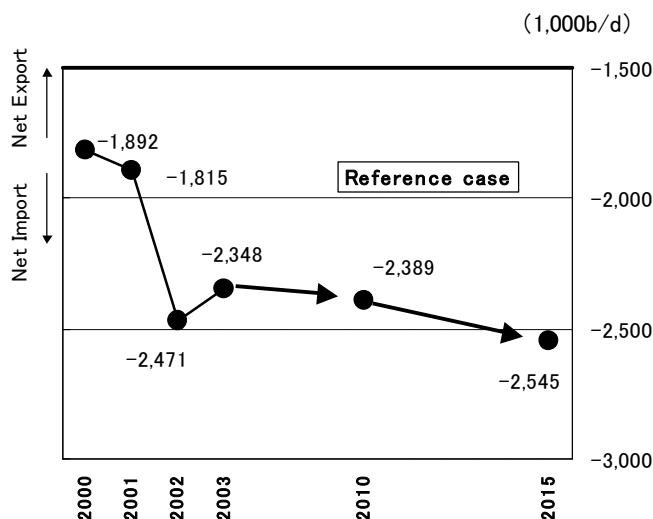
4.3.1 Reference Case:

(a) Petroleum product supply/demand balances in Asia (including Japan):

Figure 4.3.1 and Table 4.3.1 present petroleum product supply/demand balances for the entire Asia region including Japan. While Asia’s net petroleum product import volume rose from 1.89 million b/d in 2000 to 2.47 million b/d in 2002, it fell by 0.12 million b/d to 2.35 million b/d in 2003. As of 2003, the ratio of Asia’s net petroleum product import to the total demand was 11%.

With regard to the future of the petroleum product supply/demand balances for Asia, the net petroleum product import volume is expected to increase by 40,000 b/d from 2.35 million b/d in 2003 to 2.39 million b/d in 2010, and another 160,000 b/d after that to 2.55 million b/d in 2015.

[Figure 4.3.1] Petroleum Product Supply/Demand Balances in Asia (including Japan, Reference Case)



Sources: IEA Energy Statistics 2005 etc. for results, IEEJ estimates for forecasts

[Table 4.3.1] Petroleum Product Supply/Demand Balances in Asia (including Japan, Reference Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	21.3	25.7	29.6	4.4	3.9
Petroleum product production	18.9	23.3	27.0	4.4	3.7
Asia (incl. Japan) S/D Gap	-2.3	-2.4	-2.5	0.0	-0.2
(Restated) China S/D Gap	-0.4	-0.6	-1.0	-0.2	-0.4
Refining Capacity	20.8	25.1	29.1	4.3	3.9
Refinery Utilization Rate	91.0%	92.8%	93.0%	1.8	0.2

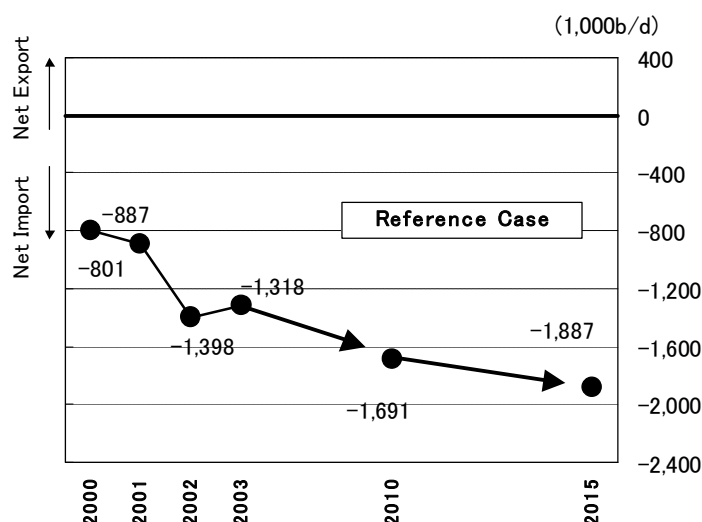
Sources: Same as Figure 4.3.1

Concerning the balance between the capacity expansion and the demand increase for Asia as a whole, since the demand increase from 2003 to 2010 is projected at 4.4 million b/d, exceeding the refining capacity expansions of 4.3 million b/d in the same period, the capacity utilization rate is forecast to go up from 91.0% in 2003 to 92.8% in 2010. For the 2010 to 2015 period, although the capacity expansion and the demand increase are projected to roughly balance out at about 3.9 million b/d each, the volume of net petroleum product import is forecast to increase by about 150,000 b/d during the same period mainly because a gap of about 500,000 b/d has been maintained in the computation results between the demand and the refining capacity.

(b) Petroleum product supply/demand balances in Asia (excluding Japan):

Petroleum product supply/demand balances for Asia excluding Japan are shown in Figure 4.3.2 and Table 4.3.2. It is forecast that Asia's net petroleum product import volume would rise from 1.32 million b/d in 2003 to 1.69 million b/d in 2010, and thereafter would increase by a further 0.19 million b/d to reach 1.89 million b/d in 2015.

[Figure 4.3.2] Petroleum Product Supply/Demand Balances in Asia (excluding Japan, Reference Case)



Sources: IEA *Energy Statistics 2005 etc.* for results, IEEJ estimates for forecasts

[Table 4.3.2] Petroleum Product Supply/Demand Balances in Asia (excluding Japan, Reference Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	15.9	20.6	24.5	4.7	3.9
Petroleum product production	14.6	18.9	22.6	4.3	3.7
Asia (excl. Japan) S/D Gap	-1.3	-1.7	-1.9	-0.4	-0.2
(Restated) China S/D Gap	-0.4	-0.6	-1.0	-0.2	-0.4
Refining Capacity	16.1	20.5	24.4	4.4	3.9
Refinery Utilization Rate	90.5%	92.3%	92.6%	1.8	0.3

Sources: Same as Figure 4.3.2

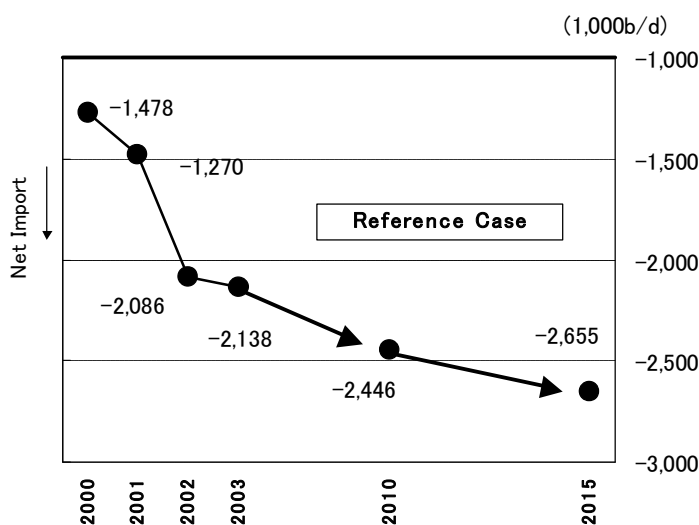
For the period from 2003 through 2010, since the demand increase is projected to exceed the refining capacity expansions, capacity utilization is forecast to go up by about 2% and at the same time, the net petroleum product import is forecast to increase by 370,000 b/d. However, for the 2010 to 2015 period, as the capacity expansion and the demand increase are projected to roughly balance out, the pace of net petroleum product import is forecast to slow down from the preceding period to 190,000 b/d.

Nevertheless, at the forecasting point of 2015, as a gap of about 100,000 b/d is still maintained between the demand and the refining capacity, the capacity utilization rate is projected to slightly go up by 0.3% to 92.6%. At this point, while refining facilities in respective countries are forecast to increase their output, the production would still fall short of the demand increase and the gap between supply and demand would widen further.

(c) Petroleum product supply/demand balances in East Asia (including Japan):

Figure 4.3.2 and Table 4.3.2 show the petroleum product supply/demand balances for East Asia including Japan. While the demand increase over the period from 2003 to 2010 is projected at 3.6 million b/d for East Asia, the refining capacity expansions would stand at only 2.6 million b/d in the same period. The imbalance between the demand increase and the refining capacity expansion would cause the capacity utilization rate to go up by about 2% and, at the same time, the net petroleum product import to increase from 2.14 million b/d in 2003 to 2.45 million b/d in 2010.

[Figure 4.3.3] Petroleum Product Supply/Demand Balances in East Asia (including Japan, Reference Case)



Sources: IEA *Energy Statistics 2005 etc.* for results, IEEJ estimates for forecasts

For the period from 2010 through 2015, since the refining capacity is projected to increase by 3 million b/d to match the demand increase of 3 million b/d for the period, the rise in the capacity utilization rate is forecast to remain minimal at 0.1%. However, as a gap of about 400,000 b/d is still maintained between the demand and the refining capacity, the net petroleum product import is forecast to increase from 2.45 million b/d in 2010 by an additional 200,000 b/d to 2.65 million b/d in 2015.

[Table 4.3.3] Petroleum Product Supply/Demand Balances in East Asia (including Japan, Reference Case)

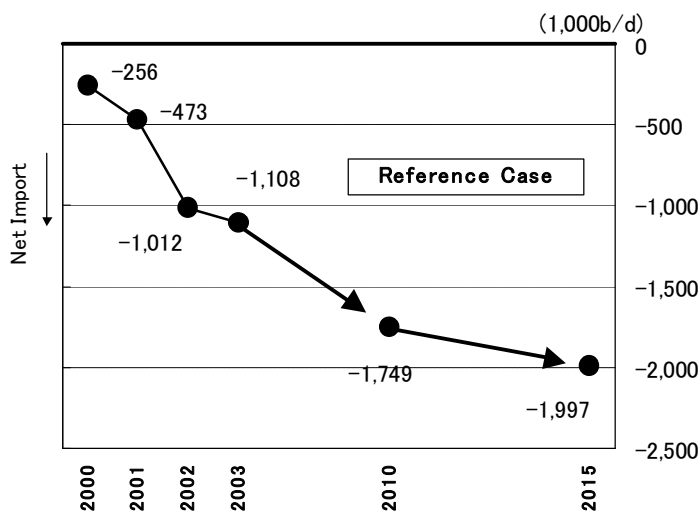
Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	18.2	21.7	24.7	3.6	3.0
Petroleum product production	16.0	19.3	22.0	3.2	2.8
East Asia (incl. Japan) S/D Gap	-2.1	-2.4	-2.7	-0.3	-0.2
(Restated) China S/D Gap	-0.4	-0.6	-1.0	-0.2	-0.4
Refining Capacity	18.2	21.3	24.3	3.1	3.0
Refinery Utilization Rate	88.1%	90.4%	90.5%	2.3	0.0

Sources: IEA *Energy Statistics 2005 etc.* for results, IEEJ estimates for forecasts

(d) Petroleum product supply/demand balances in East Asia (excluding Japan):

Petroleum product supply/demand balances for Asia excluding Japan are shown in Figure 4.3.4 and Table 4.3.4. Even though the capacity utilization rate is forecast to rise by 2.6% over the period from 2003 to 2010, as the demand increase in East Asia is projected to exceed the refining capacity expansions, the supply/demand gap is still estimated to widen from a net importing position of 1.11 million b/d to 1.75 million b/d.

[Figure 4.3.4] Petroleum Product Supply/Demand Balances in East Asia (excluding Japan, Reference Case)



Sources: Same as Table 4.3.3

For the period after 2010, due to the progress in the refining capacity expansions and new constructions, the total available capacity is projected to exceed the total petroleum product demand by about 100,000 b/d. This would act to restrain the capacity utilization rate at 89.4% or just 0.3% higher than that of 2010. While refining facilities in respective countries are estimated to increase their output, for the reasons related to supply/demand balances for individual products, production would still fall short of the demand increase

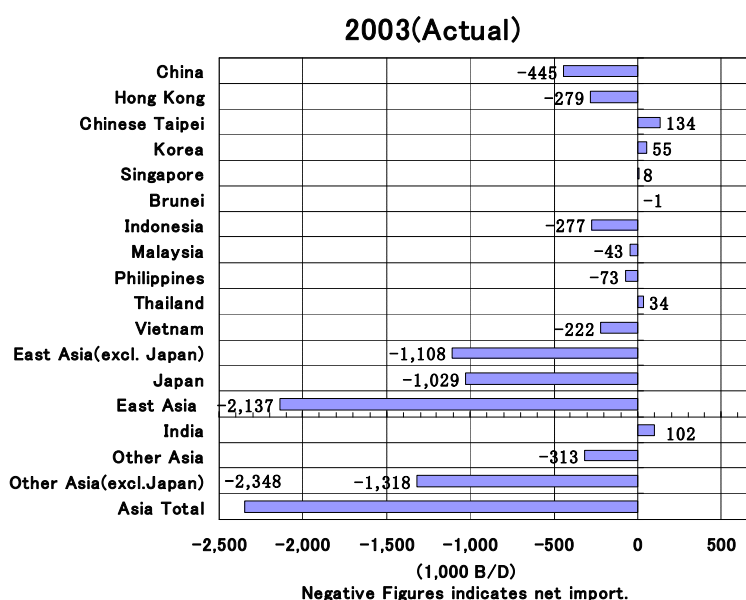
particularly for light fractions and the gap between supply and demand would widen further to a net import position of 2.0 million b/d.

[Table 4.3.4] Petroleum Product Supply/Demand Balances in East Asia (excluding Japan, Reference Case)

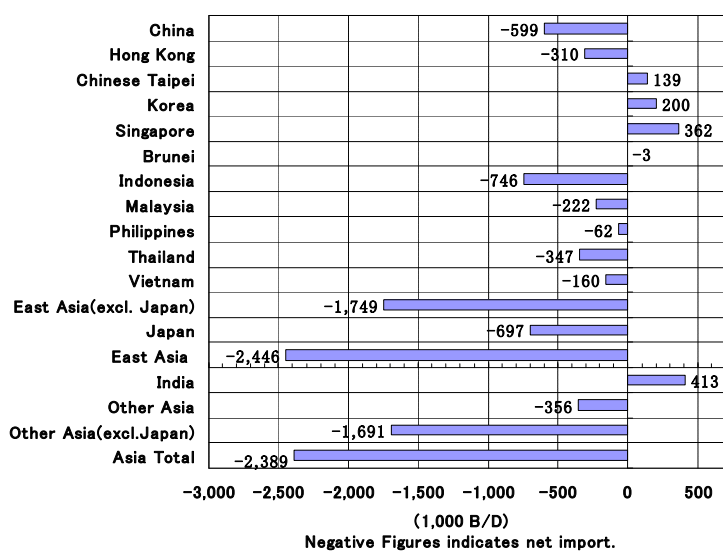
Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	12.8	16.6	19.6	3.8	3.0
Petroleum product production	11.7	14.8	17.6	3.2	2.8
East Asia (excl. Japan) S/D Gap	-1.1	-1.7	-2.0	-0.6	-0.2
(Restated) China S/D Gap	-0.4	-0.6	-1.0	-0.2	-0.4
Refining Capacity	13.5	16.6	19.7	3.1	3.0
Refinery Utilization Rate	86.5%	89.1%	89.4%	2.7	0.3

Sources: IEA *Energy Statistics 2005 etc.* for results, IEEJ estimates for forecasts

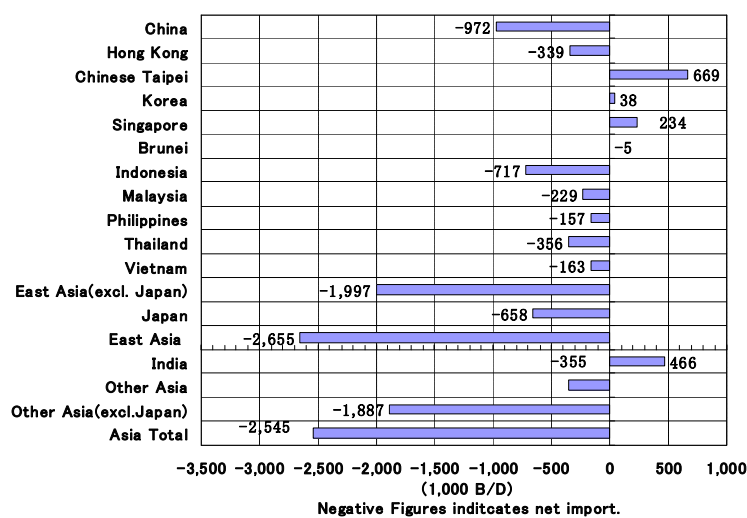
[Figure 4.3.5] Petroleum Product Supply/Demand Balances by Country in Asia



### 2010年(Reference)



### 2015(Reference Case)



Sources: Same as Table 4.3.4

(e) Petroleum product supply/demand balances by country in Asia:

The three charts given in Figure 4.3.5 illustrate the petroleum product supply/demand balances for each country in Asia. A country-by-country examination should reveal that, as of 2003, the countries that are in a net exporting position are Taiwan, India, Korea, and Singapore. In the simulation results for 2010 and 2015 also, the exact same four countries are shown as taking net exporting positions.

India is forecast to increase its export availability further as the country is expected to undertake a considerable scale of capacity expansions over the period up to 2010, and Taiwan is forecast to follow suit toward the 2010~2020 period to gain more export capacity. Conversely, export capacity of Singapore is projected to dwindle for the 2010~2015 period, during which no capacity expansions are assumed in this study. The remaining countries of Asia are all in net importing positions, wherein the net import volume of petroleum product by China including Hong Kong is projected to steadily increase from 460,000 b/d in 2003 to 600,000 b/d in 2010, and 970,000 b/d in 2015.

## 4.3.2 Low Growth Case:

In the Low Growth Case, Asian economic growth after 2011 is set at a rate lower than the Reference Case by 1.0 percentage point (0.5 percentage point for Japan and Korea). As a result of this change, demand for petroleum products in 2015 would become 860,000 b/d less than in the Reference Case forecast for all of Asia, and about 600,000 b/d and 700,000 b/d less in the forecasts for Asia (excluding Japan) and East Asia (excluding Japan), respectively.

[Table 4.3.5] Comparison of Asian Demand Reference Case vs. Low Growth Case

Unit: Millions of b/d	Actual	Reference		Low Growth	Changes vs. Ref.
	2003	2010	2015	2015	2015
Asia	21.3	25.7	29.6	28.7	-0.9
Asia (excluding Japan)	15.9	20.6	24.5	23.8	-0.7
East Asia	18.2	21.7	24.7	24.0	-0.7
East Asia(excluding Japan)	12.8	16.6	19.6	19.0	-0.6

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecasts

Tables 4.3.6 and 4.3.7 show the petroleum product supply/demand balances for Asia in the Low Growth Case, either including or excluding Japan. Not surprisingly, the net product import volume for Asia (including Japan) in 2015 is estimated to fall from the 2010 picture by 390,000 b/d to 2.0 million b/d, with the supply/demand gap heading for a shrinking trend.

[Table 4.3.6] Petroleum Product Supply/Demand Balances in Asia (including Japan, Low Growth Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	21.3	25.7	28.7	4.4	3.0
Petroleum product production	18.9	23.3	26.7	4.4	3.4
Asia (incl. Japan) S/D Gap	-2.3	-2.4	-2.0	0.0	0.4
(Restated) China S/D Gap	-0.4	-0.6	-0.7	-0.2	-0.1
Refining Capacity	21.3	25.1	29.1	3.8	3.9
Refinery Utilization Rate	81.6%	92.8%	91.9%	11.2	-0.9

Sources: Same as Table 4.3.5

In the next picture excluding Japan, the net product import volume for Asia (excluding Japan) in 2015 is estimated to fall from the 2010 picture by 200,000 b/d to 1.5 million b/d, along with the same shrinking trend for the supply/demand gap.

[Table 4.3.7] Petroleum Product Supply/Demand Balances in Asia (excluding Japan, Low Growth Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	15.9	20.6	23.8	4.7	3.2
Petroleum product production	14.6	18.9	22.3	4.3	3.4
Asia (excl. Japan) S/D Gap	-1.3	-1.7	-1.5	-0.4	0.2
(Restated) China S/D Gap	-0.4	-0.6	-0.7	-0.2	-0.1
Refining Capacity	16.5	20.5	24.4	3.9	3.9
Refinery Utilization Rate	88.2%	92.3%	91.3%	4.1	-1.0

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecasts

Tables 4.3.8 and 4.3.9 show the petroleum product supply/demand balances for East Asia in the Low Growth Case, either including or excluding Japan. The net product import volume for East Asia (including Japan) in 2015 is estimated to fall from the 2010 figure by 210,000 b/d to 2.23 million b/d. The picture excluding Japan also shows that the net product import volume in 2015 is estimated to fall from the 2010 figure by 20,000 b/d to 1.73 million b/d.

[Table 4.3.8] Petroleum Product Supply/Demand Balances in East Asia  
(including Japan, Low Growth Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	18.2	21.7	24.0	3.6	2.2
Petroleum product production	16.0	19.3	21.7	3.2	2.5
East Asia (incl. Japan) S/D Gap	-2.1	-2.4	-2.2	-0.3	0.2
(Restated) China S/D Gap	-0.4	-0.6	-0.7	-0.2	-0.1
Refining Capacity	18.7	21.3	24.3	2.6	3.0
Refinery Utilization Rate	85.7%	90.4%	89.2%	4.8	-1.2

Sources: Same as Table 4.3.7

[Table 4.3.9] Petroleum Product Supply/Demand Balances in East Asia  
(excluding Japan, Low Growth Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	12.8	16.6	19.0	3.8	2.4
Petroleum product production	11.7	14.8	17.3	3.2	2.5
East Asia (excl. Japan) S/D Gap	-1.1	-1.7	-1.7	-0.6	0.0
(Restated) China S/D Gap	-0.4	-0.6	-0.7	-0.2	-0.1
Refining Capacity	13.9	16.6	19.7	2.7	3.0
Refinery Utilization Rate	83.7%	89.1%	87.9%	5.5	-1.3

Sources: Same as Table 4.3.7

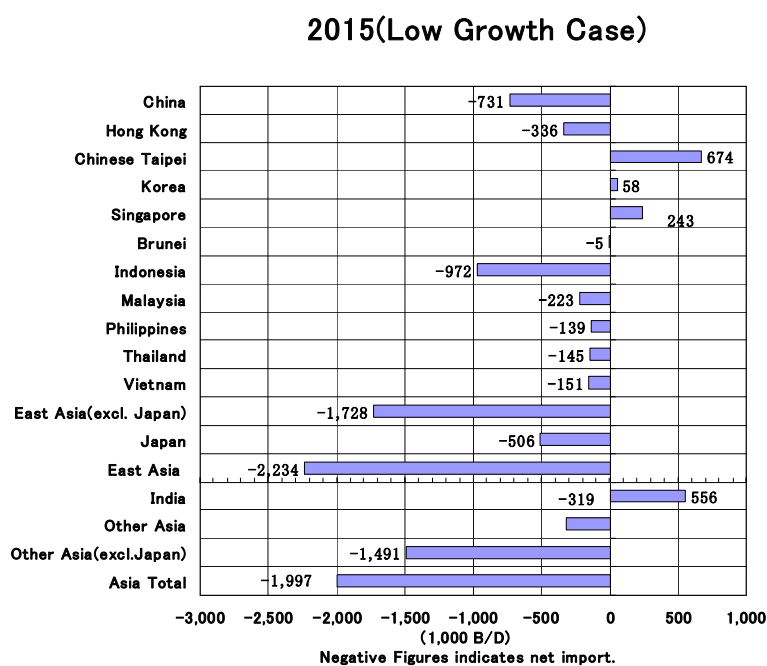
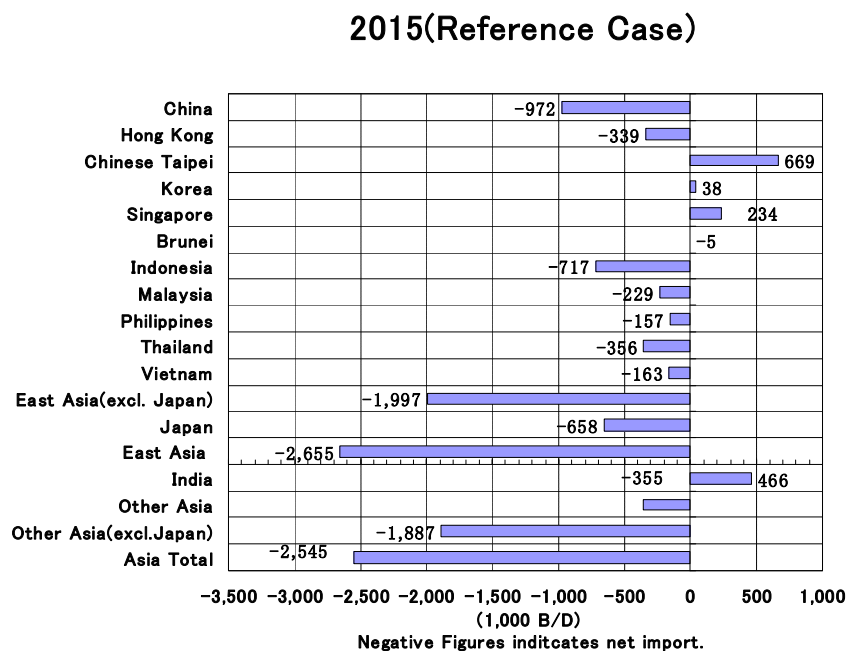
The four charts in Figure 4.3.6 illustrate trends in Asia's net projected petroleum product imports in the Low Growth Case. In this exercise, the supply/demand gap for Asia (including Japan) is forecast to



improve (i.e. contract) by 550,000 b/d compared with the Reference Case to a net import position of 2.0 million b/d, whereas the gap for Asia excluding Japan is forecast to improve by 400,000 b/d to a net import position of 1.49 million b/d.

Concerning the supply/demand gap for East Asia (including Japan), it is forecast to improve by 420,000 b/d compared with the Reference Case to a net import position of 2.23 million b/d, whereas the gap for East Asia (excluding Japan) is forecast to improve by 270,000 b/d to a net import position of 1.73 million b/d.

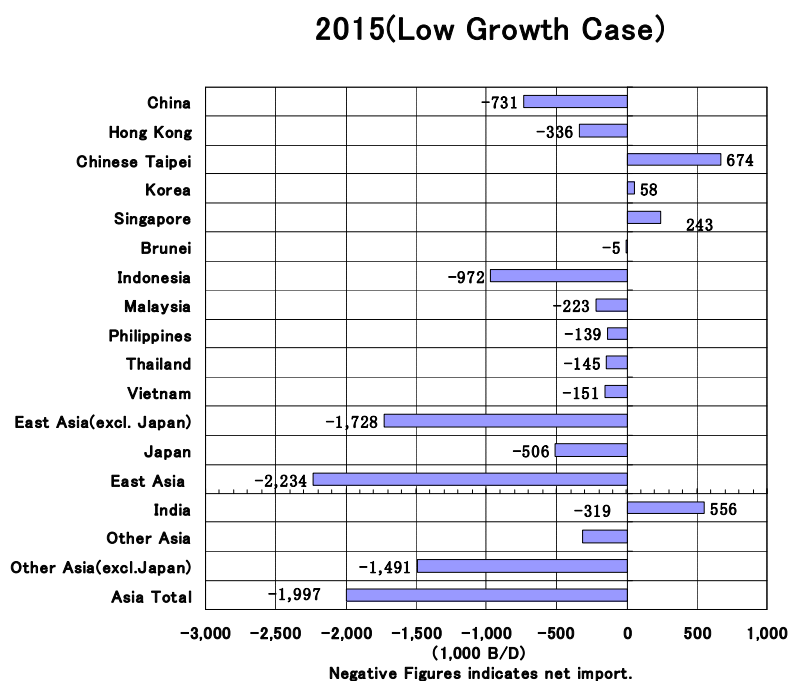
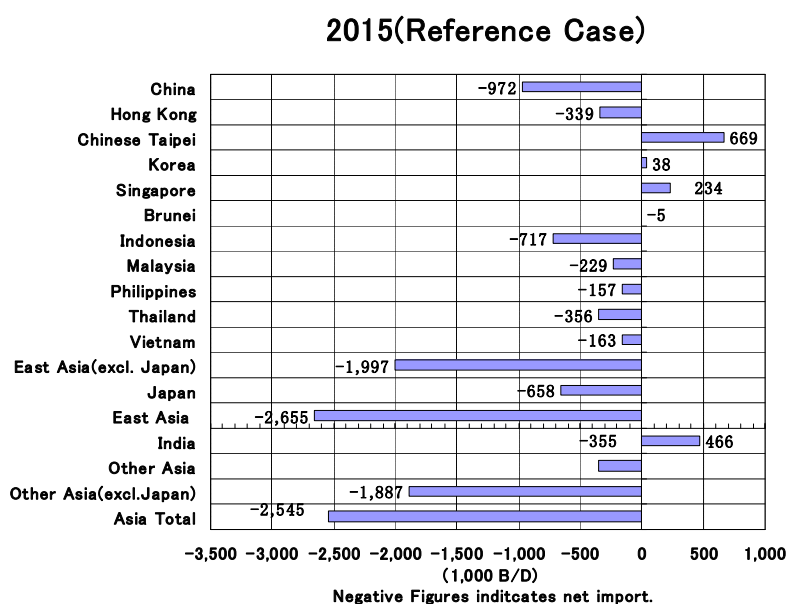
[Figure 4.3.6] Trend on Asia's net projected petroleum product imports (Low Growth Case)



Sources: IEA *Energy Statistics 2005, etc.* for results, IEEJ estimates for forecasts

Figure 4.3.7 illustrates petroleum product supply/demand balances by country in Asia. Because of the contraction in demand compared with the Reference Case, the country-by-country supply/demand balances show reduced net import volumes. The reason for the increase in net exporting capacity in Taiwan and India is that more of the export volumes have become available as a result of reduced domestic demands. These pictures show that the reduced petroleum product demand and the expanded export capacity contribute to a contraction in supply/demand gap for Asia. As in the case with the Reference Case, the countries that are in a net exporting position are Taiwan, India, Korea, and Singapore.

[Figure 4.3.7] Petroleum Product Supply/Demand Balances by Country in Asia (Low Growth Case)



Sources: IEA *Energy Statistics 2005, etc.* for results, IEEJ estimates for forecasts

#### 4.3.3 India Expansion Case:

In the India Expansion Case, India's refining capacity in 2015 has been expanded by 500,000 b/d over the 2015 Reference Case capacity. As a result, India's export capacity (i.e. production minus domestic demand) is forecast to increase to 410,000 b/d in 2010 and 1.0 million b/d in 2015, strengthening the country's export position.

[Table 4.3.10] Outlook on India's Product Export Capacity

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Reference Case	0.1	0.4	0.5	0.3	0.1
India Expansion Case	0.1	0.4	1.0	0.3	0.6

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecasts

While the forecasts in the Reference Case indicated that the supply/demand gap for Asia (including Japan) would expand to 2.55 million b/d in 2015, in the India Expansion Case, an increased product export flow from India to East Asian countries would work to improve the self-sufficiency in petroleum product supplies within Asia. As a result, the supply/demand gap is estimated to contract from the Reference Case by 240,000 b/d to 2.31 million b/d.

[Table 4.3.11] Petroleum Product Supply/Demand Balances in Asia  
(including Japan, India Expansion Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	21.3	25.7	29.6	4.4	3.9
Petroleum product production	18.9	23.3	27.2	4.4	3.9
Asia (incl. Japan) S/D Gap	-2.3	-2.4	-2.3	0.0	0.1
(Restated) India S/D Gap	0.1	0.4	1.0	0.3	0.6
Refining Capacity	20.8	25.1	29.6	4.3	4.4
Refinery Utilization Rate	81.6%	92.8%	92.2%	11.2	-0.6

Sources: Same as Table 4.3.10

In a similar exercise on the supply/demand gap for Asia but excluding Japan with the India Expansion Case, the same phenomenon of the increase in the product export flow from India to East Asian countries is forecast to occur and improve the self-sufficiency in petroleum product supplies within Asia.

As a result, while the forecasts in the Reference Case indicated that the supply/demand gap would expand to 1.89 million b/d in 2015, the gap is estimated to contract from the Reference Case by 230,000 b/d to 1.66 million b/d.

[Table 4.3.12] Petroleum Product Supply/Demand Balances in Asia  
(excluding Japan, India Expansion Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	15.9	20.6	24.5	4.7	3.9
Petroleum product production	14.6	18.9	22.8	4.3	3.9
Asia (excl. Japan) S/D Gap	-1.3	-1.7	-1.7	-0.4	0.0
(Restated) India S/D Gap	0.1	0.4	1.0	0.3	0.6
Refining Capacity	16.1	20.5	24.9	4.4	4.4
Refinery Utilization Rate	90.5%	92.3%	91.6%	1.8	-0.7

Sources: IEA *Energy Statistics 2005* for results, IEEJ estimates for forecasts

Looking at pictures for East Asia, while the forecasts in the Reference Case indicated that the supply/demand gap for East Asia including Japan would amount to 2.66 million b/d in 2015, in the India Expansion Case, the increased product export flow from India to East Asian countries would work to further widen the East Asian supply/demand gap from the Reference Case forecast by 300,000 b/d to 2.96 million b/d. This trend applies also to the picture for the supply/demand gap for East Asia excluding Japan, where the supply/demand gap would expand from the Reference Case forecast by 300,000 b/d to 2.30 million b/d.

[Table 4.3.13] Petroleum Product Supply/Demand Balances in East Asia  
(including Japan, India Expansion Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	18.2	21.7	24.7	3.6	3.0
Petroleum product production	16.0	19.3	21.7	3.2	2.5
East Asia (incl. Japan) S/D Gap	-2.1	-2.4	-3.0	-0.3	-0.5
(Restated) India S/D Gap	-0.4	-0.6	-1.0	-0.2	-0.4
Refining Capacity	18.2	21.3	24.3	3.1	3.0
Refinery Utilization Rate	88.1%	90.4%	89.2%	2.3	-1.2

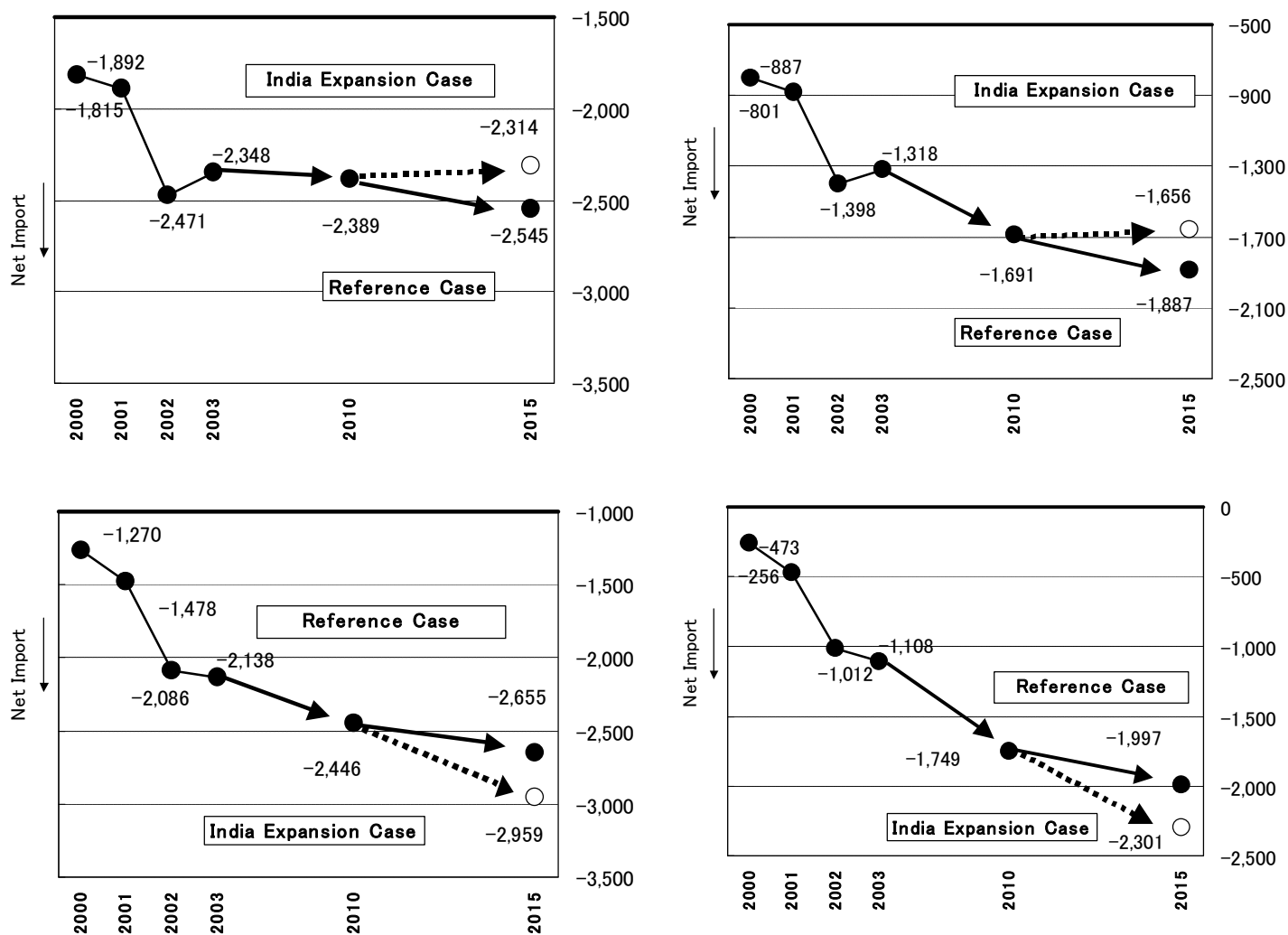
Sources: Same as Table 4.3.12

[Table 4.3.14] Petroleum Product Supply/Demand Balances in East Asia  
(excluding Japan, India Expansion Case)

Unit: Millions of b/d	2003	2010	2015	Changes	
				'03~'10	'10~'15
Petroleum product demand	12.8	16.6	19.6	3.8	3.0
Petroleum product production	11.7	14.8	17.3	3.2	2.5
East Asia (excl. Japan) S/D Gap	-1.1	-1.7	-2.3	-0.6	-0.6
(Restated) India S/D Gap	0.1	0.4	1.0	0.3	0.6
Refining Capacity	13.5	16.6	19.7	3.1	3.0
Refinery Utilization Rate	86.5%	89.1%	87.9%	2.7	-1.3

Sources: Same as Table 4.3.12

[Figure 4.3.8] Trend on Asia's net projected petroleum product imports (India Expansion Case)

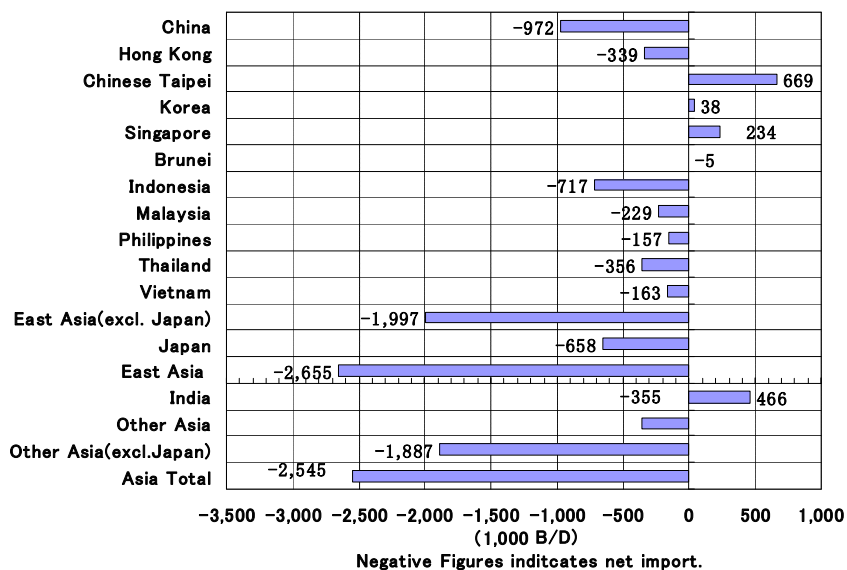


Sources: IEA *Energy Statistics 2005, etc.* for results, IEEJ estimates for forecasts

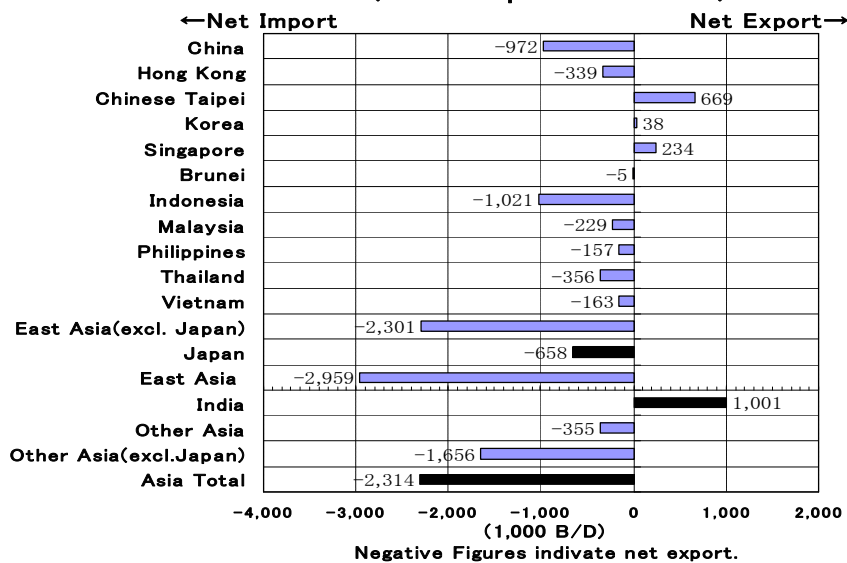
With regard to the petroleum product supply/demand balances by country in Asia, while the product export from India is forecast to expand in comparison with the Reference Case, the bulk of this increase would be directed to Indonesia (i.e. Indonesia to reduce domestic production and fill the shortage with the imports from India). As a result, the product imports by East Asian countries are forecast to increase while the improved self-sufficiency in petroleum product supplies would work to reduce the supply/demand gap for all of Asia.

[Figure 4.3.9] Petroleum Product Supply/Demand Balances by Country in Asia (India Expansion Case)

**2015(Reference Case)**



**2015(India Expansion Case)**



Sources: IEA *Energy Statistics 2005, etc.* for results, IEEJ estimates for forecasts

5. Crude Oil Supply and Demand Analysis (for 2020 and 2030)

5.1 Crude oil production capacity

This study assumes that realization of an optimum investment environment in the upstream sector will invite adequate investments for exploration in major oil-producing countries. In other words, this study has based the crude oil supply and demand forecast for each year up to 2030 on the assumption that there will be ample production capacity to meet the demand.

[Table 5.1.1] Crude Production Capacity up to 2030

Unit: Millions of b/d	2001 Production Capacity	2010 Production Capacity	2020 Production Capacity	2030 Production Capacity
<b>Total North America</b>	<b>15.4</b>	<b>17.7</b>	<b>17.4</b>	<b>17.0</b>
USA	9.0	9.9	7.8	6.5
Canada	2.8	3.5	4.9	5.4
Mexico	3.6	4.3	4.7	5.1
<b>Total Latin America</b>	<b>7.2</b>	<b>8.3</b>	<b>11.1</b>	<b>14.2</b>
Venezuela	3.2	3.5	4.7	6.7
Other Latin America	4.0	4.8	6.4	7.4
<b>Total North Sea/West Europe</b>	<b>7.1</b>	<b>5.8</b>	<b>5.1</b>	<b>4.1</b>
<b>Total Former Soviet Union</b>	<b>9.0</b>	<b>13.9</b>	<b>16.9</b>	<b>19.8</b>
Other Former USSR	9	13.5	16.1	18.5
Sakhalin	0	0.4	0.8	1.3
<b>Total Africa</b>	<b>8.5</b>	<b>10.6</b>	<b>14.1</b>	<b>18.1</b>
Algeria	1.6	2.0	2.4	3.3
Libya	1.7	2.0	2.5	3.4
Nigeria	2.2	2.6	3.4	4.5
Other Africa	3	4.0	5.8	6.9
<b>Total Middle East</b>	<b>24.4</b>	<b>30.9</b>	<b>38.9</b>	<b>50.3</b>
Saudi Arabia	10.2	14.0	15.4	17.6
Iran	3.7	4.2	5.7	7.7
Iraq	2.8	3.5	5.3	8.5
Kuwait	2.4	2.9	4.5	6.0
UAE	2.7	3.3	4.5	6.7
Other Middle East	2.6	2.9	3.4	3.9
Australia	0.7	1.0	0.9	0.9
<b>Total Asia</b>	<b>7.0</b>	<b>6.7</b>	<b>6.7</b>	<b>6.7</b>
China	3.3	3.7	2.3	2.0
Indonesia	1.5	1.5	1.3	1.1
Other Asia	2.2	2.7	2.1	2.1
<b>Total World</b>	<b>79.3</b>	<b>95.0</b>	<b>111.1</b>	<b>131.0</b>

Source: Prepared in reference to DOE/EIA *International Energy Outlook 2005*, BP *Statistical Review of World Energy*, etc.

In order to increase the degree of freedom in crude oil selection at the time of performing optimization for the linear programming (LP) model, specific figures have been set for the crude oil production capacity up to 2030 by referencing the expectations for the crude oil production capacity up to 2025 as provided in the *International Energy Outlook 2005* published by the US Department of Energy.

The expected yearly crude oil production capacity up to 2030 is 97 million b/d for 2010, 110 million b/d for 2020, and 130 million b/d for 2030.

### 5.2 Product yield and sulfur content of 70 crude oils

In the LP-based optimization in this study, the product yield and sulfur content were set for each of the 70 types of crude oil, as well as the sulfur content of each semi-finished product emanating from the refining units. The LP model aims to calculate crude oil outputs so that the item-specific supply and demand may balance for crude oils and petroleum products in the 30 regions, at the same time satisfying the sulfur regulations by oil type in each region, with a least possible cost for the total operation.

In short, the model obtains crude oil outputs that would be achieved at the lowest total costs for the entire systems in the 30 regions, including crude oil prices, freight costs for crude oils and products, and operating costs for atmospheric distillation (or CDU = Crude Distillation Unit) and secondary refining units such as vacuum distillation, catalytic reforming and others.

[Table 5.2.1] Examples of Crude Assay

Crude oil	Producer country	API	Sulfur content (%)	Yield weight (%)					Sulfur content (%)				
				LPG	Gasoline	Kerosene	Gas oil	Residue	CD			VD	
									Kerosene	Gas oil	Residue	Gas oil	Residue
Arabian XL	Saudi Arabia	33.6	1.2	1.1	20.4	21.4	17.8	39.3	0.06	0.60	2.53	1.88	4.04
Arabian Light	Saudi Arabia	33.0	1.7	1.2	17.9	19.0	17.4	44.5	0.09	0.87	3.10	2.59	4.30

Source: Prepared in reference to *The International Crude Oil handbook, 2006, etc.*

Note: See Appendix for API and sulfur content of all 70 crude oils

### 5.3 Oil demand assumptions for 2020 and 2030

The global oil demand is expected to increase from 77 million b/d in 2003 to 122.3 million b/d in 2030, up by 45 million b/d. Out of the above figures, the Asian region is expected to consume 44.2 million b/d in 2030, up by 22.9 million b/d from the 2003 consumption of 21.3 million b/d. The Asian market will account for 51% of the expected global consumption growth, thereby driving the world oil demand. With the continuing economic growth in the background, oil consumptions are also expected to increase by 7.6 million b/d in the Middle East, by 5.9 million b/d in North America, and by 4.7 million b/d in Latin America, respectively accounting for 17%, 13%, and 10% of the expected global growth of oil demand.

Concerning Asia, China is expected to consume 16.4 million b/d in 2030, up by 11.1 million b/d from 5.3 million b/d in 2003. As a result, China's share of the growth of oil demand in Asia will rise to reach 49%, leading the Asian demand growth. Meanwhile, India's demand will reach 6.5 million b/d in 2030, representing an increase of 4 million b/d against 2.5 million b/d in 2003 and accounting for 17% of the total Asian demand growth.

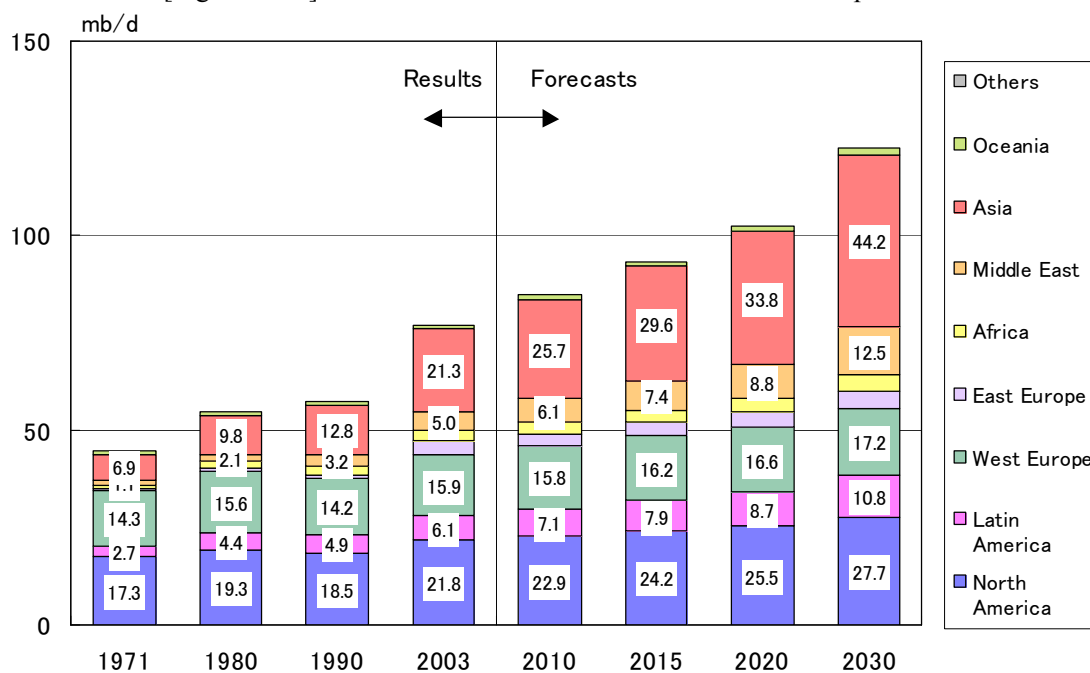


[Table 5.3.1] World's Oil Demand in 2020 and 2030

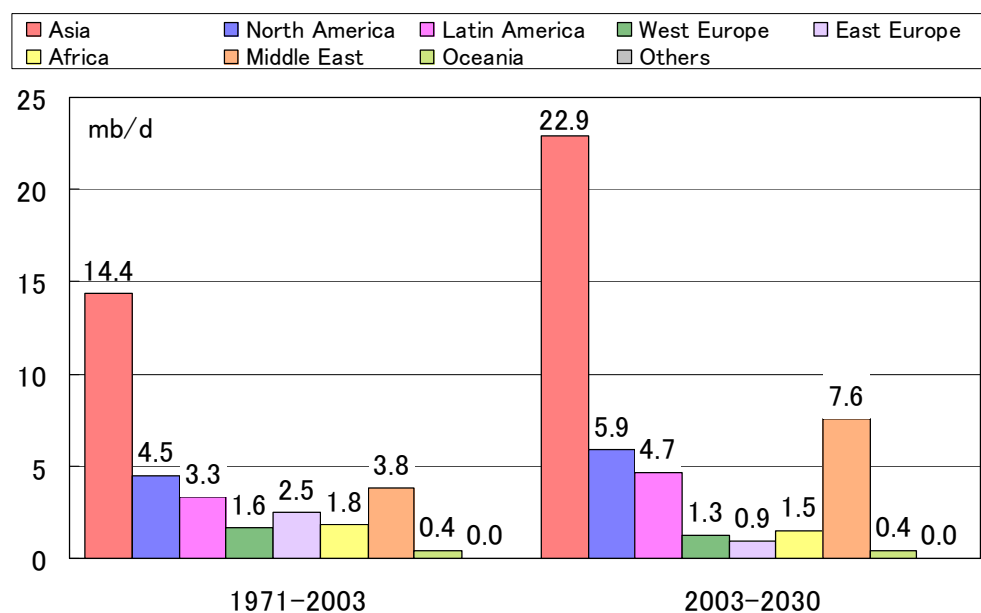
Unit: Millions of b/d	2003	2020	2030	Growth 2003 to 2030	% Share in World Growth
Asia	21.3	33.8	44.2	22.9	50.7
North America	21.8	25.5	27.7	5.9	13.0
Latin America	6.1	8.7	10.8	4.7	10.3
West Europe	15.9	16.6	17.2	1.3	2.8
East Europe	3.2	4.0	4.1	0.9	2.1
Africa	2.7	3.4	4.2	1.5	3.4
Middle East	5.0	8.8	12.5	7.6	16.7
Oceania	1.0	1.3	1.4	0.4	1.0
Other	0.0	0.0	0.0	0.0	0.0
Total World	77.0	102.1	122.3	45.3	100.0

Sources: BP *Statistical Review of World Energy* for results, IEEJ estimates for forecasts

[Figure 5.3.1] World's Petroleum Product Demand Outlook up to 2030



Sources: Same as Table 5.3.1



[Figure 5.3.2] Outlook for World's Petroleum Product Demand Growth

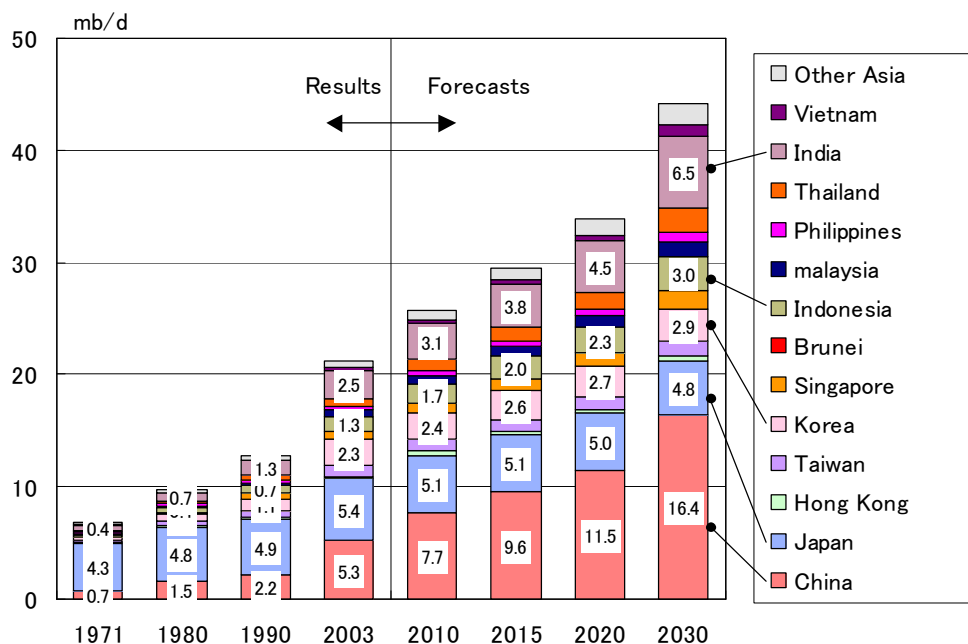
Sources: BP *Statistical Review of World Energy* for results, IEEJ estimates for forecasts

[Table 5.3.2] Asian Countries' Oil Demand in 2020 and 2030

Unit: Millions of b/d	2003	2020	2030	Growth 2003 to 2030	% Share in Asian Growth
China	5.3	11.5	16.4	11.1	48.6
Japan	5.4	5.0	4.8	-0.6	-2.6
Hong Kong	0.3	0.4	0.4	0.2	0.7
Taiwan	0.9	1.1	1.3	0.3	1.5
Korea	2.3	2.7	2.9	0.6	2.7
Singapore	0.7	1.2	1.6	0.8	3.5
Brunei	0.0	0.0	0.0	0.0	0.0
Indonesia	1.3	2.3	3.0	1.7	7.3
Malaysia	0.5	1.0	1.3	0.8	3.4
Philippines	0.3	0.6	0.9	0.6	2.4
Thailand	0.8	1.5	2.2	1.4	6.3
India	2.5	4.5	6.5	4.0	17.4
Vietnam	0.2	0.5	0.9	0.7	2.8
Other Asia	0.6	1.4	2.0	1.3	5.8
<b>Total Asia</b>	<b>21.3</b>	<b>33.8</b>	<b>44.2</b>	<b>22.9</b>	<b>100.0</b>

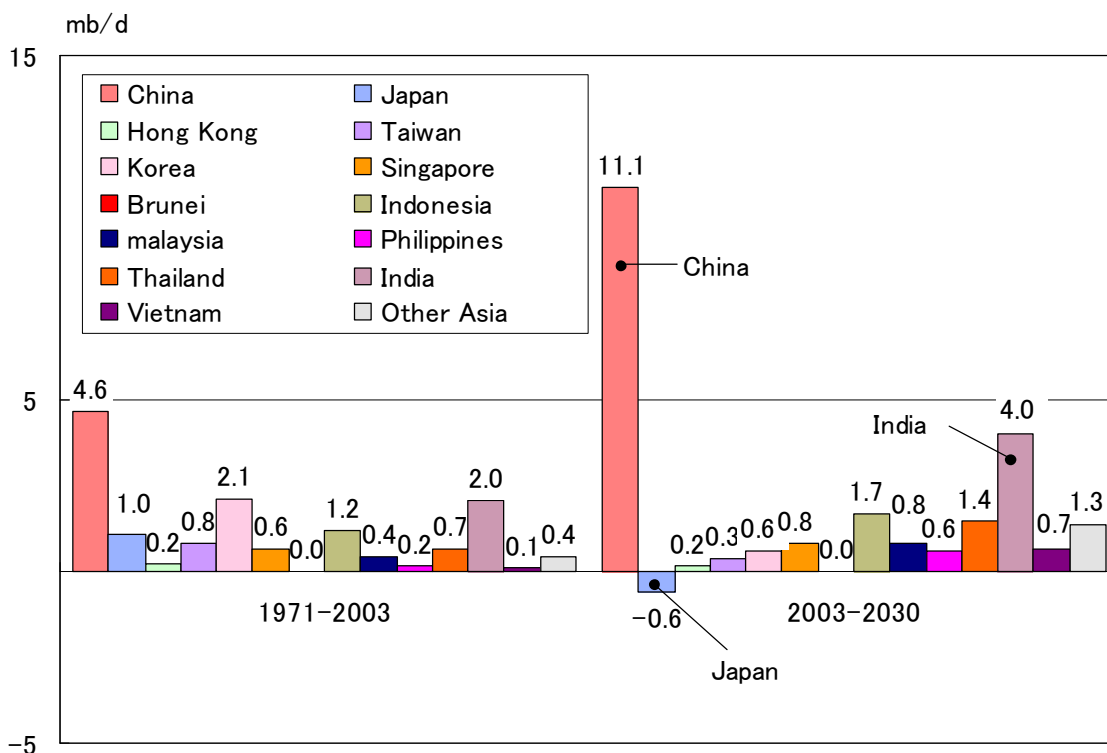
Sources: Same as Table 5.3.2

[Figure 5.3.3] Asia's Petroleum Product Demand Outlook up to 2030



Sources: BP *Statistical Review of World Energy* for results, IEEJ estimates for forecasts

[Figure 5.3.4] Outlook for Asia's Petroleum Product Demand Growth



Sources: Same as Table 5.3.3

## 5.4 Crude oil production outlook by region

The table shown below lists expected crude oil production in 2030, based on the demand forecasts cited above. The total crude oil production in the Middle East is expected to reach 50.3 million b/d, exceeding the total combined production of South America, Africa and the former Soviet Union, which is estimated at 49.8 million b/d. Meanwhile, production is projected to decrease for the USA, the North Sea oilfields and Asia where China and Indonesia are expected to produce less.

In order to increase freedom in crude oil selection, possible but relatively generous assumptions were given for the production capacity for each crude oil. As a result, the production figures for Africa, South America, North America and the former Soviet Union have left some spare production capacity. However, the former Soviet Union's spare supply capacity is expected to shrink comparatively because the needs for crude oils from the former Soviet Union are growing in geographically close East Asia and also because they are relatively light as well as low in sulfur compared to other oil types.

[Table 5.4.1] World's Crude Oil Production by Country/Region in 2030, in millions of b/d

in Million b/d	2001 Capacity	2001 Production	2030 Production	Increase '01 thru '30	Spare Capacity	2030 Capacity
<b>Total North America</b>	<b>15.4</b>	<b>14.0</b>	<b>16.3</b>	<b>2.3</b>	<b>0.7</b>	<b>17.0</b>
USA	9.0	7.7	6.5	-1.2	0.0	6.5
Canada	2.8	2.7	4.6	1.9	0.7	5.4
Mexico	3.6	3.6	5.1	1.5	0.0	5.1
<b>Total Latin America</b>	<b>7.2</b>	<b>6.9</b>	<b>13.5</b>	<b>6.6</b>	<b>0.7</b>	<b>14.2</b>
Venezuela	3.2	3.2	6.8	3.6	0.0	6.7
Other Lat. Amer.	4.0	3.7	6.8	3.1	0.7	7.4
<b>Total N.Sea/West Europe</b>	<b>7.1</b>	<b>6.9</b>	<b>4.1</b>	<b>-2.8</b>	<b>0.0</b>	<b>4.1</b>
<b>Total Former Soviet Union</b>	<b>9.0</b>	<b>9.0</b>	<b>18.9</b>	<b>9.9</b>	<b>0.9</b>	<b>19.8</b>
Other Fmr. USSR	9	9.0	17.6	8.6	0.9	18.5
Sakhalin	0	0.0	1.3	1.3	0.0	1.3
<b>Total Africa</b>	<b>8.5</b>	<b>7.9</b>	<b>17.4</b>	<b>9.5</b>	<b>0.6</b>	<b>18.1</b>
Algeria	1.6	1.6	2.6	1.0	0.6	3.3
Libya	1.7	1.4	3.4	2.0	0.0	3.4
Nigeria	2.2	2.2	4.5	2.3	0.0	4.5
Other Africa	3	2.7	6.9	4.2	0.0	6.9
<b>Total Middle East</b>	<b>24.4</b>	<b>22.2</b>	<b>50.3</b>	<b>28.1</b>	<b>0.0</b>	<b>50.3</b>
Saudi Arabia	10.2	9.0	17.6	8.6	0.0	17.6
Iran	3.7	3.7	7.7	4.0	0.0	7.7
Iraq	2.8	2.4	8.5	6.1	0.0	8.5
Kuwait	2.4	2.1	6.0	3.9	0.0	6.0
UAE	2.7	2.4	6.7	4.3	0.0	6.7
Other Mid. East	2.6	2.6	3.9	1.3	0.0	3.9
Australia	0.7	0.7	0.8	0.0	0.1	0.9
<b>Total Asia</b>	<b>7.0</b>	<b>6.9</b>	<b>4.9</b>	<b>-2.0</b>	<b>1.8</b>	<b>6.7</b>
China	3.3	3.3	2.0	-1.3	0.0	2.0
Indonesia	1.5	1.4	1.0	-0.4	0.1	1.1
Other Asia	2.2	2.2	1.9	-0.3	0.2	2.1
<b>Total World</b>	<b>79.3</b>	<b>74.5</b>	<b>126.2</b>	<b>51.7</b>	<b>4.9</b>	<b>131.0</b>

Sources: IEEJ estimates for 2003 results, others prepared in reference to DOE/EIA *International Energy Outlook 2005*, BP *Statistical Review of World Energy*, etc.

## 5.5 OPEC and non-OPEC crude oil production

OPEC crude oils:

Looking at expected changes in supply availability against the projected demand of about 122.3 million b/d in 2030, OPEC's production is likely to increase steadily, and in particular, Middle East-OPEC countries alone are expected to produce in excess of 49.2 million b/d (an increase of about 30.2 million b/d from 2003). Among them, production of Saudi crude oils is forecast to reach 17.6 million b/d (up by about 9.2 million b/d over 2003), accounting for 36% of the combined crude oil production by Middle East-OPEC countries.

[Table 5.5.1] OPEC and Non-OPEC Crude Oil Production by Country/Region

Millions of B/D		2003	2010	2020	2030	2030-2003 Increase	Share in the Increase %
		Results	Forecasts				
OPEC	Middle East	18.9	26.6	36.8	49.2	30.2	58.0
	Saudi Arabia	8.4	12.0	15.2	17.6	9.2	17.6
	Iraq	2.0	3.5	5.3	8.5	6.4	12.4
	Iran	3.4	3.6	4.7	5.4	2.0	3.9
	Kuweit	1.6	2.9	4.5	6.0	4.4	8.5
	Qatar	0.8	0.7	1.8	3.1	2.3	4.4
	UAE	2.2	2.9	4.0	6.7	4.5	8.6
	Neutral Zone	0.5	0.9	1.3	1.9	1.4	2.7
	Other OPEC	9.6	10.5	13.4	18.3	8.7	16.7
	Indonesia	1.3	1.5	1.2	1.0	-0.2	-0.5
	Nigeria	2.0	2.3	3.1	4.5	2.5	4.8
	Argeria	1.7	1.6	1.9	2.6	1.0	1.8
	Lybia	1.4	1.6	2.5	3.4	2.0	3.8
Venezuera	3.2	3.5	4.7	6.8	3.5	6.8	
<b>OPEC Total</b>		<b>28.5</b>	<b>37.1</b>	<b>50.2</b>	<b>67.5</b>	<b>38.9</b>	<b>74.7</b>
Non-OPEC	Mature market economies	21.2	21.6	21.5	21.1	-0.1	-0.1
	USA	7.6	8.4	6.8	6.5	-1.1	-2.1
	Canada	2.8	3.1	4.2	4.6	1.8	3.4
	Mexico	3.6	4.1	4.7	5.1	1.5	2.9
	North Sea	6.2	5.2	5.1	4.1	-2.1	-4.0
	Australia & other	1.0	0.8	0.7	0.8	-0.2	-0.4
	Others/ Eurasia	13.2	17.0	19.0	20.9	7.7	14.7
	Russia	9.9	13.8	16.6	18.9	9.0	17.3
	China	3.3	3.2	2.3	2.0	-1.3	-2.6
	Others/ Non-Eurasia	11.2	11.4	14.1	16.8	5.6	10.7
	C.& S. America	3.7	4.3	5.7	6.8	3.0	5.8
	Middle East	2.0	1.1	1.0	0.9	-1.1	-2.1
Africa	2.9	3.8	5.4	7.2	4.3	8.3	
Asia	2.6	2.2	1.9	1.9	-0.7	-1.3	
<b>Non-OPEC Total</b>		<b>45.6</b>	<b>49.9</b>	<b>54.5</b>	<b>58.7</b>	<b>13.2</b>	<b>25.3</b>
<b>World Total</b>		<b>74.1</b>	<b>87.0</b>	<b>104.7</b>	<b>126.2</b>	<b>52.1</b>	<b>100.0</b>
Share (%)	OPEC	<b>38.5</b>	<b>42.6</b>	<b>47.9</b>	<b>53.5</b>		
	Non-OPEC	<b>61.5</b>	<b>57.4</b>	<b>52.1</b>	<b>46.5</b>		

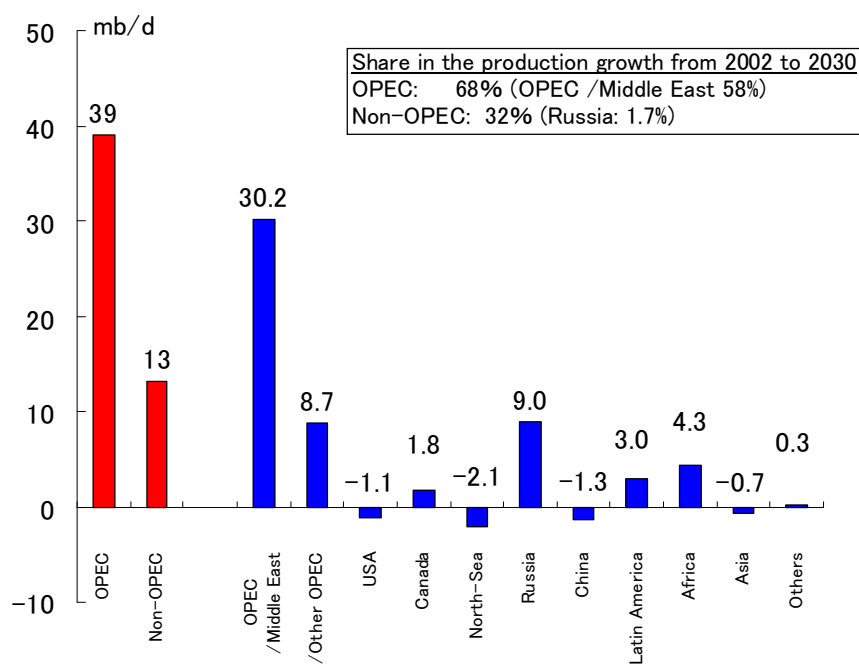
Sources: BP *Statistical Review of World Energy*, etc. for results, IEEJ for estimates

Out of the expected global production growth over the 2003~2030 period, the combined production by Middle East-OPEC countries will account for 58%, with the total OPEC production accounting for 75% of the global growth, indicating a greater degree of dependence upon OPEC crude oils for future oil productions. Note, however, that opening of mining areas in Middle East-OPEC countries as well as input of the technical capability and investments from oil majors seem to be critical for the above assumption to become a reality.

Non-OPEC crude oils:

Among non-OPEC crude oils, those produced in the former Soviet Union where production is expected to expand in East Siberia and the Caspian Sea region appear to become the greatest contributors with a projected production growth of about 9 million b/d over 2003. Although production increases are also forecast in North America (Canada and Mexico), Latin America, and Africa, because of an adverse effect from the projected reduction in North Sea crude production, the production increase for the total non-OPEC crude oils are estimated to stagnate at about 13.2 million b/d, or less than half of the expected production increases for Middle East-OPEC crude oils over 2003.

[Figure 5.5.1] Outlook for OPEC and Non-OPEC Crude Oil Production Increase by Country/Region



Source: IEEJ estimates

5.6 Results of crude oil productions and import-export balance forecast

Table 5.6.1 below shows the results of forecast on production and import-export balance in the 2030 Reference Case. For the East Asian region, a net import of 23.5 million b/d is required for 2030 due to rapid increase in demand in the region combined with reductions in production of Minas and other southern crude oils. East Asia's self-sufficiency rate for crude oils is forecast to be 12%, which is the lowest among

the comparable figures for major oil-consuming regions such as 53% for North America and 24% for Europe.

With regard to China, due to a sharp increase in crude oil imports, the crude oil self-sufficiency rate over total oil demand is projected at 12% in 2030, representing a significant drop from the historical rate of 73% for 2002. Likewise, China's crude oil import dependency rate is forecast to reach nearly 80% in 2030.

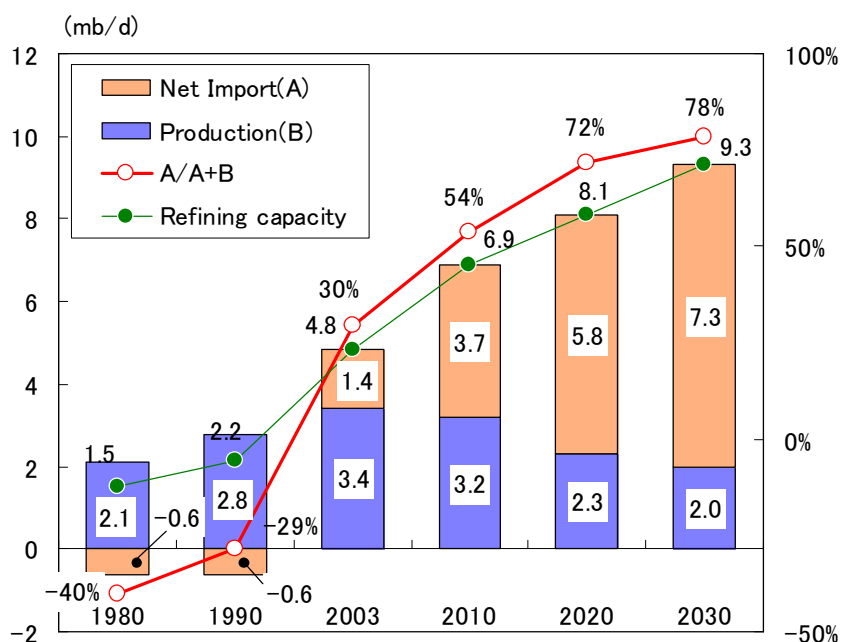
[Table 5.6.1] Crude Oil Production and Import-Export Balance in 2030

Unit: Millions of b/d	Crude Throughput	Crude Production	Net Imports	Imports	Exports	Crude Self Sufficiency
North America	27.1	16.3	10.8	16.3	5.5	53.3%
Latin America	11.8	13.5	-1.8	4.4	6.1	170.0%
West Europe	20.6	4.1	16.5	18.3	1.8	23.6%
Former Soviet Union	5.6	18.9	-13.3	0.0	13.3	459.2%
Africa	5.1	17.4	-12.4	0.0	12.4	412.5%
Middle East	17.4	50.3	-32.9	2.2	35.1	402.0%
Oceania	1.2	0.8	0.5	0.6	0.2	53.1%
China	9.3	2.0	7.3	7.3	0.0	12.2%
Japan	3.8	0.0	3.9	3.9	0.0	0.0%
Other East Asia	14.6	2.3	12.3	13.5	1.2	16.1%
India	7.9	0.6	7.3	7.3	0.0	9.3%
Other Asia	1.8	0.0	1.8	1.8	0.0	0.0%
<b>Total East Asia</b>	<b>27.8</b>	<b>4.3</b>	<b>23.5</b>	<b>24.7</b>	<b>1.2</b>	<b>12.1%</b>
Total World	126.1	126.2	0.0	75.5	75.5	100.0%

(Note: Crude oil self-sufficiency rate is calculated by dividing the crude oil production with the total oil demand in the locality in question.)

Source: IEEJ estimates

[Figure 5.6.1] China's Crude Oil Import-Export Balance Outlook



Sources: BP Statistical Review of World Energy, etc. for results, IEEJ for estimates

### 5.7 Crude oil trade flows in Asia

#### 5.7.1 Changes in crude oil trade flow in East Asia:

Out of the increase in crude oil import in East Asia of about 13.94 million b/d projected for the period between 2003 and 2030, Russian crude oils such as Sakhalin crude oil are forecast to amount to 1.78 million b/d, or 13% of the total increase. Nevertheless, the region's dependency on the Middle Eastern crude oils in the total imports will climb and reach 82%, representing an increase of about 4 percent point over 2003.

[Table 5.7.1] East Asia's Crude Oil Imports by Source

East Asia Crude Imports		2003	2020	2030	'03→'30 Changes
Unit: '000 b/d					
Total Imports		10,780	20,062	24,717	13,937
Sources	Middle East	8,440	16,385	20,305	11,865
	Africa	720	610	610	-110
	Russia	100	1,242	1,775	1,675
	Latin America	80	744	968	888
	Other	1,440	1,081	1,059	-381
Middle East Dependency		78.3%	81.7%	82.1%	3.9%
M-E Ratio for Northeast Asia		81.4%	82.8%	88.2%	6.7%

(Note: Northeast Asia: China, Korea, and Japan)

Sources: Same as 5.6.1



## 5.7.2 Changes in Japan's crude oil trade flow:

According to the estimation in this study, import of Sakhalin and other Russian crude oils will increase by about 110,000 b/d over the period from 2003 to 2030. However, Japan's Middle East dependency will also increase by 6 percent point from 89% in 2003 to 95% in 2030, since Middle East crude oils account for the largest part of Japan's crude oil imports.

[Table 5.7.2] Japan's Crude Oil Imports by Source

Japan Crude Imports Unit: '000 b/d		2003	2020	2030	'03→'30 Changes
Total Imports		4,219	4,049	3,859	-360
Sources	Middle East	3,734	3,766	3,683	-51
	Africa	46	23	11	-35
	Russia	6	163	112	106
	Latin America	6	0	0	-6
	Other	417	97	53	-364
Middle East Dependency		89%	93%	95%	6.7%
Throughput	(excl. fuel use)	4,204	3,996	3,806	-398
Refining Capacity		4,703	4,206	4,006	-761
Utilization Rate		88%	95%	95%	7%

Sources: BP *Statistical Review of World Energy*, etc. for results, IEEJ for estimates

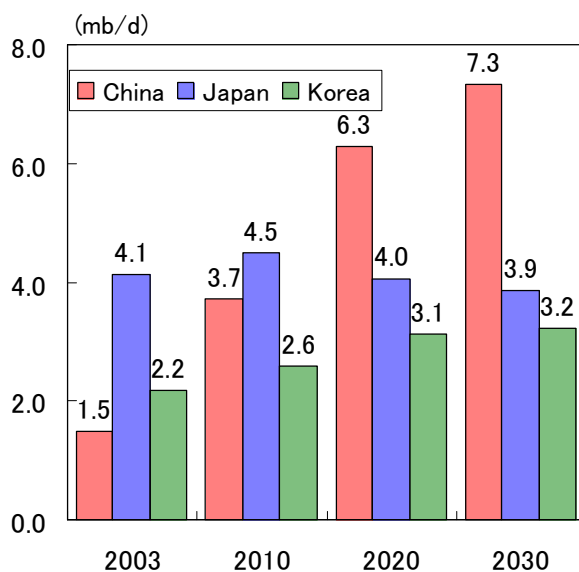
With regard to the future prospect, while the heavy crudes from Iran's Azadegan field could be newly added to the list of Japan's crude oil imports, it would make it necessary to expand the available capacity of secondary refining units. Therefore, one option may be to import more of the Russian crude oils that are presumably light and low in sulfur. In any event, since it is also likely for imports from Iraq to increase, the import ratio of Middle East crude oils could go up even higher.

[Table 5.7.3] China's Crude Oil Imports by Source

China Crude Imports Unit: '000 b/d		2003	2020	2030	'03→'30 Changes
Total Imports		1,209	6,293	7,337	6,128
Sources	Middle East	679	4,456	5,998	5,318
	Africa	272	587	599	327
	Russia	46	442	526	480
	Latin America	0	744	0	0
	Other	212	64	214	2
Middle East Dependency		56%	71%	82%	26%
Share of Africa/ex-USSR		26%	16%	15%	-11%

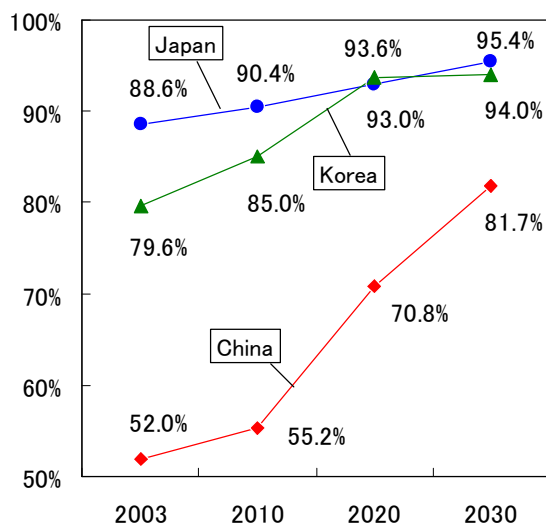
Sources: Same as Table 5.7.2

[Figure 5.7.1] Northeast Asia Outlook for Crude Oil Imports



Sources: BP *Statistical Review of World Energy*, etc. for results, IEEJ for estimates

[Figure 5.7.2] Northeast Asia Outlook for M.E. Crude Oil Dependency



Sources: Same as Figure 5.7.1

### 5.7.3 Changes in China's crude oil trade flow:

While the global oil demand is forecast to grow at an average annual rate of about 1.7 million b/d between 2003 and 2030, China's oil demand is also projected to increase rapidly at an average annual rate of about 400,000 b/d, accounting for about 24% of the world growth. As for imported crude oils, although imports from Russia and Africa will increase by about 480,000 b/d and 330,000 b/d, respectively, due to increases in Middle East crude oil imports by as much as about 5.32 million b/d that are needed to satisfy the enormous demand growth during the period, China's import dependency on the Middle Eastern crude oils will steadily increase from 56% in 2003, to levels reaching 71% in 2020 and 82% in 2030.

## 5.7.4 Changes in India's crude oil trade flow:

Next to China, India will also see significant demand increase by 2030. Imports of Middle East crude oils are projected to grow by about 5.73 million b/d, causing dependency on the Middle East to rise from 61% in 2003 to 91% in 2030. Even if there was a shift to India's crude oil slate of one million b/d of African crude oils that India is trying to develop in earnest, India's dependency on the Middle East will stay at a high level of 77% with importing from the Middle East forecast at about 5.63 million b/d in 2030.

[Table 5.7.4] India's Crude Oil Imports by Source

India Crude Imports Unit: '000 b/d		2003	2020	2030	'03→'30 Changes
Total Imports		1,480	4,790	7,278	5,798
Sources	Middle East	900	4,350	6,630	5,730
	Africa	520	440	383	-137
	Russia	0	0	0	0
	Latin America	0	0	265	265
	Other	60	0	0	-60
Middle East Dependency		61%	91%	91%	30%

Sources: BP *Statistical Review of World Energy*, etc. for results, IEEJ for estimates

## 5.7.5 Outlook for Middle East crude oil export:

The volume of Middle Eastern crude oil exports to East Asia is forecast to be 20.31 million b/d in 2030, up by 11.75 million b/d from 8.56 million b/d in 2003. As a result, the ratio of Middle East crude oil exports to East Asia against the total volume exported to all destinations will grow to 58% in 2030 from 53% in 2003. As the future population in the Middle East is also expected to grow at an annual rate of a 2~3% level, Asia with its rapidly increasing crude oil demand will become the most important market for the Middle Eastern producers in seeking to secure and increase oil revenues.

[Table 5.7.5] Middle East Crude Oil Exports by Destination

Middle East Crude Exports Unit: '000 b/d		2003	2020	2030	'03→'30 Changes
Total Exports		16,220	29,392	35,072	18,852
Destination	East Asia	8,560	16,385	20,305	11,745
	India	840	4,350	6,630	5,790
	North America	2,800	3,468	2,826	26
	West Europe	3,140	4,339	3,825	685
	Other	880	850	1,485	605
East Asia Share of Total		53%	56%	58%	5%

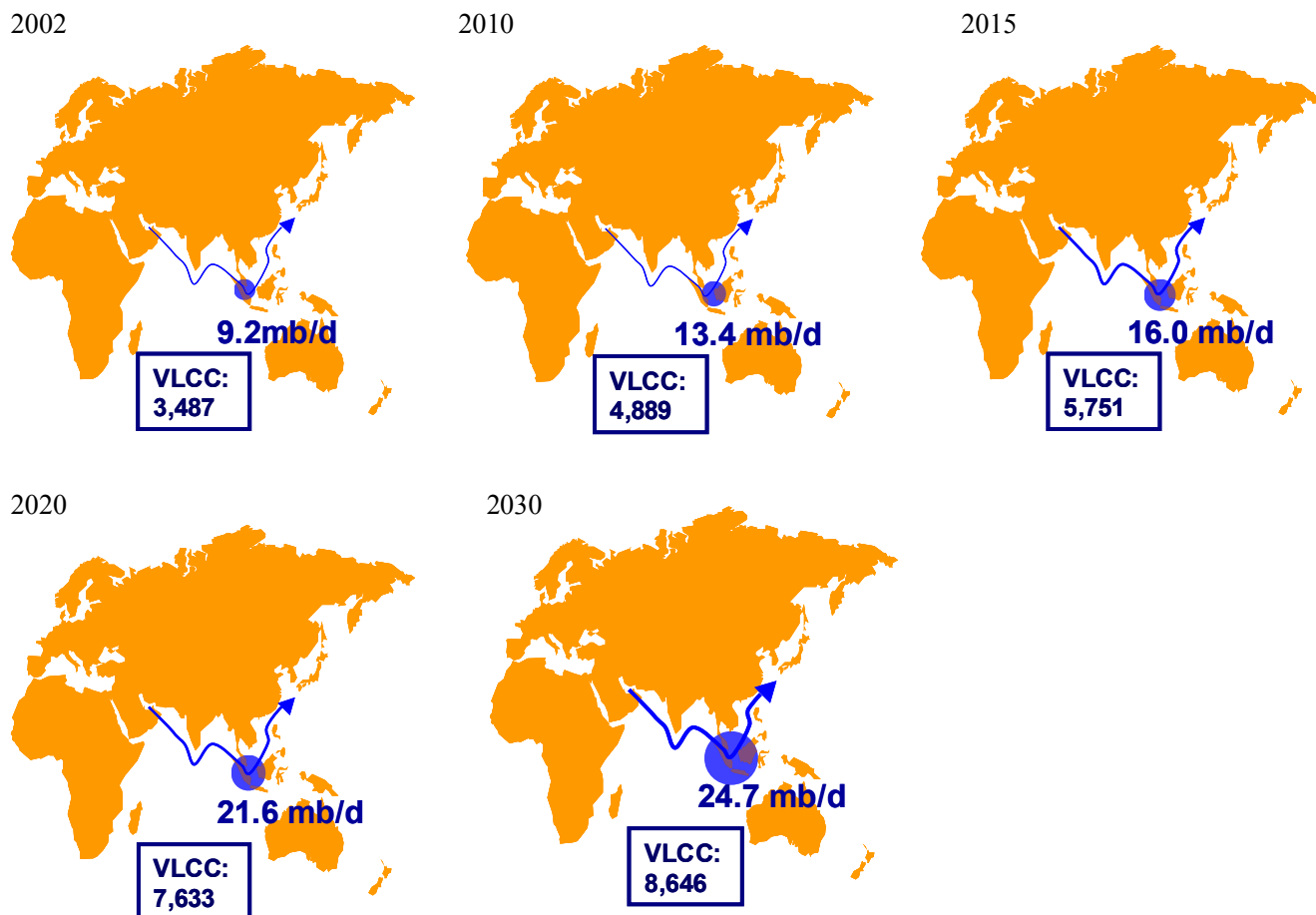
Sources: Same as Table 5.7.4

5.8 Outlook for the crude oil volume transiting the Strait of Malacca

Along with the steady growth of global energy demand, notably in Asia, the oil trade volume will be increasing substantially. Particularly in China, where it is undergoing full-scale urbanization and industrialization, oil imports are rapidly increasing due to a sharp growth of oil demand coupled with a sluggish domestic oil production. Since the bulk of the increased import is coming from Middle Eastern countries among others, the oil traffic passing through the Straits of Malacca-Singapore is also steadily increasing in volume.

Assuming the oil shipping volume transiting the Strait of Malacca to be the combined oil imports from the Middle East and Africa, the traffic through the Strait of Malacca would amount to 13.4 million b/d in 2010 and 24.7 million b/d in 2030, growing from 9.2 million b/d in 2002. As the above would also indicate that the number of VLCCs passing through the Straits would increase from 3,487 in 2002 to 4,889 in 2010, and 8,646 in 2030, congestion in the Strait of Malacca could become far more serious than the present state.

[Figure 5.8.1] Outlook for Crude Oil Traffic through Strait of Malacca



(Note: VLCCs are counted at 300,000 Deadweight-tons each)

Sources: Malaysian Government data for results, IEEJ estimates for forecasts

## 6. Summary and implication analysis

### 6.1 Trends on petroleum product supply and demand

#### 6.1.1 Trends for China:

- (i) The petroleum product demand in China is projected to grow by an annual rate of 5.6% from now until 2010, and further by 3.8% every year until 2015 to reach a total of 9.6 million b/d at that point, or 1.8 times the size of 2003 demand.
- (ii) To deal with the expanding demand above, major Chinese oil companies are planning expansion and/or new construction of refining facilities, including the 610,000 b/d expansion projected by CNPC/PetroChina, 1.4 million b/d planned by SINOPEC, and 240,000 by CNOOC.
- (iii) Nevertheless, the results of the simulations in this study have indicated that the Chinese petroleum product imports will continue to grow towards 2015, since the growth in the domestic demand is projected to far exceed the expansion in the refining facilities, with the product imports growing from 450,000 b/d in 2003 to 970,000 b/d in 2015.
- (iv) The upward trend in product imports is similarly forecast in the Low Growth Case (with the rate of economic growth from 2011 to 2015 set at 1.0 percentage point below the Reference Case), which indicated the product imports to increase up to 730,000 b/d in 2015.

#### 6.1.2 Trends for India:

- (i) The petroleum product demand in India is projected to grow by an annual rate of 4.6% from now until 2010, and further by 3.7% annually until 2015 to reach a total of 3.8 million b/d, or 1.5 times the size of the 2003 demand.
- (ii) Among the planned facility expansions, the Jamnagar Refinery owned by Reliance Industries is planned to expand the current capacity of 600,000 b/d to 1,200,000 b/d, to become the largest single refinery in the world after its completion in 2008.
- (iii) India already has sufficient refining capacity to cover its domestic demand and is currently exporting about 100,000 b/d of refined petroleum products. Since additional expansions as well as new constructions of refining facilities are expected to add a total combined capacity of 1,060,000 b/d by 2010, in excess of the projected increase in domestic demand of 650,000 b/d over 2003, the product export volume will further expand to reach 410,000 b/d.

#### 6.1.3 Trends for Japan:

While the Japanese petroleum product demand in 2015 is projected to contract by 5.4% over 2003, or by 290,000 b/d, as the refinery operation is likely to remain roughly at the same level as it is today, the volume of product import is estimated to fall by 370,000 b/d over 2003 to about 660,000 b/d in 2015. Likewise, in the Low Growth Case, the product imports are forecast to further drop to 510,000 b/d, down by 520,000 b/d or just half of the 2003 volume.

#### 6.1.4 Outlook for petroleum product supply/demand balance within Asia:

The study results have shown that the volume of petroleum product imports into the Asian region is likely to expand towards 2015. Namely, Asia's import position is estimated to grow from 2.35 million b/d in 2003 to 2.39 million b/d in 2010, and 2.55 million b/d in 2015. Naturally, however, the import

requirement will shrink in the Low Growth Case simulation to just 2.0 million b/d in 2015.

#### 6.1.5 Unconventional oils:

Among unconventional oils, oilsands and Orinoco tar have already been put into commercial use as crude oil substitutes. Other unconventional fuels for which expansion in future supplies is considered possible include GTL, DME, or biofuels such as ethanol. It may be possible that these latter types of fuels may gradually replace demand for petroleum as alternatives for use as fuel base materials, blending components, or substitutes for LPG (in the case of DME), transportation fuel (GTL to replace gas oil) or domestic fuel (GTL replacing kerosene) in the future. However, their supply availability would be estimated at the most about 3.0 million b/d even in 2015, accounting for just several percentage points of the world oil demand, which is not significant enough to affect the importance of conventional oil products.

### 6.2 Trends in crude oil supply and demand

#### 6.2.1 Trends for China:

The ratio of imported crude oils in the total crude oil demand in China is forecast to rise from about 23% in 2003 (1.2 million b/d) to 45% (7.3 million b/d) in 2030, due in part to the gradual decline in the domestic crude production.

#### 6.2.1 Trends for India:

The ratio of imported crude oils in the total crude oil demand in India is forecast to rise from about 60% in 2003 (1.5 million b/d) to about 92% (7.28 million b/d) in 2030, as the domestic crude production rate is estimated to remain roughly unchanged against the ever increasing demand.

#### 6.2.3 Trends for Japan:

- (i) The study results have indicated that, by 2020, the crude oil imports by China (estimated at 6.29 million b/d) and India (4.79 million b/d) are likely to exceed Japan's estimated imports of 4.2 million b/d. It is therefore conceivable that the position of Japan as a consuming country in the eyes of producing countries may fall relative to the above countries, with a potential adverse impact.
- (ii) In order for Japan to maintain and develop relationships with producing countries, it would be necessary to further promote mutual investments than ever before, which entails preparation of an adequate investment environment as well as alliance building. Moreover, diversifying the crude import sources as much as possible will become a future challenge.

#### 6.2.4 Outlook for the Middle East import dependency by East Asia:

The study results have indicated that Northeast Asia's dependency on the Middle Eastern crude oils in the total imports will increase from 81% in 2003 to 88% in 2030. Major importing countries in East Asia are likely to see a sharp rise in the Middle Eastern dependency, with Japan going from 89% in 2003 to 95% in 2030, and China from 56% to 82% in the same time span, just to give a few examples.

To put the import dependency on Middle Eastern oils under control, it would become crucial in the future for the East Asian countries to aggressively develop alternative supply sources and routes that are currently under study or in progress in countries such as Russia who are outside of the Middle East.

Specifically, projects such as the Kazakhstan – China pipelines, Sakhalin oil developments, East Siberian pipelines, East Siberian oil developments, and Canadian oilsands developments could be mentioned as possible candidates, all of which would require active involvement by Japan if it wishes to be part of the equation.

[Reference]

(i) Kazakhstan – China pipelines:

Current plans call for the system to be put into operation sometime after 2006 with an initial capacity of 200,000 b/d, to be ultimately expanded to 400,000 b/d.

(ii) Sakhalin oil developments:

According to the present plans, production for Sakhalin-I and -II is set at 300,000 b/d. While developments of Sakhalin-III and thereafter including new discoveries in this region would be a future issue, it would depend on the investment climate.

(iii) East Siberian pipelines:

Current plans are to complete the sections up to the Chinese border by the end of 2008. From now on, the focus will be on issues such as the timing of final decision on routing and which of the Pacific route and the Chinese route will be completed first for export. The timing for such decisions is speculated as being before the end of 2007 considering the political agenda in Russia, or as late as 2009 or later depending on how things develop.

(iv) East Siberian oil developments:

One of the factors that can influence the initiation of the development program is whether an adequate investment climate is laid out or not including the tax incentives. It is also linked to the decision timing on the East Siberian pipeline routing, where the development could be advanced if a routing decision is made as early as within 2007, but held up with a later decision making.

(v) Development status on Canadian oilsands:

While oils produced from Canadian oilsands once had a reputation of being expensive, their cost has dropped to a level comparable to conventional oils and the enormous size of oilsand reserves, which is surpassed only by Saudi Arabia, is drawing attention from the world. Out of the total 2004 Canadian oil production of 2.57 million b/d, oils originating from oilsands accounted for about 39%, with 470,000 b/d having been produced via open mining and 530,000 b/d via in-situ recovery methods.

The U.S. markets as the main export destinations are facing competition from oil producing countries in Latin America, Middle East, or Africa. Consequently, oilsand producers have begun to eye the Asia-Pacific markets where the growth is significant, and construction of pipelines from Edmonton, Alberta, to the Pacific Coast is being considered.

For Japan, securing a foothold in the oilsand resources would have important implications from the standpoint of energy security as well as the diversification of oil supply sources. Since Japan is the second largest trade partner for Canada after the USA, Canada is putting considerable hopes on exporting to Japan.

Last but not least, as the volume of Middle Eastern crude oils to be imported by China and other East

Asian countries expands in the future, a significant increase in output will be required of Saudi Arabia and other Middle East OPEC countries. Since the increase in crude oil production cannot be achieved in a short period of time, it will be important to deepen the mutual understanding through discussions between the producing countries and the consuming countries concerning matters such as the long term crude oil supply and demand.

#### 6.2.5 Security in Malacca Strait traffic:

Assuming the oil shipping volume transiting the Strait of Malacca to be the combined oil imports from the Middle East and Africa, the traffic through the Strait of Malacca would amount to 13.4 million b/d in 2010 and 24.7 million b/d in 2030, growing from 9.2 million b/d in 2002. With regard to the number of VLCCs passing through the Straits, it would increase from 3,487 in 2002 to 4,889 in 2010, and 8,646 in 2030, thereby exacerbating the congestion in the Strait of Malacca to a more serious state than at the present.

In addition, it appears certain that the traffic of LNG vessels from the Middle East to Asia will increase, as well the possibility of an increase in the number of product carriers heading for Asia. Furthermore, along with the development of the FTA arrangements and the globalization of trade in general, an increase could be anticipated in the traffic of general cargo ships, which are far more numerous than tankers. Judging from the congested state at the present, an emergency such as a shipwreck could have a much larger socio-economical impact than at present. To deal with such a risk, it would become crucial to develop contingency plans including the establishment of alternative shipping routes such as through the Strait of Lombok and, on a longer term basis, to diversify the crude supply sources.

(End)

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**Petroleum Products Balances in Asia**  
( Reference Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/03	Production	(share)	10/03	Net Export	Demand	(share)	15/03	Production	(share)	15/03	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>China</b>																					
Products Total	5,304	(100.0)	5.7	4,859	(100.0)	5.0	-445	7,723	(100.0)	5.5	7,123	(100.0)	5.6	-599	9,555	(100.0)	4.3	8,583	(100.0)	3.8	-972
Gasoline	876	(16.5)	6.3	1,030	(21.2)	6.7	154	1,311	(17.0)	5.9	1,311	(18.4)	3.5	0	1,710	(17.9)	5.5	1,326	(15.5)	0.2	-384
Naphtha	570	(10.8)	11.8	570	(11.7)	10.5	0	1,103	(14.3)	9.9	784	(11.0)	4.6	-319	1,335	(14.0)	3.9	944	(11.0)	3.8	-391
Kero/Jet	191	(3.6)	4.0	184	(3.8)	3.5	-7	305	(3.9)	6.9	309	(4.3)	7.7	4	450	(4.7)	8.1	343	(4.0)	2.1	-106
Gas oil	1,778	(33.5)	7.4	1,806	(37.2)	7.0	28	2,443	(31.6)	4.6	2,518	(35.4)	4.9	75	3,205	(33.5)	5.6	3,262	(38.0)	5.3	57
Heavy Fuel	862	(16.3)	1.7	418	(8.6)	-1.6	-445	1,156	(15.0)	4.3	784	(11.0)	9.4	-373	1,233	(12.9)	1.3	944	(11.0)	3.8	-289
Fuel Oil Total	4,277	(80.6)	5.4	4,007	(82.5)	4.8	-270	6,318	(81.8)	5.7	5,706	(80.1)	5.2	-612	7,932	(83.0)	4.7	6,820	(79.5)	3.6	-1,113
LPG	609	(11.5)	11.4	466	(9.6)	10.1	-142	532	(6.9)	-1.9	542	(7.6)	2.2	10	607	(6.4)	2.7	480	(5.6)	-2.4	-127
Other Products	418	(7.9)	4.1	385	(7.9)	3.6	-33	872	(11.3)	11.1	876	(12.3)	12.4	4	1,015	(10.6)	3.1	1,284	(15.0)	8.0	269
CDU capacity	5,619	thou.b/d			Oper. Rate:	86.5 %		8,446	thou.b/d			Oper. Rate:	82.0 %		10,158	thou.b/d			Oper. Rate:	85.0 %	
<b>Hong Kong</b>																					
Products Total	279	(100.0)	3.4	0	(0.0)	0.0	-279	310	(100.0)	1.5	0	(0.0)	0.0	-310	339	(100.0)	1.8	0	(0.0)	0.0	-339
Gasoline	8	(2.7)	2.8	0	(0.0)	0.0	-8	9	(3.0)	3.0	0	(0.0)	0.0	-9	10	(3.0)	2.1	0	(0.0)	0.0	-10
Naphtha	14	(5.0)	8.6	0	(0.0)	0.0	-14	14	(4.4)	0.0	0	(0.0)	0.0	-14	14	(4.1)	0.0	0	(0.0)	0.0	-14
Kero/Jet	70	(25.3)	5.9	0	(0.0)	0.0	-70	75	(24.1)	0.9	0	(0.0)	0.0	-75	77	(22.7)	0.5	0	(0.0)	0.0	-77
Gas oil	113	(40.6)	7.5	0	(0.0)	0.0	-113	123	(39.8)	1.2	0	(0.0)	0.0	-123	137	(40.3)	2.1	0	(0.0)	0.0	-137
Heavy Fuel	62	(22.1)	-1.0	0	(0.0)	0.0	-62	75	(24.3)	2.9	0	(0.0)	0.0	-75	87	(25.8)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	267	(95.7)	3.4	0	(0.0)	0.0	-267	297	(95.7)	1.5	0	(0.0)	0.0	-297	325	(95.9)	1.8	0	(0.0)	0.0	-325
LPG	9	(3.1)	5.6	0	(0.0)	0.0	-9	10	(3.1)	1.4	0	(0.0)	0.0	-10	10	(3.0)	1.1	0	(0.0)	0.0	-10
Other Products	3	(1.2)	2.4	0	(0.0)	0.0	-3	4	(1.2)	1.7	0	(0.0)	0.0	-4	4	(1.1)	1.3	0	(0.0)	0.0	-4
CDU capacity	0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %	
<b>Chinese Taipei</b>																					
Products Total	949	(100.0)	3.9	1,083	(100.0)	4.9	134	1,020	(100.0)	1.0	1,159	(100.0)	1.0	139	1,060	(100.0)	0.8	1,729	(100.0)	8.3	669
Gasoline	168	(17.7)	7.5	208	(19.2)	8.3	39	184	(18.1)	1.3	199	(17.2)	-0.6	15	188	(17.8)	0.4	314	(18.1)	9.5	125
Naphtha	221	(23.3)	9.0	175	(16.2)	8.6	-46	291	(28.5)	4.0	304	(26.2)	8.2	13	337	(31.8)	3.0	451	(26.1)	8.2	114
Kero/Jet	46	(4.9)	6.2	59	(5.5)	5.8	13	48	(4.7)	0.7	116	(10.0)	10.0	68	52	(4.9)	1.5	173	(10.0)	8.3	121
Gas oil	110	(11.5)	3.2	209	(19.2)	5.4	99	132	(12.9)	2.7	243	(21.0)	2.2	111	144	(13.6)	1.8	363	(21.0)	8.3	219
Heavy Fuel	263	(27.7)	0.6	288	(26.6)	1.9	25	214	(20.9)	-2.9	181	(15.6)	-6.4	-33	180	(17.0)	-3.3	269	(15.6)	8.2	89
Fuel Oil Total	808	(85.2)	3.6	939	(86.7)	4.8	131	869	(85.2)	1.0	1,043	(90.0)	1.5	174	902	(85.1)	0.7	1,570	(90.8)	8.5	668
LPG	68	(7.1)	3.8	59	(5.5)	3.6	-8	70	(6.8)	0.5	35	(3.0)	-7.2	-35	69	(6.5)	-0.3	52	(3.0)	8.3	-17
Other Products	73	(7.7)	9.4	85	(7.9)	10.7	12	81	(7.9)	1.4	81	(7.0)	-0.8	0	89	(8.4)	2.0	107	(6.2)	5.8	18
CDU capacity	1,220	thou.b/d			Oper. Rate:	88.8 %		1,220	thou.b/d			Oper. Rate:	95.0 %		1,820	thou.b/d			Oper. Rate:	95.0 %	
<b>Korea</b>																					
Products Total	2,313	(100.0)	6.6	2,367	(100.0)	6.9	55	2,399	(100.0)	0.5	2,598	(100.0)	1.3	200	2,560	(100.0)	1.3	2,598	(100.0)	0.0	38
Gasoline	158	(6.8)	10.0	191	(8.1)	10.9	33	184	(7.7)	2.1	208	(8.0)	1.2	24	192	(7.5)	0.9	208	(8.0)	0.0	16
Naphtha	666	(28.8)	11.5	392	(16.6)	9.1	-274	749	(31.2)	1.7	468	(18.0)	2.5	-281	822	(32.1)	1.9	468	(18.0)	0.0	-355
Kero/Jet	237	(10.3)	9.0	337	(14.2)	10.1	100	226	(9.4)	-0.7	294	(11.3)	-1.9	68	246	(9.6)	1.7	349	(13.4)	3.4	103
Gas oil	447	(19.3)	6.2	599	(25.3)	7.5	153	493	(20.5)	1.4	728	(28.0)	2.8	235	551	(21.5)	2.3	728	(28.0)	0.0	177
Heavy Fuel	501	(21.7)	2.4	602	(25.4)	3.6	101	442	(18.4)	-1.8	650	(25.0)	1.1	208	435	(17.0)	-0.3	650	(25.0)	0.0	214
Fuel Oil Total	2,009	(86.9)	6.2	2,122	(89.6)	6.6	112	2,093	(87.2)	0.6	2,347	(90.3)	1.5	254	2,246	(87.7)	1.4	2,401	(92.4)	0.5	156
LPG	227	(9.8)	11.8	133	(5.6)	9.6	-95	232	(9.7)	0.3	173	(6.7)	3.9	-59	238	(9.3)	0.4	119	(4.6)	-7.3	-119
Other Products	76	(3.3)	10.6	113	(4.8)	12.3	37	74	(3.1)	-0.5	78	(3.0)	-5.2	4	77	(3.0)	0.8	78	(3.0)	0.0	1
CDU capacity	2,750	thou.b/d			Oper. Rate:	86.1 %		2,735	thou.b/d			Oper. Rate:	95.0 %		2,735	thou.b/d			Oper. Rate:	95.0 %	

**Petroleum Products Balances in Asia**  
( Reference Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/03	Production	(share)	10/03	Net Export	Demand	(share)	15/03	Production	(share)	15/03	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>Singapore</b>																					
Products Total	742	(100.0)	5.9	750	(100.0)	0.7	8	909	(100.0)	2.9	1,270	(100.0)	7.8	362	1,036	(100.0)	2.7	1,270	(100.0)	0.0	234
Gasoline	15	(2.1)	3.1	75	(10.0)	0.3	59	17	(1.9)	1.5	152	(12.0)	10.7	136	18	(1.7)	1.2	152	(12.0)	0.0	135
Naphtha	86	(11.6)	19.7	74	(9.8)	2.1	-12	131	(14.4)	6.2	127	(10.0)	8.1	-4	161	(15.6)	4.3	127	(10.0)	0.0	-34
Kero/Jet	62	(8.4)	5.2	159	(21.2)	0.1	96	73	(8.1)	2.3	327	(25.8)	10.9	254	83	(8.0)	2.5	363	(28.6)	2.1	281
Gas oil	59	(8.0)	3.9	214	(28.6)	2.1	155	70	(7.7)	2.3	445	(35.0)	11.0	375	78	(7.5)	2.2	445	(35.0)	0.0	367
Heavy Fuel	495	(66.7)	5.8	120	(16.0)	-2.4	-375	584	(64.3)	2.4	54	(4.2)	-10.8	-531	658	(63.5)	2.4	18	(1.4)	-20.0	-641
Fuel Oil Total	717	(96.7)	6.0	641	(85.5)	0.2	-76	875	(96.3)	2.9	1,105	(87.0)	8.1	230	998	(96.3)	2.7	1,105	(87.0)	0.0	107
LPG	16	(2.2)	4.4	31	(4.2)	9.8	15	24	(2.7)	6.0	76	(6.0)	13.5	52	28	(2.7)	3.0	76	(6.0)	0.0	48
Other Products	9	(1.2)	1.3	77	(10.3)	5.3	69	10	(1.1)	1.8	89	(7.0)	2.0	79	10	(1.0)	0.4	89	(7.0)	0.0	79
CDU capacity	1,337	thou.b/d				Oper. Rate: 56.1 %		1,337	thou.b/d				Oper. Rate: 95.0 %		1,337	thou.b/d				Oper. Rate: 95.0 %	
<b>Brunei</b>																					
Products Total	12	(100.0)	4.9	11	(100.0)	21.9	-1	14	(100.0)	1.5	10	(100.0)	-1.6	-3	16	(100.0)	2.7	10	(100.0)	0.0	-5
Gasoline	5	(36.8)	5.2	4	(39.3)		0	5	(35.8)	1.1	0	(0.0)	-100.0	-5	5	(34.0)	1.7	0	(0.0)		-5
Naphtha	0	(1.0)	-1.1	0	(1.2)		0	0	(1.1)	2.2	3	(27.4)	54.2	3	0	(0.9)	0.0	3	(27.4)	0.0	3
Kero/Jet	2	(14.9)	5.6	2	(15.6)		0	3	(20.2)	6.0	2	(17.0)	-0.4	-1	4	(23.6)	5.9	2	(0.0)	0.0	-2
Gas oil	4	(28.8)	3.3	3	(30.3)		0	3	(23.6)	-1.4	3	(25.0)	-4.3	-1	4	(22.6)	1.9	3	(25.0)	0.0	-1
Heavy Fuel	0	(0.2)	0.2	0	(0.2)		0	0	(0.2)	0.0	0	(1.0)	26.2	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.7)	4.3	10	(86.5)		0	11	(80.9)	1.3	7	(70.4)	-4.5	-4	13	(81.3)	2.8	7	(70.4)	0.0	-5
LPG	2	(16.1)	13.0	2	(13.5)	11.7	0	2	(16.4)	1.7	1	(11.1)	-4.3	-1	3	(16.1)	2.3	1	(11.1)	0.0	-1
Other Products	0	(2.2)	2.3	0	(0.0)		0	0	(2.8)	4.8	2	(18.5)	0.0	2	0	(2.7)	2.1	2	(18.5)	0.0	1
CDU capacity	9	thou.b/d				Oper. Rate: 132.5 %		9	thou.b/d				Oper. Rate: 118.2 %		9	thou.b/d				Oper. Rate: 118.2 %	
<b>Indonesia</b>																					
Products Total	1,320	(100.0)	5.2	1,043	(100.0)	4.7	-277	1,708	(100.0)	3.8	962	(100.0)	-1.1	-746	1,973	(100.0)	2.9	1,256	(100.0)	5.5	-717
Gasoline	244	(18.5)	6.3	192	(18.4)	6.6	-52	327	(19.1)	4.3	281	(29.2)	5.6	-46	386	(19.6)	3.4	352	(28.1)	4.6	-34
Naphtha	50	(3.8)		48	(4.6)		-1	72	(4.2)	5.6	0	(0.0)	-100.0	-72	90	(4.5)	4.4	18	(1.4)		-72
Kero/Jet	261	(19.8)	2.6	195	(18.7)	4.5	-66	337	(19.7)	3.7	90	(9.4)	-10.4	-247	398	(20.2)	3.4	130	(10.3)	7.6	-268
Gas oil	537	(40.7)	6.1	297	(28.5)	7.8	-240	697	(40.8)	3.8	318	(33.0)	0.9	-379	795	(40.3)	2.7	386	(30.7)	4.0	-409
Heavy Fuel	175	(13.3)	4.4	235	(22.5)	1.3	60	214	(12.5)	2.9	231	(24.0)	-0.2	17	236	(12.0)	1.9	318	(25.3)	6.6	82
Fuel Oil Total	1,266	(95.9)	5.1	967	(92.7)	4.6	-300	1,647	(96.4)	3.8	920	(95.6)	-0.7	-727	1,905	(96.6)	3.0	1,204	(95.9)	5.5	-701
LPG	39	(3.0)	10.8	38	(3.6)	4.0	-1	47	(2.7)	2.7	23	(2.4)	-6.5	-23	53	(2.7)	2.6	27	(2.1)	2.6	-27
Other Products	15	(1.1)	4.7	39	(3.7)	9.2	24	15	(0.9)	0.0	19	(2.0)	-9.5	5	15	(0.7)	0.0	25	(2.0)	5.5	11
CDU capacity	993	thou.b/d				Oper. Rate: 105.1 %		1,093	thou.b/d				Oper. Rate: 88.1 %		1,360	thou.b/d				Oper. Rate: 92.3 %	
<b>Malaysia</b>																					
Products Total	514	(100.0)	5.1	470	(100.0)	6.3	-43	740	(100.0)	5.4	518	(100.0)	1.4	-222	889	(100.0)	3.7	660	(100.0)	5.0	-229
Gasoline	175	(34.0)	8.5	96	(20.3)	7.3	-79	268	(36.2)	6.3	121	(23.4)	3.5	-147	327	(36.8)	4.1	175	(26.5)	7.6	-152
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0	(0.0)			0	(0.0)		0
Kero/Jet	45	(8.8)	5.8	70	(14.8)	9.3	25	69	(9.3)	6.2	47	(9.0)	-5.6	-22	84	(9.5)	4.1	80	(12.0)	11.3	-5
Gas oil	194	(37.8)	5.7	189	(40.1)	7.5	-5	266	(35.9)	4.6	242	(46.8)	3.6	-23	314	(35.3)	3.4	275	(41.6)	2.5	-39
Heavy Fuel	48	(9.4)	-0.9	37	(7.8)	-0.9	-11	53	(7.2)	1.4	9	(1.8)	-17.9	-44	60	(6.7)	2.5	5	(0.8)	-9.9	-55
Fuel Oil Total	462	(89.9)	4.9	391	(83.1)	5.7	-71	655	(88.6)	5.1	419	(81.0)	1.0	-236	785	(88.3)	3.7	535	(81.0)	5.0	-250
LPG	29	(5.7)	9.2	25	(5.3)	8.9	-5	36	(4.9)	3.1	52	(10.0)	11.0	15	44	(5.0)	4.1	66	(10.0)	5.0	22
Other Products	22	(4.3)	6.4	55	(11.6)	13.9	32	48	(6.5)	11.7	47	(9.0)	-2.3	-2	60	(6.7)	4.2	59	(9.0)	5.0	0
CDU capacity	516	thou.b/d				Oper. Rate: 91.1 %		545	thou.b/d				Oper. Rate: 95.0 %		695	thou.b/d				Oper. Rate: 94.9 %	

**Petroleum Products Balances in Asia**  
( Reference Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/03	Production	(share)	10/03	Net Export	Demand	(share)	15/03	Production	(share)	15/03	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>Philippines</b>																					
Products Total	328	(100.0)	1.6	255	(100.0)	1.4	-73	378	(100.0)	2.1	316	(100.0)	3.1	-62	474	(100.0)	4.6	316	(100.0)	0.0	-157
Gasoline	64	(19.6)	3.8	41	(16.1)	1.5	-23	90	(23.8)	4.9	13	(4.1)	-15.1	-77	122	(25.8)	6.3	54	(17.0)	32.7	-68
Naphtha	1	(0.2)	-4.7	12	(4.6)	8.2	11	1	(0.2)	0.1	47	(14.7)	21.6	46	1	(0.2)	0.0	20	(6.5)	-15.2	20
Kero/Jet	27	(8.3)	3.1	22	(8.6)	1.3	-5	35	(9.2)	3.6	52	(16.5)	13.2	17	46	(9.6)	5.6	29	(9.1)	-11.3	-17
Gas oil	128	(39.0)	3.7	83	(32.5)	2.7	-45	154	(40.8)	2.7	77	(24.5)	-1.0	-77	201	(42.4)	5.4	83	(26.3)	1.4	-117
Heavy Fuel	72	(21.9)	-1.9	78	(30.6)	0.0	6	49	(12.8)	-5.4	101	(32.0)	3.8	53	48	(10.1)	-0.3	101	(32.0)	0.0	53
Fuel Oil Total	292	(89.1)	1.4	236	(92.5)	1.4	-56	328	(86.8)	1.7	290	(91.8)	3.0	-38	417	(88.1)	4.9	287	(90.8)	-0.2	-130
LPG	32	(9.7)	4.1	16	(6.3)	1.6	-16	46	(12.0)	5.2	23	(7.2)	5.2	-23	52	(10.9)	2.6	26	(8.2)	2.6	-26
Other Products	4	(1.2)	-1.3	3	(1.3)	-0.9	-1	4	(1.2)	1.7	3	(1.0)	-0.2	-1	5	(1.0)	1.5	3	(1.0)	0.0	-2
CDU capacity	333	thou.b/d				Oper. Rate: 76.6 %		333	thou.b/d				Oper. Rate: 95.0 %		333	thou.b/d				Oper. Rate: 95.0 %	
<b>Thailand</b>																					
Products Total	785	(100.0)	5.5	819	(100.0)	7.7	34	1,070	(100.0)	4.5	723	(100.0)	-1.8	-347	1,289	(100.0)	3.8	933	(100.0)	5.2	-356
Gasoline	123	(15.7)	5.8	139	(17.0)	7.4	16	175	(16.4)	5.2	168	(23.2)	2.7	-7	214	(16.6)	4.1	211	(22.6)	4.7	-3
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0
Kero/Jet	61	(7.8)	4.9	81	(9.9)	6.7	20	87	(49.7)	5.2	3	(0.4)	-37.4	-84	106	(8.3)	4.1	102	(11.0)	102.1	-4
Gas oil	320	(40.8)	6.8	342	(41.7)	8.9	21	450	(0.0)	5.0	438	(60.6)	3.6	-12	549	(42.6)	4.1	486	(52.1)	2.1	-63
Heavy Fuel	139	(17.8)	1.8	160	(19.6)	5.3	21	171	(196.7)	3.0	21	(2.8)	-25.4	-151	199	(15.5)	3.1	24	(2.6)	3.0	-176
Fuel Oil Total	644	(82.1)	4.8	722	(88.1)	7.3	78	884	(82.6)	4.6	630	(87.1)	-1.9	-254	1,069	(83.0)	3.9	823	(88.2)	5.5	-246
LPG	120	(15.3)	13.4	77	(9.3)	12.7	-43	154	(34.3)	3.7	77	(10.7)	0.1	-77	182	(14.1)	3.4	91	(9.8)	3.4	-91
Other Products	21	(2.7)	8.5	21	(2.6)	10.1	0	31	(18.3)	5.9	16	(2.2)	-3.8	-15	37	(2.9)	3.6	19	(2.0)	3.2	-19
CDU capacity	703	thou.b/d				Oper. Rate: 116.5 %		761	thou.b/d				Oper. Rate: 95.0 %		982	thou.b/d				Oper. Rate: 95.0 %	
<b>Vietnam</b>																					
Products Total	222	(100.0)	8.1	0	(0.0)		-222	300	(100.0)	4.4	141	(100.0)	0.0	-160	393	(100.0)	5.6	230	(100.0)	10.3	-163
Gasoline	47	(21.0)	8.1	0	(0.0)		-47	56	(18.5)	2.6	35	(25.0)		-20	65	(16.6)	3.3	57	(25.0)	10.3	-8
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		16	(11.3)		16	0	(0.0)		0	(0.0)		0
Kero/Jet	13	(5.8)	4.1	0	(0.0)		-13	16	(28.7)	3.1	0	(0.0)		-16	20	(5.1)	4.6	17	(7.3)		-3
Gas oil	93	(42.0)	8.0	0	(0.0)		-93	135	(0.0)	5.4	74	(52.7)		-61	180	(45.7)	5.9	89	(38.8)	3.8	-90
Heavy Fuel	46	(20.9)	8.4	0	(0.0)		-46	61	(381.7)	4.0	4	(2.5)		-57	90	(23.0)	8.2	41	(17.9)	63.7	-49
Fuel Oil Total	199	(89.7)	7.7	0	(0.0)		-199	267	(89.0)	4.3	129	(91.5)		-138	355	(90.3)	5.9	205	(89.0)	9.7	-151
LPG	14	(6.2)	23.9	0	(0.0)		-14	24	(17.8)	8.2	12	(8.5)	0.0	-12	29	(7.3)	3.8	25	(11.0)	16.2	-3
Other Products	9	(4.1)	10.8	0	(0.0)		-9	9	(15.0)	0.0	0	(0.0)		-9	9	(2.3)	0.0	0	(0.0)		-9
CDU capacity	0	thou.b/d				Oper. Rate: 0.0 %		148	thou.b/d				Oper. Rate: 95.0 %		242	thou.b/d				Oper. Rate: 94.9 %	
<b>East Asia (excluding Japan)</b>																					
Products Total	12,766	(100.0)	5.4	11,658	(100.0)	4.9	-1,108	16,570	(100.0)	3.8	14,821	(100.0)	3.5	-1,749	19,583	(100.0)	3.4	17,586	(100.0)	3.5	-1,997
Gasoline	1,882	(14.7)	6.6	1,975	(16.9)	6.4	93	2,625	(15.8)	4.9	2,489	(16.8)	3.4	-137	3,240	(16.5)	4.3	2,850	(16.2)	2.7	-390
Naphtha	1,607	(12.6)	11.4	1,272	(10.9)	8.8	-336	2,360	(14.2)	5.6	1,748	(11.8)	4.6	-613	2,760	(14.1)	3.2	2,031	(11.6)	3.1	-729
Kero/Jet	1,016	(8.0)	4.7	1,108	(9.5)	4.5	91	1,274	(7.7)	3.3	1,241	(8.4)	1.6	-33	1,565	(8.0)	4.2	1,587	(9.0)	5.1	22
Gas oil	3,783	(29.6)	6.5	3,742	(32.1)	6.5	-40	4,965	(30.0)	4.0	5,086	(34.3)	4.5	121	6,155	(31.4)	4.4	6,118	(34.8)	3.8	-37
Heavy Fuel	2,663	(20.9)	2.1	1,937	(16.6)	0.8	-726	3,019	(18.2)	1.8	2,033	(13.7)	0.7	-986	3,228	(16.5)	1.3	2,370	(13.5)	3.1	-858
Fuel Oil Total	10,952	(85.8)	5.1	10,034	(86.1)	4.6	-918	14,244	(86.0)	3.8	12,596	(85.0)	3.3	-1,648	16,947	(86.5)	3.5	14,957	(85.1)	3.5	-1,991
LPG	1,164	(9.1)	9.9	846	(7.3)	8.4	-318	1,178	(7.1)	0.2	1,015	(6.8)	2.6	-163	1,315	(6.7)	2.2	963	(5.5)	-1.0	-352
Other Products	650	(5.1)	5.0	779	(6.7)	5.6	128	1,148	(6.9)	8.5	1,210	(8.2)	6.5	62	1,321	(6.7)	2.8	1,666	(9.5)	6.6	345
CDU capacity	13,479	thou.b/d				Oper. Rate: 86.5 %		16,626	thou.b/d				Oper. Rate: 89.1 %		19,671	thou.b/d				Oper. Rate: 89.4 %	

**Petroleum Products Balances in Asia**  
( Reference Case )

	2003 ( Actual )							2010					2015								
	Demand (share)	2002/80	Production (share)	2002/80	Net Export	Demand (share)	10/03	Production (share)	10/03	Net Export	Demand (share)	15/03	Production (share)	15/03	Net Export						
	thou.b/d	%	thou.b/d	%	thou.b/d	thou.b/d	%	thou.b/d	%	thou.b/d	%	thou.b/d	%	thou.b/d	%						
<b>India</b>																					
Products Total	2,483	(100.0)	6.0	2,585	(100.0)	7.2	102	3,135	(100.0)	3.4	3,548	(100.0)	4.6	413	3,784	(100.0)	3.8	4,250	(100.0)	3.7	466
Gasoline	176	(7.1)	7.6	245	(9.5)	9.2	69	224	(7.2)	3.5	245	(6.9)	0.0	20	257	(6.8)	2.7	416	(9.8)	11.2	159
Naphtha	266	(10.7)	7.9	236	(9.1)	7.4	-30	350	(11.2)	4.0	567	(16.0)	13.4	217	436	(11.5)	4.5	521	(12.3)	-1.7	85
Kero/Jet	278	(11.2)	4.0	317	(12.3)	6.7	39	341	(10.9)	3.0	355	(10.0)	1.6	14	412	(10.9)	3.9	425	(10.0)	3.7	13
Gas oil	882	(35.5)	5.9	970	(37.5)	7.7	88	1,068	(34.1)	2.8	1,384	(39.0)	5.2	316	1,236	(32.7)	3.0	1,658	(39.0)	3.7	422
Heavy Fuel	344	(13.9)	3.4	378	(14.6)	4.6	34	454	(14.5)	4.0	454	(12.8)	2.7	0	579	(15.3)	5.0	620	(14.6)	6.4	42
Fuel Oil Total	1,946	(78.4)	5.4	2,145	(83.0)	6.9	200	2,438	(77.8)	3.3	3,004	(84.7)	4.9	567	2,920	(77.2)	3.7	3,640	(85.7)	3.9	720
LPG	284	(11.4)	12.5	191	(7.4)	10.8	-93	343	(10.9)	2.7	319	(9.0)	7.6	-24	432	(11.4)	4.7	383	(9.0)	3.7	-50
Other Products	253	(10.2)	7.6	249	(9.6)	8.2	-4	354	(11.3)	4.9	224	(6.3)	-1.5	-130	432	(11.4)	4.0	227	(5.3)	0.2	-205
CDU capacity	2,135	thou.b/d		Oper. Rate:	121.1 %			3,316	thou.b/d		Oper. Rate:	107.0 %			3,972	thou.b/d		Oper. Rate:	107.0 %		
<b>Other Asia</b>																					
Products Total	635	(100.0)	4.4	323	(100.0)	1.9	-313	863	(100.0)	4.5	507	(100.0)	6.7	-356	1,092	(100.0)	4.8	737	(100.0)	7.8	-355
Gasoline	66	(10.3)	2.7	48	(14.8)	1.8	-18	89	(10.3)	4.4	120	(23.7)	14.0	31	103	(9.4)	3.0	103	(13.9)	-3.0	0
Naphtha	4	(0.6)		18	(5.5)	2.8	14	4	(0.4)	0.0	4	(0.7)	-20.2	0	4	(0.3)	0.0	9	(1.3)	20.4	6
Kero/Jet	71	(11.1)	1.8	41	(12.7)	1.1	-30	94	(10.9)	4.2	51	(10.0)	3.1	-44	125	(11.5)	5.8	74	(10.0)	7.8	-52
Gas oil	310	(48.8)	5.5	102	(31.6)	2.5	-208	413	(47.9)	4.2	137	(27.0)	4.3	-276	523	(47.9)	4.8	263	(35.7)	13.9	-260
Heavy Fuel	142	(22.4)	4.7	82	(25.4)	1.0	-60	212	(24.5)	5.8	144	(28.5)	8.4	-67	277	(25.4)	5.6	221	(30.0)	8.9	-56
Fuel Oil Total	593	(93.3)	4.3	291	(90.0)	1.8	-302	811	(94.0)	4.6	456	(89.9)	6.6	-356	1,032	(94.5)	4.9	669	(90.9)	8.0	-362
LPG	23	(3.7)	7.1	12	(3.8)	4.2	-11	26	(3.1)	1.7	26	(5.1)	11.3	0	30	(2.8)	2.8	30	(4.1)	3.1	0
Other Products	19	(3.1)	2.7	20	(6.2)	2.5	1	25	(2.9)	3.7	25	(5.0)	3.5	0	30	(2.8)	3.7	37	(5.0)	7.8	7
CDU capacity	477	thou.b/d		Oper. Rate:	67.6 %			512	thou.b/d		Oper. Rate:	98.9 %			744	thou.b/d		Oper. Rate:	99.0 %		
<b>Asia (excluding Japan)</b>																					
Products Total	15,885	(100.0)	5.4	14,566	(100.0)	5.1	-1,318	20,567	(100.0)	3.8	18,876	(100.0)	3.8	-1,691	24,459	(100.0)	3.5	22,572	(100.0)	3.6	-1,887
Gasoline	2,124	(13.4)	6.5	2,268	(15.6)	6.5	144	2,938	(14.3)	4.7	2,854	(15.1)	3.3	-85	3,599	(14.7)	4.1	3,369	(14.9)	3.4	-230
Naphtha	1,877	(11.8)	10.7	1,525	(10.5)	8.4	-352	2,714	(13.2)	5.4	2,318	(12.3)	6.2	-396	3,200	(13.1)	3.4	2,562	(11.3)	2.0	-638
Kero/Jet	1,365	(8.6)	4.3	1,465	(10.1)	4.7	101	1,710	(8.3)	3.3	1,646	(8.7)	1.7	-64	2,102	(8.6)	4.2	2,086	(9.2)	4.8	-16
Gas oil	4,975	(31.3)	6.3	4,814	(33.0)	6.6	-161	6,446	(31.3)	3.8	6,607	(35.0)	4.6	160	7,914	(32.4)	4.2	8,039	(35.6)	4.0	125
Heavy Fuel	3,150	(19.8)	2.3	2,397	(16.5)	1.2	-752	3,685	(17.9)	2.3	2,632	(13.9)	1.3	-1,053	4,084	(16.7)	2.1	3,212	(14.2)	4.1	-872
Fuel Oil Total	13,491	(84.9)	5.1	12,470	(85.6)	4.9	-1,021	17,493	(85.1)	3.8	16,056	(85.1)	3.7	-1,437	20,899	(85.4)	3.6	19,267	(85.4)	3.7	-1,633
LPG	1,472	(9.3)	10.2	1,049	(7.2)	8.7	-423	1,547	(7.5)	0.7	1,360	(7.2)	3.8	-187	1,777	(7.3)	2.8	1,376	(6.1)	0.2	-402
Other Products	923	(5.8)	5.5	1,048	(7.2)	6.0	125	1,527	(7.4)	7.5	1,460	(7.7)	4.9	-67	1,783	(7.3)	3.1	1,930	(8.6)	5.7	147
CDU capacity	16,092	thou.b/d		Oper. Rate:	90.5 %			20,454	thou.b/d		Oper. Rate:	92.3 %			24,387	thou.b/d		Oper. Rate:	92.6 %		
<b>Japan</b>																					
Products Total	5,389	(100.0)	0.6	4,359	(100.0)	0.3	-1,029	5,136	(100.0)	-0.7	4,438	(100.0)	0.3	-697	5,097	(100.0)	-0.2	4,438	(100.0)	0.0	-658
Gasoline	4,486	(83.3)	0.5	3,840	(88.1)	0.2	-646	4,107	(80.0)	-1.3	3,689	(83.1)	-0.6	-418	4,057	(79.6)	-0.2	3,727	(84.0)	0.2	-330
Naphtha	994	(18.4)	2.6	962	(22.1)	2.6	-32	1,014	(19.7)	0.3	1,159	(26.1)	2.7	146	1,002	(19.7)	-0.2	1,315	(29.6)	2.5	313
Kero/Jet	805	(14.9)	2.5	305	(7.0)	-0.6	-500	805	(15.7)	0.0	244	(5.5)	-3.1	-561	806	(15.8)	0.0	244	(5.5)	0.0	-562
Gas oil	740	(13.7)	1.9	650	(14.9)	1.3	-90	720	(14.0)	-0.4	688	(15.5)	0.8	-32	715	(14.0)	-0.1	688	(15.5)	0.0	-27
Heavy Fuel	1,249	(23.2)	2.2	1,238	(28.4)	2.3	-11	1,086	(21.2)	-2.0	1,154	(26.0)	-1.0	68	1,081	(21.2)	-0.1	1,081	(24.4)	-1.3	0
Fuel Oil Total	5,389	(100.0)	0.6	4,359	(100.0)	0.3	-1,029	5,136	(100.0)	-0.7	4,438	(100.0)	0.3	-697	5,097	(100.0)	-0.2	4,438	(100.0)	0.0	-658
LPG	620	(11.5)	1.2	300	(6.9)	1.2	-320	522	(10.2)	-2.4	261	(5.9)	-2.0	-261	535	(10.5)	0.5	267	(6.0)	0.5	-267
Other Products	282	(5.2)	1.4	219	(5.0)	1.0	-63	506	(9.9)	8.7	488	(11.0)	12.1	-18	505	(9.9)	-0.1	444	(10.0)	-1.9	-61
CDU capacity	4,703	thou.b/c	0	Oper. Rate:	92.7 %			4,672	thou.b/c	0	Oper. Rate:	95.0 %			4,672	thou.b/c	0	Oper. Rate:	95.0 %		
<b>Asia</b>																					
Products Total	21,274	(100.0)	3.6	18,926	(100.0)	3.4	-2,348	25,703	(100.0)	2.7	23,314	(100.0)	3.0	-2,389	29,556	(100.0)	2.8	27,011	(100.0)	3.0	-2,545
Gasoline	17,977	(84.5)	3.4	16,310	(86.2)	3.2	-1,667	21,601	(84.0)	2.7	19,745	(84.7)	2.8	-1,855	24,956	(84.4)	2.9	22,994	(85.1)	3.1	-1,962
Naphtha	3,118	(14.7)	4.9	3,230	(17.1)	4.9	112	3,952	(15.4)	3.4	4,013	(17.2)	3.1	61	4,601	(15.6)	3.1	4,683	(17.3)	3.1	82
Kero/Jet	2,682	(12.6)	6.5	1,830	(9.7)	5.0	-852	3,519	(13.7)	4.0	2,562	(11.0)	4.9	-957	4,006	(13.6)	2.6	2,806	(10.4)	1.8	-1,200
Gas oil	2,105	(9.9)	3.3	2,115	(11.2)	3.4	11	2,430	(9.5)	2.1	2,334	(10.0)	1.4	-96	2,817	(9.5)	3.0	2,774	(10.3)	3.5	-43
Heavy Fuel	6,224	(29.3)	5.1	6,052	(32.0)	5.3	-172	7,532	(29.3)	2.8	7,761	(33.3)	3.6	228	8,995	(30.4)	3.6	9,120	(33.8)	3.3	125
Fuel Oil Total	21,274	(100.0)	3.6	18,926	(100.0)	3.4	-2,348	25,703	(100.0)	2.7	23,314	(100.0)	3.0	-2,389	29,556	(100.0)	2.8	27,011	(100.0)	3.0	-2,545
LPG	2,092	(9.8)	5.4	1,349	(7.1)	5.6	-743	2,069	(8.0)	-0.2	1,621	(7.0)	2.7	-448	2,312	(7.8)	2.2	1,643	(6.1)	0.3	-669
Other Products	1,205	(5.7)	4.1	1,267	(6.7)	4.6	62	2,034	(7.9)	7.8	1,948	(8.4)	6.3	-86	2,288	(7.7)	2.4	2,374	(8.8)	4.0	86
CDU capacity	20,794	thou.b/c	0	Oper. Rate:	91.0 %			25,126	thou.b/c	0	Oper. Rate:	92.8 %			29,059	thou.b/c	0	Oper. Rate:	93.0 %		

**Petroleum Products Balances in East Asia**  
( Low Growth Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>China</b>																					
Products Total	5,304	(100.0)	5.7	4,859	(100.0)	5.0	-445	7,723	(100.0)	5.5	7,123	(100.0)	5.6	-599	9,315	(100.0)	3.8	8,583	(100.0)	3.8	-731
Gasoline	876	(16.5)	6.3	1,030	(21.2)	6.7	154	1,311	(17.0)	5.9	1,311	(18.4)	3.5	0	1,650	(17.7)	4.7	1,326	(15.5)	0.2	-323
Naphtha	570	(10.8)	11.8	570	(11.7)	10.5	0	1,103	(14.3)	9.9	784	(11.0)	4.6	-319	1,294	(13.9)	3.3	944	(11.0)	3.8	-350
Kero/Jet	191	(3.6)	4.0	184	(3.8)	3.5	-7	305	(3.9)	6.9	309	(4.3)	7.7	4	438	(4.7)	7.5	343	(4.0)	2.1	-95
Gas oil	1,778	(33.5)	7.4	1,806	(37.2)	7.0	28	2,443	(31.6)	4.6	2,518	(35.4)	4.9	75	3,111	(33.4)	4.9	3,262	(38.0)	5.3	151
Heavy Fuel	862	(16.3)	1.7	418	(8.6)	-1.6	-445	1,156	(15.0)	4.3	784	(11.0)	9.4	-373	1,221	(13.1)	1.1	944	(11.0)	3.8	-277
Fuel Oil Total	4,277	(80.6)	5.4	4,007	(82.5)	4.8	-270	6,318	(81.8)	5.7	5,706	(80.1)	5.2	-612	7,713	(82.8)	4.1	6,820	(79.5)	3.6	-894
LPG	609	(11.5)	11.4	466	(9.6)	10.1	-142	532	(6.9)	-1.9	542	(7.6)	2.2	10	593	(6.4)	2.2	424	(4.9)	-4.8	-170
Other Products	418	(7.9)	4.1	385	(7.9)	3.6	-33	872	(11.3)	11.1	876	(12.3)	12.4	4	1,008	(10.8)	2.9	1,340	(15.6)	8.9	332
CDU capacity	5,619	thou.b/d			Oper. Rate:	86.5 %		8,446	thou.b/d			Oper. Rate:	82.2 %		10,158	thou.b/d			Oper. Rate:	85.0 %	
<b>Hong Kong</b>																					
Products Total	279	(100.0)	3.4	0	(0.0)		-279	310	(100.0)	1.5	0	(0.0)	0.0	-310	336	(100.0)	1.6	0	(0.0)	0.0	-336
Gasoline	8	(2.7)	2.8	0	(0.0)		-8	9	(3.0)	3.0	0	(0.0)	0.0	-9	10	(2.9)	1.3	0	(0.0)	0.0	-10
Naphtha	14	(5.0)	8.6	0	(0.0)		-14	14	(4.4)	0.0	0	(0.0)	0.0	-14	14	(4.1)	0.0	0	(0.0)	0.0	-14
Kero/Jet	70	(25.3)	5.9	0	(0.0)		-70	75	(24.1)	0.9	0	(0.0)	0.0	-75	76	(22.7)	0.4	0	(0.0)	0.0	-76
Gas oil	113	(40.6)	7.5	0	(0.0)		-113	123	(39.8)	1.2	0	(0.0)	0.0	-123	135	(40.1)	1.7	0	(0.0)	0.0	-135
Heavy Fuel	62	(22.1)	-1.0	0	(0.0)		-62	75	(24.3)	2.9	0	(0.0)	0.0	-75	87	(26.0)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	267	(95.7)	3.4	0	(0.0)		-267	297	(95.7)	1.5	0	(0.0)	0.0	-297	322	(95.9)	1.6	0	(0.0)	0.0	-322
LPG	9	(3.1)	5.6	0	(0.0)		-9	10	(3.1)	1.4	0	(0.0)	0.0	-10	10	(3.0)	0.7	0	(0.0)	0.0	-10
Other Products	3	(1.2)	2.4	0	(0.0)		-3	4	(1.2)	1.7	0	(0.0)	0.0	-4	4	(1.1)	0.9	0	(0.0)	0.0	-4
CDU capacity	0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %	
<b>Chinese Taipei</b>																					
Products Total	949	(100.0)	3.9	1,083	(100.0)	4.9	134	1,020	(100.0)	1.0	1,159	(100.0)	1.0	139	1,055	(100.0)	0.7	1,729	(100.0)	8.3	674
Gasoline	168	(17.7)	7.5	208	(19.2)	8.3	39	184	(18.1)	1.3	199	(17.2)	-0.6	15	188	(17.8)	0.4	297	(17.2)	8.3	109
Naphtha	221	(23.3)	9.0	175	(16.2)	8.6	-46	291	(28.5)	4.0	304	(26.2)	8.2	13	337	(32.0)	3.0	451	(26.1)	8.2	114
Kero/Jet	46	(4.9)	6.2	59	(5.5)	5.8	13	48	(4.7)	0.7	116	(10.0)	10.0	68	51	(4.9)	1.2	173	(10.0)	8.3	122
Gas oil	110	(11.5)	3.2	209	(19.2)	5.4	99	132	(12.9)	2.7	243	(21.0)	2.2	111	141	(13.4)	1.3	363	(21.0)	8.3	222
Heavy Fuel	263	(27.7)	0.6	288	(26.6)	1.9	25	214	(20.9)	-2.9	181	(15.6)	-6.4	-33	180	(17.1)	-3.4	269	(15.6)	8.2	89
Fuel Oil Total	808	(85.2)	3.6	939	(86.7)	4.8	131	869	(85.2)	1.0	1,043	(90.0)	1.5	174	898	(85.1)	0.6	1,553	(89.8)	8.3	655
LPG	68	(7.1)	3.8	59	(5.5)	3.6	-8	70	(6.8)	0.5	35	(3.0)	-7.2	-35	69	(6.5)	-0.3	69	(4.0)	14.5	0
Other Products	73	(7.7)	9.4	85	(7.9)	10.7	12	81	(7.9)	1.4	81	(7.0)	-0.8	0	89	(8.4)	1.8	107	(6.2)	5.8	19
CDU capacity	1,220	thou.b/d			Oper. Rate:	88.8 %		1,220	thou.b/d			Oper. Rate:	95.0 %		1,820	thou.b/d			Oper. Rate:	95.0 %	
<b>Korea</b>																					
Products Total	2,313	(100.0)	6.6	2,367	(100.0)	6.9	55	2,399	(100.0)	0.5	2,598	(100.0)	1.3	200	2,540	(100.0)	1.2	2,598	(100.0)	0.0	58
Gasoline	158	(6.8)	10.0	191	(8.1)	10.9	33	184	(7.7)	2.1	208	(8.0)	1.2	24	190	(7.5)	0.6	208	(8.0)	0.0	18
Naphtha	666	(28.8)	11.5	392	(16.6)	9.1	-274	749	(31.2)	1.7	468	(18.0)	2.5	-281	817	(32.2)	1.8	468	(18.0)	0.0	-350
Kero/Jet	237	(10.3)	9.0	337	(14.2)	10.1	100	226	(9.4)	-0.7	294	(11.3)	-1.9	68	244	(9.6)	1.6	350	(13.5)	3.5	105
Gas oil	447	(19.3)	6.2	599	(25.3)	7.5	153	493	(20.5)	1.4	728	(28.0)	2.8	235	546	(21.5)	2.1	728	(28.0)	0.0	182
Heavy Fuel	501	(21.7)	2.4	602	(25.4)	3.6	101	442	(18.4)	-1.8	650	(25.0)	1.1	208	432	(17.0)	-0.4	650	(25.0)	0.0	217
Fuel Oil Total	2,009	(86.9)	6.2	2,122	(89.6)	6.6	112	2,093	(87.2)	0.6	2,347	(90.3)	1.5	254	2,229	(87.8)	1.3	2,402	(92.5)	0.5	173
LPG	227	(9.8)	11.8	133	(5.6)	9.6	-95	232	(9.7)	0.3	173	(6.7)	3.9	-59	236	(9.3)	0.3	118	(4.5)	-7.4	-118
Other Products	76	(3.3)	10.6	113	(4.8)	12.3	37	74	(3.1)	-0.5	78	(3.0)	-5.2	4	75	(2.9)	0.2	78	(3.0)	0.0	3
CDU capacity	2,750	thou.b/d			Oper. Rate:	86.1 %		2,735	thou.b/d			Oper. Rate:	95.0 %		2,735	thou.b/d			Oper. Rate:	95.0 %	

**Petroleum Products Balances in East Asia**  
( Low Growth Case )

	2003 ( Actual )							2010					2015								
	Demand (share)	2002/80	Production (share)	2002/80	Net Export	Demand (share)	10/02	Production (share)	10/02	Net Export	Demand (share)	15/02	Production (share)	15/02	Net Export						
	thou.b/d	%	thou.b/d	%	thou.b/d	thou.b/d	%	thou.b/d	%	thou.b/d	thou.b/d	%	thou.b/d	%	thou.b/d						
<b>Singapore</b>																					
Products Total	742	(100.0)	5.9	750	(100.0)	0.7	8	909	(100.0)	2.9	1,270	(100.0)	7.8	362	1,027	(100.0)	2.5	1,270	(100.0)	0.0	243
Gasoline	15	(2.1)	3.1	75	(10.0)	0.3	59	17	(1.9)	1.5	152	(12.0)	10.7	136	18	(1.7)	1.1	152	(12.0)	0.0	135
Naphtha	86	(11.6)	19.7	74	(9.8)	2.1	-12	131	(14.4)	6.2	127	(10.0)	8.1	-4	161	(15.7)	4.3	127	(10.0)	0.0	-34
Kero/Jet	62	(8.4)	5.2	159	(21.2)	0.1	96	73	(8.1)	2.3	327	(25.8)	10.9	254	80	(7.8)	1.8	377	(29.7)	2.9	297
Gas oil	59	(8.0)	3.9	214	(28.6)	2.1	155	70	(7.7)	2.3	445	(35.0)	11.0	375	78	(7.6)	2.2	445	(35.0)	0.0	367
Heavy Fuel	495	(66.7)	5.8	120	(16.0)	-2.4	-375	584	(64.3)	2.4	54	(4.2)	-10.8	-531	653	(63.5)	2.2	4	(0.3)	-40.2	-648
Fuel Oil Total	717	(96.7)	6.0	641	(85.5)	0.2	-76	875	(96.3)	2.9	1,105	(87.0)	8.1	230	990	(96.3)	2.5	1,105	(87.0)	0.0	115
LPG	16	(2.2)	4.4	31	(4.2)	9.8	15	24	(2.7)	6.0	76	(6.0)	13.5	52	28	(2.7)	3.0	76	(6.0)	0.0	48
Other Products	9	(1.2)	1.3	77	(10.3)	5.3	69	10	(1.1)	1.8	89	(7.0)	2.0	79	10	(1.0)	0.3	89	(7.0)	0.0	79
CDU capacity	1,337	thou.b/d		Oper. Rate:	56.1	%		1,337	thou.b/d		Oper. Rate:	95.0	%		1,337	thou.b/d		Oper. Rate:	95.0	%	
<b>Brunei</b>																					
Products Total	12	(100.0)	4.9	11	(100.0)	21.9	-1	14	(100.0)	1.5	10	(100.0)	-1.6	-3	15	(100.0)	2.1	10	(100.0)	0.0	-5
Gasoline	5	(36.8)	5.2	4	(39.3)	0.0	0	5	(35.8)	1.1	0	(0.0)	-100.0	-5	5	(34.0)	1.1	0	(0.0)	0.0	-5
Naphtha	0	(1.0)	-1.1	0	(1.2)	0.0	0	0	(1.1)	2.2	3	(27.4)	54.2	3	0	(1.0)	0.0	3	(27.4)	0.0	3
Kero/Jet	2	(14.9)	5.6	2	(15.6)	0.0	0	3	(20.2)	6.0	2	(17.0)	-0.4	-1	4	(23.3)	5.1	2	(17.0)	0.0	-2
Gas oil	4	(28.8)	3.3	3	(30.3)	0.0	0	3	(23.6)	-1.4	3	(25.0)	-4.3	-1	3	(22.6)	1.3	3	(25.0)	0.0	-1
Heavy Fuel	0	(0.2)	0.2	0	(0.2)	0.0	0	0	(0.2)	0.0	0	(1.0)	26.2	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.7)	4.3	10	(86.5)	0.0	0	11	(80.9)	1.3	7	(70.4)	-4.5	-4	12	(81.0)	2.2	7	(70.4)	0.0	-5
LPG	2	(16.1)	13.0	2	(13.5)	11.7	0	2	(16.4)	1.7	1	(11.1)	-4.3	-1	2	(16.3)	2.0	1	(11.1)	0.0	-1
Other Products	0	(2.2)	2.3	0	(0.0)	0.0	0	0	(2.8)	4.8	2	(18.5)	#####	2	0	(2.8)	2.1	2	(18.5)	0.0	1
CDU capacity	9	thou.b/d		Oper. Rate:	132.5	%		9	thou.b/d		Oper. Rate:	118.2	%		9	thou.b/d		Oper. Rate:	118.2	%	
<b>Indonesia</b>																					
Products Total	1,320	(100.0)	5.2	1,043	(100.0)	4.7	-277	1,708	(100.0)	3.8	962	(100.0)	-1.1	-746	1,924	(100.0)	2.4	952	(100.0)	-0.2	-972
Gasoline	244	(18.5)	6.3	192	(18.4)	6.6	-52	327	(19.1)	4.3	281	(29.2)	5.6	-46	380	(19.7)	3.1	365	(38.3)	5.4	-15
Naphtha	50	(3.8)	0.0	48	(4.6)	0.0	-1	72	(4.2)	5.6	0	(0.0)	-100.0	-72	90	(4.7)	4.4	0	(0.0)	0.0	-90
Kero/Jet	261	(19.8)	2.6	195	(18.7)	4.5	-66	337	(19.7)	3.7	90	(9.4)	-10.4	-247	386	(20.1)	2.8	84	(8.9)	-1.3	-302
Gas oil	537	(40.7)	6.1	297	(28.5)	7.8	-240	697	(40.8)	3.8	318	(33.0)	0.9	-379	773	(40.2)	2.1	314	(33.0)	-0.2	-459
Heavy Fuel	175	(13.3)	4.4	235	(22.5)	1.3	60	214	(12.5)	2.9	231	(24.0)	-0.2	17	228	(11.9)	1.3	144	(15.1)	-9.1	-85
Fuel Oil Total	1,266	(95.9)	5.1	967	(92.7)	4.6	-300	1,647	(96.4)	3.8	920	(95.6)	-0.7	-727	1,857	(96.5)	2.4	907	(95.2)	-0.3	-951
LPG	39	(3.0)	10.8	38	(3.6)	4.0	-1	47	(2.7)	2.7	23	(2.4)	-6.5	-23	53	(2.7)	2.3	26	(2.8)	2.3	-26
Other Products	15	(1.1)	4.7	39	(3.7)	9.2	24	15	(0.9)	0.0	19	(2.0)	-9.5	5	15	(0.8)	0.0	19	(2.0)	-0.2	5
CDU capacity	993	thou.b/d		Oper. Rate:	105.1	%		1,093	thou.b/d		Oper. Rate:	88.1	%		1,360	thou.b/d		Oper. Rate:	70.0	%	
<b>Malaysia</b>																					
Products Total	514	(100.0)	5.1	470	(100.0)	6.3	-43	740	(100.0)	5.4	518	(100.0)	1.4	-222	883	(100.0)	3.6	660	(100.0)	5.0	-223
Gasoline	175	(34.0)	8.5	96	(20.3)	7.3	-79	268	(36.2)	6.3	121	(23.4)	3.5	-147	323	(36.6)	3.9	186	(28.2)	8.9	-137
Naphtha	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	45	(8.8)	5.8	70	(14.8)	9.3	25	69	(9.3)	6.2	47	(9.0)	-5.6	-22	83	(9.4)	3.9	83	(12.6)	12.3	0
Gas oil	194	(37.8)	5.7	189	(40.1)	7.5	-5	266	(35.9)	4.6	242	(46.8)	3.6	-23	312	(35.3)	3.2	264	(40.0)	1.7	-48
Heavy Fuel	48	(9.4)	-0.9	37	(7.8)	-0.9	-11	53	(7.2)	1.4	9	(1.8)	-17.9	-44	60	(6.8)	2.5	1	(0.2)	-32.8	-59
Fuel Oil Total	462	(89.9)	4.9	391	(83.1)	5.7	-71	655	(88.6)	5.1	419	(81.0)	1.0	-236	778	(88.2)	3.5	535	(81.0)	5.0	-244
LPG	29	(5.7)	9.2	25	(5.3)	8.9	-5	36	(4.9)	3.1	52	(10.0)	11.0	15	44	(5.0)	4.1	66	(10.0)	5.0	22
Other Products	22	(4.3)	6.4	55	(11.6)	13.9	32	48	(6.5)	11.7	47	(9.0)	-2.3	-2	60	(6.8)	4.5	59	(9.0)	5.0	-1
CDU capacity	516	thou.b/d		Oper. Rate:	91.1	%		545	thou.b/d		Oper. Rate:	95.0	%		695	thou.b/d		Oper. Rate:	94.9	%	

**Petroleum Products Balances in East Asia**  
( Low Growth Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>Philippines</b>																					
Products Total	328	(100.0)	1.6	255	(100.0)	1.4	-73	378	(100.0)	2.1	316	(100.0)	3.1	-62	455	(100.0)	3.8	316	(100.0)	0.0	-139
Gasoline	64	(19.6)	3.8	41	(16.1)	1.5	-23	90	(23.8)	4.9	13	(4.1)	-15.1	-77	118	(25.9)	5.6	54	(17.0)	32.7	-64
Naphtha	1	(0.2)	-4.7	12	(4.6)	8.2	11	1	(0.2)	0.1	47	(14.7)	21.6	46	1	(0.2)	0.0	13	(4.0)	-22.9	12
Kero/Jet	27	(8.3)	3.1	22	(8.6)	1.3	-5	35	(9.2)	3.6	52	(16.5)	13.2	17	43	(9.5)	4.5	42	(13.4)	-4.1	-1
Gas oil	128	(39.0)	3.7	83	(32.5)	2.7	-45	154	(40.8)	2.7	77	(24.5)	-1.0	-77	192	(42.2)	4.5	69	(21.9)	-2.2	-123
Heavy Fuel	72	(21.9)	-1.9	78	(30.6)	0.0	6	49	(12.8)	-5.4	101	(32.0)	3.8	53	46	(10.0)	-1.2	101	(32.0)	0.0	56
Fuel Oil Total	292	(89.1)	1.4	236	(92.5)	1.4	-56	328	(86.8)	1.7	290	(91.8)	3.0	-38	399	(87.7)	4.0	279	(88.3)	-0.8	-120
LPG	32	(9.7)	4.1	16	(6.3)	1.6	-16	46	(12.0)	5.2	23	(7.2)	5.2	-23	51	(11.2)	2.3	34	(10.7)	8.3	-17
Other Products	4	(1.2)	-1.3	3	(1.3)	-0.9	-1	4	(1.2)	1.7	3	(1.0)	-0.2	-1	5	(1.0)	1.3	3	(1.0)	0.0	-2
CDU capacity	333	thou.b/d			Oper. Rate:	76.6 %		333	thou.b/d			Oper. Rate:	95.0 %		333	thou.b/d			Oper. Rate:	95.0 %	
<b>Thailand</b>																					
Products Total	785	(100.0)	5.5	819	(100.0)	7.7	34	1,070	(100.0)	4.5	723	(100.0)	-1.8	-347	1,078	(100.0)	0.1	933	(100.0)	5.2	-145
Gasoline	123	(15.7)	5.8	139	(17.0)	7.4	16	175	(16.4)	5.2	168	(23.2)	2.7	-7	153	(14.2)	-2.7	153	(16.4)	-1.8	0
Naphtha	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	61	(7.8)	4.9	81	(9.9)	6.7	20	87	(49.7)	5.2	3	(0.4)	-37.4	-84	76	(7.1)	-2.7	76	(8.2)	90.5	0
Gas oil	320	(40.8)	6.8	342	(41.7)	8.9	21	450	(0.0)	5.0	438	(60.6)	3.6	-12	411	(38.1)	-1.8	514	(55.1)	3.3	103
Heavy Fuel	139	(17.8)	1.8	160	(19.6)	5.3	21	171	(196.7)	3.0	21	(2.8)	-25.4	-151	183	(17.0)	1.3	45	(4.8)	16.7	-138
Fuel Oil Total	644	(82.1)	4.8	722	(88.1)	7.3	78	884	(82.6)	4.6	630	(87.1)	-1.9	-254	823	(76.4)	-1.4	788	(84.5)	4.6	-35
LPG	120	(15.3)	13.4	77	(9.3)	12.7	-43	154	(34.3)	3.7	77	(10.7)	0.1	-77	161	(15.0)	0.9	126	(13.5)	10.3	-35
Other Products	21	(2.7)	8.5	21	(2.6)	10.1	0	31	(18.3)	5.9	16	(2.2)	-3.8	-15	94	(8.7)	24.5	19	(2.0)	3.2	-75
CDU capacity	703	thou.b/d			Oper. Rate:	116.5 %		761	thou.b/d			Oper. Rate:	95.0 %		982	thou.b/d			Oper. Rate:	95.0 %	
<b>Vietnam</b>																					
Products Total	222	(100.0)	8.1	0	(0.0)		-222	300	(100.0)	4.4	141	(100.0)	0.0	-160	381	(100.0)	4.9	230	(100.0)	10.3	-151
Gasoline	47	(21.0)	8.1	0	(0.0)		-47	56	(18.5)	2.6	35	(25.0)	0.0	-20	64	(16.7)	2.7	57	(25.0)	10.3	-6
Naphtha	0	(0.0)	0.0	0	(0.0)		0	0	(0.0)	0.0	16	(11.3)	0.0	16	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	13	(5.8)	4.1	0	(0.0)		-13	16	(28.7)	3.1	0	(0.0)	0.0	-16	19	(4.9)	3.0	19	(8.0)		0
Gas oil	93	(42.0)	8.0	0	(0.0)		-93	135	(0.0)	5.4	74	(52.7)	0.0	-61	174	(45.5)	5.2	81	(35.3)	1.9	-92
Heavy Fuel	46	(20.9)	8.4	0	(0.0)		-46	61	(381.7)	4.0	4	(2.5)	0.0	-57	88	(23.2)	7.7	45	(19.4)	66.4	-44
Fuel Oil Total	199	(89.7)	7.7	0	(0.0)		-199	267	(89.0)	4.3	129	(91.5)	0.0	-138	344	(90.2)	5.2	202	(87.8)	9.4	-142
LPG	14	(6.2)	23.9	0	(0.0)		-14	24	(17.8)	8.2	12	(8.5)	0.0	-12	28	(7.4)	3.2	28	(12.2)	18.6	0
Other Products	9	(4.1)	10.8	0	(0.0)		-9	9	(15.0)	0.0	0	(0.0)	0.0	-9	9	(2.4)	0.0	0	(0.0)	0.0	-9
CDU capacity	0	thou.b/d			Oper. Rate:	0.0 %		148	thou.b/d			Oper. Rate:	95.0 %		242	thou.b/d			Oper. Rate:	94.9 %	
<b>East Asia (excluding Japan)</b>																					
Products Total	12,766	(100.0)	5.4	11,658	(100.0)	4.9	-1,108	16,570	(100.0)	3.8	14,821	(100.0)	3.5	-1,749	19,010	(100.0)	2.8	17,282	(100.0)	3.1	-1,728
Gasoline	1,882	(14.7)	6.6	1,975	(16.9)	6.4	93	2,625	(15.8)	4.9	2,489	(16.8)	3.4	-137	3,098	(16.3)	3.4	2,798	(16.2)	2.4	-300
Naphtha	1,607	(12.6)	11.4	1,272	(10.9)	8.8	-336	2,360	(14.2)	5.6	1,748	(11.8)	4.6	-613	2,715	(14.3)	2.8	2,006	(11.6)	2.8	-709
Kero/Jet	1,016	(8.0)	4.7	1,108	(9.5)	4.5	91	1,274	(7.7)	3.3	1,241	(8.4)	1.6	-33	1,501	(7.9)	3.3	1,549	(9.0)	4.5	48
Gas oil	3,783	(29.6)	6.5	3,742	(32.1)	6.5	-40	4,965	(30.0)	4.0	5,086	(34.3)	4.5	121	5,874	(30.9)	3.4	6,042	(35.0)	3.5	168
Heavy Fuel	2,663	(20.9)	2.1	1,937	(16.6)	0.8	-726	3,019	(18.2)	1.8	2,033	(13.7)	0.7	-986	3,178	(16.7)	1.0	2,202	(12.7)	1.6	-976
Fuel Oil Total	10,952	(85.8)	5.1	10,034	(86.1)	4.6	-918	14,244	(86.0)	3.8	12,596	(85.0)	3.3	-1,648	16,366	(86.1)	2.8	14,598	(84.5)	3.0	-1,769
LPG	1,164	(9.1)	9.9	846	(7.3)	8.4	-318	1,178	(7.1)	0.2	1,015	(6.8)	2.6	-163	1,276	(6.7)	1.6	968	(5.6)	-0.9	-308
Other Products	650	(5.1)	5.0	779	(6.7)	5.6	128	1,148	(6.9)	8.5	1,210	(8.2)	6.5	62	1,367	(7.2)	3.6	1,716	(9.9)	7.2	349
CDU capacity	13,479	thou.b/d			Oper. Rate:	86.5 %		16,626	thou.b/d			Oper. Rate:	89.1 %		19,671	thou.b/d			Oper. Rate:	87.9 %	

**Petroleum Products Balances in East Asia**  
( Low Growth Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>India</b>																					
Products Total	2,483	(100.0)	6.0	2,585	(100.0)	7.2	102	3,135	(100.0)	3.4	3,548	(100.0)	4.6	413	3,694	(100.0)	3.3	4,250	(100.0)	3.7	556
Gasoline	176	(7.1)	7.6	245	(9.5)	9.2	69	224	(7.2)	3.5	245	(6.9)	0.0	20	253	(6.8)	2.4	561	(13.2)	18.0	308
Naphtha	266	(10.7)	7.9	236	(9.1)	7.4	-30	350	(11.2)	4.0	567	(16.0)	13.4	217	436	(11.8)	4.5	510	(12.0)	-2.1	73
Kero/Jet	278	(11.2)	4.0	317	(12.3)	6.7	39	341	(10.9)	3.0	355	(10.0)	1.6	14	397	(10.8)	3.1	425	(10.0)	3.7	28
Gas oil	882	(35.5)	5.9	970	(37.5)	7.7	88	1,068	(34.1)	2.8	1,384	(39.0)	5.2	316	1,206	(32.6)	2.5	1,658	(39.0)	3.7	452
Heavy Fuel	344	(13.9)	3.4	378	(14.6)	4.6	34	454	(14.5)	4.0	454	(12.8)	2.7	0	566	(15.3)	4.5	566	(13.3)	4.5	0
Fuel Oil Total	1,946	(78.4)	5.4	2,145	(83.0)	6.9	200	2,438	(77.8)	3.3	3,004	(84.7)	4.9	567	2,858	(77.4)	3.2	3,719	(87.5)	4.4	861
LPG	284	(11.4)	12.5	191	(7.4)	10.8	-93	343	(10.9)	2.7	319	(9.0)	7.6	-24	417	(11.3)	4.0	383	(9.0)	3.7	-35
Other Products	253	(10.2)	7.6	249	(9.6)	8.2	-4	354	(11.3)	4.9	224	(6.3)	-1.5	-130	419	(11.3)	3.4	149	(3.5)	-7.9	-270
CDU capacity	2,135	thou.b/d			Oper. Rate:	121.1 %		3,316	thou.b/d			Oper. Rate:	107.0 %		3,972	thou.b/d			Oper. Rate:	107.0 %	
<b>Other Asia</b>																					
Products Total	635	(100.0)	4.4	323	(100.0)	1.9	-313	863	(100.0)	4.5	507	(100.0)	6.7	-356	1,056	(100.0)	4.1	737	(100.0)	7.8	-319
Gasoline	66	(10.3)	2.7	48	(14.8)	1.8	-18	89	(10.3)	4.4	120	(23.7)	14.0	31	101	(9.6)	2.7	101	(13.8)	-3.3	0
Naphtha	4	(0.6)	0.0	18	(5.5)	2.8	14	4	(0.4)	0.0	4	(0.7)	-20.2	0	4	(0.3)	0.0	11	(1.5)	23.7	7
Kero/Jet	71	(11.1)	1.8	41	(12.7)	1.1	-30	94	(10.9)	4.2	51	(10.0)	3.1	-44	120	(11.3)	4.9	81	(11.0)	9.9	-39
Gas oil	310	(48.8)	5.5	102	(31.6)	2.5	-208	413	(47.9)	4.2	137	(27.0)	4.3	-276	502	(47.6)	4.0	256	(34.8)	13.4	-246
Heavy Fuel	142	(22.4)	4.7	82	(25.4)	1.0	-60	212	(24.5)	5.8	144	(28.5)	8.4	-67	270	(25.6)	5.0	221	(30.0)	8.9	-49
Fuel Oil Total	593	(93.3)	4.3	291	(90.0)	1.8	-302	811	(94.0)	4.6	456	(89.9)	6.6	-356	997	(94.5)	4.2	671	(91.0)	8.0	-327
LPG	23	(3.7)	7.1	12	(3.8)	4.2	-11	26	(3.1)	1.7	26	(5.1)	11.3	0	29	(2.8)	2.1	29	(4.0)	2.3	0
Other Products	19	(3.1)	2.7	20	(6.2)	2.5	1	25	(2.9)	3.7	25	(5.0)	3.5	0	29	(2.8)	3.1	37	(5.0)	7.8	8
CDU capacity	477	thou.b/d			Oper. Rate:	67.6 %		512	thou.b/d			Oper. Rate:	98.9 %		744	thou.b/d			Oper. Rate:	99.0 %	
<b>Asia (excluding Japan)</b>																					
Products Total	15,885	(100.0)	5.4	14,566	(100.0)	5.1	-1,318	20,567	(100.0)	3.8	18,876	(100.0)	3.8	-1,691	23,759	(100.0)	2.9	22,269	(100.0)	3.4	-1,491
Gasoline	2,124	(13.4)	6.5	2,268	(15.6)	6.5	144	2,938	(14.3)	4.7	2,854	(15.1)	3.3	-85	3,452	(14.5)	3.3	3,461	(15.5)	3.9	8
Naphtha	1,877	(11.8)	10.7	1,525	(10.5)	8.4	-352	2,714	(13.2)	5.4	2,318	(12.3)	6.2	-396	3,155	(13.3)	3.1	2,526	(11.3)	1.7	-629
Kero/Jet	1,365	(8.6)	4.3	1,465	(10.1)	4.7	101	1,710	(8.3)	3.3	1,646	(8.7)	1.7	-64	2,018	(8.5)	3.4	2,055	(9.2)	4.5	37
Gas oil	4,975	(31.3)	6.3	4,814	(33.0)	6.6	-161	6,446	(31.3)	3.8	6,607	(35.0)	4.6	160	7,582	(31.9)	3.3	7,956	(35.7)	3.8	374
Heavy Fuel	3,150	(19.8)	2.3	2,397	(16.5)	1.2	-752	3,685	(17.9)	2.3	2,632	(13.9)	1.3	-1,053	4,014	(16.9)	1.7	2,989	(13.4)	2.6	-1,025
Fuel Oil Total	13,491	(84.9)	5.1	12,470	(85.6)	4.9	-1,021	17,493	(85.1)	3.8	16,056	(85.1)	3.7	-1,437	20,222	(85.1)	2.9	18,987	(85.3)	3.4	-1,235
LPG	1,472	(9.3)	10.2	1,049	(7.2)	8.7	-423	1,547	(7.5)	0.7	1,360	(7.2)	3.8	-187	1,722	(7.2)	2.2	1,380	(6.2)	0.3	-342
Other Products	923	(5.8)	5.5	1,048	(7.2)	6.0	125	1,527	(7.4)	7.5	1,460	(7.7)	4.9	-67	1,815	(7.6)	3.5	1,902	(8.5)	5.4	86
CDU capacity	16,092	thou.b/d			Oper. Rate:	90.5 %		20,454	thou.b/d			Oper. Rate:	92.3 %		24,387	thou.b/d			Oper. Rate:	91.3 %	
<b>Asia</b>																					
Products Total	21,274	(100.0)	3.6	18,926	(100.0)	3.4	-2,348	25,703	(100.0)	2.7	23,314	(100.0)	3.0	-2,389	28,704	(100.0)	2.2	26,707	(100.0)	2.8	-1,997
Gasoline	3,118	(14.7)	4.9	3,230	(17.1)	4.9	112	3,952	(15.4)	3.4	4,013	(17.2)	3.1	61	4,385	(15.3)	2.1	4,419	(16.5)	1.9	34
Naphtha	2,682	(12.6)	6.5	1,830	(9.7)	5.0	-852	3,519	(13.7)	4.0	2,562	(11.0)	4.9	-957	3,934	(13.7)	2.3	2,770	(10.4)	1.6	-1,164
Kero/Jet	2,105	(9.9)	3.3	2,115	(11.2)	3.4	11	2,430	(9.5)	2.1	2,334	(10.0)	1.4	-96	2,727	(9.5)	2.3	2,743	(10.3)	3.3	16
Gas oil	6,224	(29.3)	5.1	6,052	(32.0)	5.3	-172	7,532	(29.3)	2.8	7,761	(33.3)	3.6	228	8,628	(30.1)	2.8	9,110	(34.1)	3.3	483
Heavy Fuel	3,849	(18.1)	0.3	3,083	(16.3)	-0.4	-766	4,167	(16.2)	1.1	3,075	(13.2)	0.0	-1,092	4,448	(15.5)	1.3	3,478	(13.0)	2.5	-970
Fuel Oil Total	17,977	(84.5)	3.4	16,310	(86.2)	3.2	-1,667	21,601	(84.0)	2.7	19,745	(84.7)	2.8	-1,855	24,123	(84.0)	2.2	22,521	(84.3)	2.7	-1,601
LPG	2,092	(9.8)	5.4	1,349	(7.1)	5.6	-743	2,069	(8.0)	-0.2	1,621	(7.0)	2.7	-448	2,262	(7.9)	1.8	1,780	(6.7)	1.9	-482
Other Products	1,205	(5.7)	4.1	1,267	(6.7)	4.6	62	2,034	(7.9)	7.8	1,948	(8.4)	6.3	-86	2,320	(8.1)	2.7	2,406	(9.0)	4.3	86
CDU capacity	20,794	thou.b/c	0		Oper. Rate:	91.0 %		25,126	thou.b/c	0		Oper. Rate:	92.8 %		29,059	thou.b/c	0		Oper. Rate:	91.9 %	



**Petroleum Products Balances in East Asia**  
( India Expansion Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>China</b>																					
Products Total	5,304	(100.0)	5.7	4,859	(100.0)	5.0	-445	7,723	(100.0)	5.5	7,123	(100.0)	5.6	-599	9,555	(100.0)	4.3	8,583	(100.0)	3.8	-972
Gasoline	876	(16.5)	6.3	1,030	(21.2)	6.7	154	1,311	(17.0)	5.9	1,311	(18.4)	3.5	0	1,710	(17.9)	5.5	1,326	(15.5)	0.2	-384
Naphtha	570	(10.8)	11.8	570	(11.7)	10.5	0	1,103	(14.3)	9.9	784	(11.0)	4.6	-319	1,335	(14.0)	3.9	944	(11.0)	3.8	-391
Kero/Jet	191	(3.6)	4.0	184	(3.8)	3.5	-7	305	(3.9)	6.9	309	(4.3)	7.7	4	450	(4.7)	8.1	343	(4.0)	2.1	-106
Gas oil	1,778	(33.5)	7.4	1,806	(37.2)	7.0	28	2,443	(31.6)	4.6	2,518	(35.4)	4.9	75	3,205	(33.5)	5.6	3,262	(38.0)	5.3	57
Heavy Fuel	862	(16.3)	1.7	418	(8.6)	-1.6	-445	1,156	(15.0)	4.3	784	(11.0)	9.4	-373	1,233	(12.9)	1.3	944	(11.0)	3.8	-289
Fuel Oil Total	4,277	(80.6)	5.4	4,007	(82.5)	4.8	-270	6,318	(81.8)	5.7	5,706	(80.1)	5.2	-612	7,932	(83.0)	4.7	6,820	(79.5)	3.6	-1,113
LPG	609	(11.5)	11.4	466	(9.6)	10.1	-142	532	(6.9)	-1.9	542	(7.6)	2.2	10	607	(6.4)	2.7	441	(5.1)	-4.0	-166
Other Products	418	(7.9)	4.1	385	(7.9)	3.6	-33	872	(11.3)	11.1	876	(12.3)	12.4	4	1,015	(10.6)	3.1	1,322	(15.4)	8.6	307
CDU capacity	5,619	thou.b/d			Oper. Rate:	86.5 %		8,446	thou.b/d			Oper. Rate:	82.2 %		10,158	thou.b/d			Oper. Rate:	85.0 %	
<b>Hong Kong</b>																					
Products Total	279	(100.0)	3.4	0	(0.0)		-279	310	(100.0)	1.5	0	(0.0)	0.0	-310	339	(100.0)	1.8	0	(0.0)	0.0	-339
Gasoline	8	(2.7)	2.8	0	(0.0)		-8	9	(3.0)	3.0	0	(0.0)	0.0	-9	10	(3.0)	2.1	0	(0.0)	0.0	-10
Naphtha	14	(5.0)	8.6	0	(0.0)		-14	14	(4.4)	0.0	0	(0.0)	0.0	-14	14	(4.1)	0.0	0	(0.0)	0.0	-14
Kero/Jet	70	(25.3)	5.9	0	(0.0)		-70	75	(24.1)	0.9	0	(0.0)	0.0	-75	77	(22.7)	0.5	0	(0.0)	0.0	-77
Gas oil	113	(40.6)	7.5	0	(0.0)		-113	123	(39.8)	1.2	0	(0.0)	0.0	-123	137	(40.3)	2.1	0	(0.0)	0.0	-137
Heavy Fuel	62	(22.1)	-1.0	0	(0.0)		-62	75	(24.3)	2.9	0	(0.0)	0.0	-75	87	(25.8)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	267	(95.7)	3.4	0	(0.0)		-267	297	(95.7)	1.5	0	(0.0)	0.0	-297	325	(95.9)	1.8	0	(0.0)	0.0	-325
LPG	9	(3.1)	5.6	0	(0.0)		-9	10	(3.1)	1.4	0	(0.0)	0.0	-10	10	(3.0)	1.1	0	(0.0)	0.0	-10
Other Products	3	(1.2)	2.4	0	(0.0)		-3	4	(1.2)	1.7	0	(0.0)	0.0	-4	4	(1.1)	1.3	0	(0.0)	0.0	-4
CDU capacity	0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %		0	thou.b/d			Oper. Rate:	0.0 %	
<b>Chinese Taipei</b>																					
Products Total	949	(100.0)	3.9	1,083	(100.0)	4.9	134	1,020	(100.0)	1.0	1,159	(100.0)	1.0	139	1,060	(100.0)	0.8	1,729	(100.0)	8.3	669
Gasoline	168	(17.7)	7.5	208	(19.2)	8.3	39	184	(18.1)	1.3	199	(17.2)	-0.6	15	188	(17.8)	0.4	320	(18.5)	10.0	131
Naphtha	221	(23.3)	9.0	175	(16.2)	8.6	-46	291	(28.5)	4.0	304	(26.2)	8.2	13	337	(31.8)	3.0	451	(26.1)	8.2	114
Kero/Jet	46	(4.9)	6.2	59	(5.5)	5.8	13	48	(4.7)	0.7	116	(10.0)	10.0	68	52	(4.9)	1.5	173	(10.0)	8.3	121
Gas oil	110	(11.5)	3.2	209	(19.2)	5.4	99	132	(12.9)	2.7	243	(21.0)	2.2	111	144	(13.6)	1.8	363	(21.0)	8.3	219
Heavy Fuel	263	(27.7)	0.6	288	(26.6)	1.9	25	214	(20.9)	-2.9	181	(15.6)	-6.4	-33	180	(17.0)	-3.3	269	(15.6)	8.3	89
Fuel Oil Total	808	(85.2)	3.6	939	(86.7)	4.8	131	869	(85.2)	1.0	1,043	(90.0)	1.5	174	902	(85.1)	0.7	1,576	(91.2)	8.6	674
LPG	68	(7.1)	3.8	59	(5.5)	3.6	-8	70	(6.8)	0.5	35	(3.0)	-7.2	-35	69	(6.5)	-0.3	46	(2.6)	5.5	-23
Other Products	73	(7.7)	9.4	85	(7.9)	10.7	12	81	(7.9)	1.4	81	(7.0)	-0.8	0	89	(8.4)	2.0	107	(6.2)	5.8	18
CDU capacity	1,220	thou.b/d			Oper. Rate:	88.8 %		1,220	thou.b/d			Oper. Rate:	95.0 %		1,820	thou.b/d			Oper. Rate:	95.0 %	
<b>Korea</b>																					
Products Total	2,313	(100.0)	6.6	2,367	(100.0)	6.9	55	2,399	(100.0)	0.5	2,598	(100.0)	1.3	200	2,560	(100.0)	1.3	2,598	(100.0)	0.0	38
Gasoline	158	(6.8)	10.0	191	(8.1)	10.9	33	184	(7.7)	2.1	208	(8.0)	1.2	24	192	(7.5)	0.9	208	(8.0)	0.0	16
Naphtha	666	(28.8)	11.5	392	(16.6)	9.1	-274	749	(31.2)	1.7	468	(18.0)	2.5	-281	822	(32.1)	1.9	468	(18.0)	0.0	-355
Kero/Jet	237	(10.3)	9.0	337	(14.2)	10.1	100	226	(9.4)	-0.7	294	(11.3)	-1.9	68	246	(9.6)	1.7	349	(13.4)	3.4	103
Gas oil	447	(19.3)	6.2	599	(25.3)	7.5	153	493	(20.5)	1.4	728	(28.0)	2.8	235	551	(21.5)	2.3	728	(28.0)	0.0	177
Heavy Fuel	501	(21.7)	2.4	602	(25.4)	3.6	101	442	(18.4)	-1.8	650	(25.0)	1.1	208	435	(17.0)	-0.3	650	(25.0)	0.0	214
Fuel Oil Total	2,009	(86.9)	6.2	2,122	(89.6)	6.6	112	2,093	(87.2)	0.6	2,347	(90.3)	1.5	254	2,246	(87.7)	1.4	2,401	(92.4)	0.5	156
LPG	227	(9.8)	11.8	133	(5.6)	9.6	-95	232	(9.7)	0.3	173	(6.7)	3.9	-59	238	(9.3)	0.4	119	(4.6)	-7.3	-119
Other Products	76	(3.3)	10.6	113	(4.8)	12.3	37	74	(3.1)	-0.5	78	(3.0)	-5.2	4	77	(3.0)	0.8	78	(3.0)	0.0	1
CDU capacity	2,750	thou.b/d			Oper. Rate:	86.1 %		2,735	thou.b/d			Oper. Rate:	95.0 %		2,735	thou.b/d			Oper. Rate:	95.0 %	

**Petroleum Products Balances in East Asia**  
( India Expansion Case )

	2003 ( Actual )							2010					2015								
	Demand (share)	2002/80	Production (share)	2002/80	Net Export	Demand (share)	10/02	Production (share)	10/02	Net Export	Demand (share)	15/02	Production (share)	15/02	Net Export						
	thou.b/d	%	thou.b/d	%	thou.b/d	thou.b/d	%	thou.b/d	%	thou.b/d	thou.b/d	%	thou.b/d	%	thou.b/d						
<b>Singapore</b>																					
Products Total	742	(100.0)	5.9	750	(100.0)	0.7	8	909	(100.0)	2.9	1,270	(100.0)	7.8	362	1,036	(100.0)	2.7	1,270	(100.0)	0.0	234
Gasoline	15	(2.1)	3.1	75	(10.0)	0.3	59	17	(1.9)	1.5	152	(12.0)	10.7	136	18	(1.7)	1.2	152	(12.0)	0.0	135
Naphtha	86	(11.6)	19.7	74	(9.8)	2.1	-12	131	(14.4)	6.2	127	(10.0)	8.1	-4	161	(15.6)	4.3	127	(10.0)	0.0	-34
Kero/Jet	62	(8.4)	5.2	159	(21.2)	0.1	96	73	(8.1)	2.3	327	(25.8)	10.9	254	83	(8.0)	2.5	378	(29.8)	2.9	295
Gas oil	59	(8.0)	3.9	214	(28.6)	2.1	155	70	(7.7)	2.3	445	(35.0)	11.0	375	78	(7.5)	2.2	445	(35.0)	0.0	367
Heavy Fuel	495	(66.7)	5.8	120	(16.0)	-2.4	-375	584	(64.3)	2.4	54	(4.2)	-10.8	-531	658	(63.5)	2.4	3	(0.2)	-43.2	-655
Fuel Oil Total	717	(96.7)	6.0	641	(85.5)	0.2	-76	875	(96.3)	2.9	1,105	(87.0)	8.1	230	998	(96.3)	2.7	1,105	(87.0)	0.0	107
LPG	16	(2.2)	4.4	31	(4.2)	9.8	15	24	(2.7)	6.0	76	(6.0)	13.5	52	28	(2.7)	3.0	76	(6.0)	0.0	48
Other Products	9	(1.2)	1.3	77	(10.3)	5.3	69	10	(1.1)	1.8	89	(7.0)	2.0	79	10	(1.0)	0.4	89	(7.0)	0.0	79
CDU capacity	1,337	thou.b/d		Oper. Rate:	56.1	%		1,337	thou.b/d		Oper. Rate:	95.0	%		1,337	thou.b/d		Oper. Rate:	95.0	%	
<b>Brunei</b>																					
Products Total	12	(100.0)	4.9	11	(100.0)	21.9	-1	14	(100.0)	1.5	10	(100.0)	-1.6	-3	16	(100.0)	2.7	10	(100.0)	0.0	-5
Gasoline	5	(36.8)	5.2	4	(39.3)	0.0	0	5	(35.8)	1.1	0	(0.0)	-100.0	-5	5	(34.0)	1.7	0	(0.0)		-5
Naphtha	0	(1.0)	-1.1	0	(1.2)	0.0	0	0	(1.1)	2.2	3	(27.4)	54.2	3	0	(0.9)	0.0	3	(27.4)	0.0	3
Kero/Jet	2	(14.9)	5.6	2	(15.6)	0.0	0	3	(20.2)	6.0	2	(17.0)	-0.4	-1	4	(23.6)	5.9	2	(17.0)	0.0	-2
Gas oil	4	(28.8)	3.3	3	(30.3)	0.0	0	3	(23.6)	-1.4	3	(25.0)	-4.3	-1	4	(22.6)	1.9	3	(25.0)	0.0	-1
Heavy Fuel	0	(0.2)	0.2	0	(0.2)	0.0	0	0	(0.2)	0.0	0	(1.0)	26.2	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.7)	4.3	10	(86.5)	0.0	0	11	(80.9)	1.3	7	(70.4)	-4.5	-4	13	(81.3)	2.8	7	(70.4)	0.0	-5
LPG	2	(16.1)	13.0	2	(13.5)	11.7	0	2	(16.4)	1.7	1	(11.1)	-4.3	-1	3	(16.1)	2.3	1	(11.1)	0.0	-1
Other Products	0	(2.2)	2.3	0	(0.0)	0.0	0	0	(2.8)	4.8	2	(18.5)	#####	2	0	(2.7)	2.1	2	(18.5)	0.0	1
CDU capacity	9	thou.b/d		Oper. Rate:	132.5	%		9	thou.b/d		Oper. Rate:	118.2	%		9	thou.b/d		Oper. Rate:	118.2	%	
<b>Indonesia</b>																					
Products Total	1,320	(100.0)	5.2	1,043	(100.0)	4.7	-277	1,708	(100.0)	3.8	962	(100.0)	-1.1	-746	1,973	(100.0)	2.9	952	(100.0)	-0.2	-1,021
Gasoline	244	(18.5)	6.3	192	(18.4)	6.6	-52	327	(19.1)	4.3	281	(29.2)	5.6	-46	386	(19.6)	3.4	372	(39.0)	5.8	-15
Naphtha	50	(3.8)	0.0	48	(4.6)	0.0	-1	72	(4.2)	5.6	0	(0.0)	-100.0	-72	90	(4.5)	4.4	0	(0.0)		-90
Kero/Jet	261	(19.8)	2.6	195	(18.7)	4.5	-66	337	(19.7)	3.7	90	(9.4)	-10.4	-247	398	(20.2)	3.4	85	(8.9)	-1.2	-313
Gas oil	537	(40.7)	6.1	297	(28.5)	7.8	-240	697	(40.8)	3.8	318	(33.0)	0.9	-379	795	(40.3)	2.7	314	(33.0)	-0.2	-481
Heavy Fuel	175	(13.3)	4.4	235	(22.5)	1.3	60	214	(12.5)	2.9	231	(24.0)	-0.2	17	236	(12.0)	1.9	136	(14.3)	-10.1	-100
Fuel Oil Total	1,266	(95.9)	5.1	967	(92.7)	4.6	-300	1,647	(96.4)	3.8	920	(95.6)	-0.7	-727	1,905	(96.6)	3.0	906	(95.2)	-0.3	-998
LPG	39	(3.0)	10.8	38	(3.6)	4.0	-1	47	(2.7)	2.7	23	(2.4)	-6.5	-23	53	(2.7)	2.6	27	(2.8)	2.6	-27
Other Products	15	(1.1)	4.7	39	(3.7)	9.2	24	15	(0.9)	0.0	19	(2.0)	-9.5	5	15	(0.7)	0.0	19	(2.0)	-0.2	5
CDU capacity	993	thou.b/d		Oper. Rate:	105.1	%		1,093	thou.b/d		Oper. Rate:	88.1	%		1,360	thou.b/d		Oper. Rate:	70.0	%	
<b>Malaysia</b>																					
Products Total	514	(100.0)	5.1	470	(100.0)	6.3	-43	740	(100.0)	5.4	518	(100.0)	1.4	-222	889	(100.0)	3.7	660	(100.0)	5.0	-229
Gasoline	175	(34.0)	8.5	96	(20.3)	7.3	-79	268	(36.2)	6.3	121	(23.4)	3.5	-147	327	(36.8)	4.1	187	(28.4)	9.1	-140
Naphtha	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	45	(8.8)	5.8	70	(14.8)	9.3	25	69	(9.3)	6.2	47	(9.0)	-5.6	-22	84	(9.5)	4.1	66	(10.0)	7.3	-18
Gas oil	194	(37.8)	5.7	189	(40.1)	7.5	-5	266	(35.9)	4.6	242	(46.8)	3.6	-23	314	(35.3)	3.4	264	(40.0)	1.7	-50
Heavy Fuel	48	(9.4)	-0.9	37	(7.8)	-0.9	-11	53	(7.2)	1.4	9	(1.8)	-17.9	-44	60	(6.7)	2.5	17	(2.6)	13.2	-43
Fuel Oil Total	462	(89.9)	4.9	391	(83.1)	5.7	-71	655	(88.6)	5.1	419	(81.0)	1.0	-236	785	(88.3)	3.7	535	(81.0)	5.0	-250
LPG	29	(5.7)	9.2	25	(5.3)	8.9	-5	36	(4.9)	3.1	52	(10.0)	11.0	15	44	(5.0)	4.1	66	(10.0)	5.0	22
Other Products	22	(4.3)	6.4	55	(11.6)	13.9	32	48	(6.5)	11.7	47	(9.0)	-2.3	-2	60	(6.7)	4.2	59	(9.0)	5.0	0
CDU capacity	516	thou.b/d		Oper. Rate:	91.1	%		545	thou.b/d		Oper. Rate:	95.0	%		695	thou.b/d		Oper. Rate:	94.9	%	

**Petroleum Products Balances in East Asia**  
( India Expansion Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>Philippines</b>																					
Products Total	328	(100.0)	1.6	255	(100.0)	1.4	-73	378	(100.0)	2.1	316	(100.0)	3.1	-62	474	(100.0)	4.6	316	(100.0)	0.0	-157
Gasoline	64	(19.6)	3.8	41	(16.1)	1.5	-23	90	(23.8)	4.9	13	(4.1)	-15.1	-77	122	(25.8)	6.3	54	(17.0)	32.7	-68
Naphtha	1	(0.2)	-4.7	12	(4.6)	8.2	11	1	(0.2)	0.1	47	(14.7)	21.6	46	1	(0.2)	0.0	13	(4.0)	-22.9	12
Kero/Jet	27	(8.3)	3.1	22	(8.6)	1.3	-5	35	(9.2)	3.6	52	(16.5)	13.2	17	46	(9.6)	5.6	46	(14.4)	-2.7	0
Gas oil	128	(39.0)	3.7	83	(32.5)	2.7	-45	154	(40.8)	2.7	77	(24.5)	-1.0	-77	201	(42.4)	5.4	68	(21.6)	-2.5	-132
Heavy Fuel	72	(21.9)	-1.9	78	(30.6)	0.0	6	49	(12.8)	-5.4	101	(32.0)	3.8	53	48	(10.1)	-0.3	101	(32.0)	0.0	53
Fuel Oil Total	292	(89.1)	1.4	236	(92.5)	1.4	-56	328	(86.8)	1.7	290	(91.8)	3.0	-38	417	(88.1)	4.9	282	(89.0)	-0.6	-135
LPG	32	(9.7)	4.1	16	(6.3)	1.6	-16	46	(12.0)	5.2	23	(7.2)	5.2	-23	52	(10.9)	2.6	32	(10.0)	6.8	-20
Other Products	4	(1.2)	-1.3	3	(1.3)	-0.9	-1	4	(1.2)	1.7	3	(1.0)	-0.2	-1	5	(1.0)	1.5	3	(1.0)	0.0	-2
CDU capacity	333	thou.b/d				Oper. Rate: 76.6 %		333	thou.b/d				Oper. Rate: 95.0 %		333	thou.b/d				Oper. Rate: 95.0 %	
<b>Thailand</b>																					
Products Total	785	(100.0)	5.5	819	(100.0)	7.7	34	1,070	(100.0)	4.5	723	(100.0)	-1.8	-347	1,289	(100.0)	3.8	933	(100.0)	5.2	-356
Gasoline	123	(15.7)	5.8	139	(17.0)	7.4	16	175	(16.4)	5.2	168	(23.2)	2.7	-7	214	(16.6)	4.1	199	(21.4)	3.5	-15
Naphtha	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	61	(7.8)	4.9	81	(9.9)	6.7	20	87	(49.7)	5.2	3	(0.4)	-37.4	-84	106	(8.3)	4.1	106	(11.4)	103.8	0
Gas oil	320	(40.8)	6.8	342	(41.7)	8.9	21	450	(0.0)	5.0	438	(60.6)	3.6	-12	549	(42.6)	4.1	493	(52.9)	2.4	-56
Heavy Fuel	139	(17.8)	1.8	160	(19.6)	5.3	21	171	(196.7)	3.0	21	(2.8)	-25.4	-151	199	(15.5)	3.1	24	(2.6)	3.1	-175
Fuel Oil Total	644	(82.1)	4.8	722	(88.1)	7.3	78	884	(82.6)	4.6	630	(87.1)	-1.9	-254	1,069	(83.0)	3.9	823	(88.2)	5.5	-246
LPG	120	(15.3)	13.4	77	(9.3)	12.7	-43	154	(34.3)	3.7	77	(10.7)	0.1	-77	182	(14.1)	3.4	91	(9.8)	3.4	-91
Other Products	21	(2.7)	8.5	21	(2.6)	10.1	0	31	(18.3)	5.9	16	(2.2)	-3.8	-15	37	(2.9)	3.6	19	(2.0)	3.2	-19
CDU capacity	703	thou.b/d				Oper. Rate: 116.5 %		761	thou.b/d				Oper. Rate: 95.0 %		982	thou.b/d				Oper. Rate: 95.0 %	
<b>Vietnam</b>																					
Products Total	222	(100.0)	8.1	0	(0.0)		-222	300	(100.0)	4.4	141	(100.0)	0.0	-160	393	(100.0)	5.6	230	(100.0)	10.3	-163
Gasoline	47	(21.0)	8.1	0	(0.0)		-47	56	(18.5)	2.6	35	(25.0)	0.0	-20	65	(16.6)	3.3	57	(25.0)	10.3	-8
Naphtha	0	(0.0)	0.0	0	(0.0)		0	0	(0.0)	0.0	16	(11.3)	0.0	16	0	(0.0)	0.0	0	(0.0)	0.0	0
Kero/Jet	13	(5.8)	4.1	0	(0.0)		-13	16	(28.7)	3.1	0	(0.0)	0.0	-16	20	(5.1)	4.6	20	(8.7)		0
Gas oil	93	(42.0)	8.0	0	(0.0)		-93	135	(0.0)	5.4	74	(52.7)	0.0	-61	180	(45.7)	5.9	79	(34.4)	1.3	-101
Heavy Fuel	46	(20.9)	8.4	0	(0.0)		-46	61	(381.7)	4.0	4	(2.5)	0.0	-57	90	(23.0)	8.2	45	(19.4)	66.4	-46
Fuel Oil Total	199	(89.7)	7.7	0	(0.0)		-199	267	(89.0)	4.3	129	(91.5)	0.0	-138	355	(90.3)	5.9	201	(87.5)	9.3	-154
LPG	14	(6.2)	23.9	0	(0.0)		-14	24	(17.8)	8.2	12	(8.5)	0.0	-12	29	(7.3)	3.8	29	(12.5)	19.2	0
Other Products	9	(4.1)	10.8	0	(0.0)		-9	9	(15.0)	0.0	0	(0.0)	0.0	-9	9	(2.3)	0.0	0	(0.0)	0.0	-9
CDU capacity	0	thou.b/d				Oper. Rate: 0.0 %		148	thou.b/d				Oper. Rate: 95.0 %		242	thou.b/d				Oper. Rate: 94.9 %	
<b>East Asia (excluding Japan)</b>																					
Products Total	12,766	(100.0)	5.4	11,658	(100.0)	4.9	-1,108	16,570	(100.0)	3.8	14,821	(100.0)	3.5	-1,749	19,583	(100.0)	3.4	17,282	(100.0)	3.1	-2,301
Gasoline	1,882	(14.7)	6.6	1,975	(16.9)	6.4	93	2,625	(15.8)	4.9	2,489	(16.8)	3.4	-137	3,240	(16.5)	4.3	2,876	(16.6)	2.9	-363
Naphtha	1,607	(12.6)	11.4	1,272	(10.9)	8.8	-336	2,360	(14.2)	5.6	1,748	(11.8)	4.6	-613	2,760	(14.1)	3.2	2,006	(11.6)	2.8	-755
Kero/Jet	1,016	(8.0)	4.7	1,108	(9.5)	4.5	91	1,274	(7.7)	3.3	1,241	(8.4)	1.6	-33	1,565	(8.0)	4.2	1,567	(9.1)	4.8	3
Gas oil	3,783	(29.6)	6.5	3,742	(32.1)	6.5	-40	4,965	(30.0)	4.0	5,086	(34.3)	4.5	121	6,155	(31.4)	4.4	6,018	(34.8)	3.4	-137
Heavy Fuel	2,663	(20.9)	2.1	1,937	(16.6)	0.8	-726	3,019	(18.2)	1.8	2,033	(13.7)	0.7	-986	3,228	(16.5)	1.3	2,189	(12.7)	1.5	-1,039
Fuel Oil Total	10,952	(85.8)	5.1	10,034	(86.1)	4.6	-918	14,244	(86.0)	3.8	12,596	(85.0)	3.3	-1,648	16,947	(86.5)	3.5	14,656	(84.8)	3.1	-2,291
LPG	1,164	(9.1)	9.9	846	(7.3)	8.4	-318	1,178	(7.1)	0.2	1,015	(6.8)	2.6	-163	1,315	(6.7)	2.2	927	(5.4)	-1.8	-387
Other Products	650	(5.1)	5.0	779	(6.7)	5.6	128	1,148	(6.9)	8.5	1,210	(8.2)	6.5	62	1,321	(6.7)	2.8	1,699	(9.8)	7.0	378
CDU capacity	13,479	thou.b/d				Oper. Rate: 86.5 %		16,626	thou.b/d				Oper. Rate: 89.1 %		19,671	thou.b/d				Oper. Rate: 87.9 %	

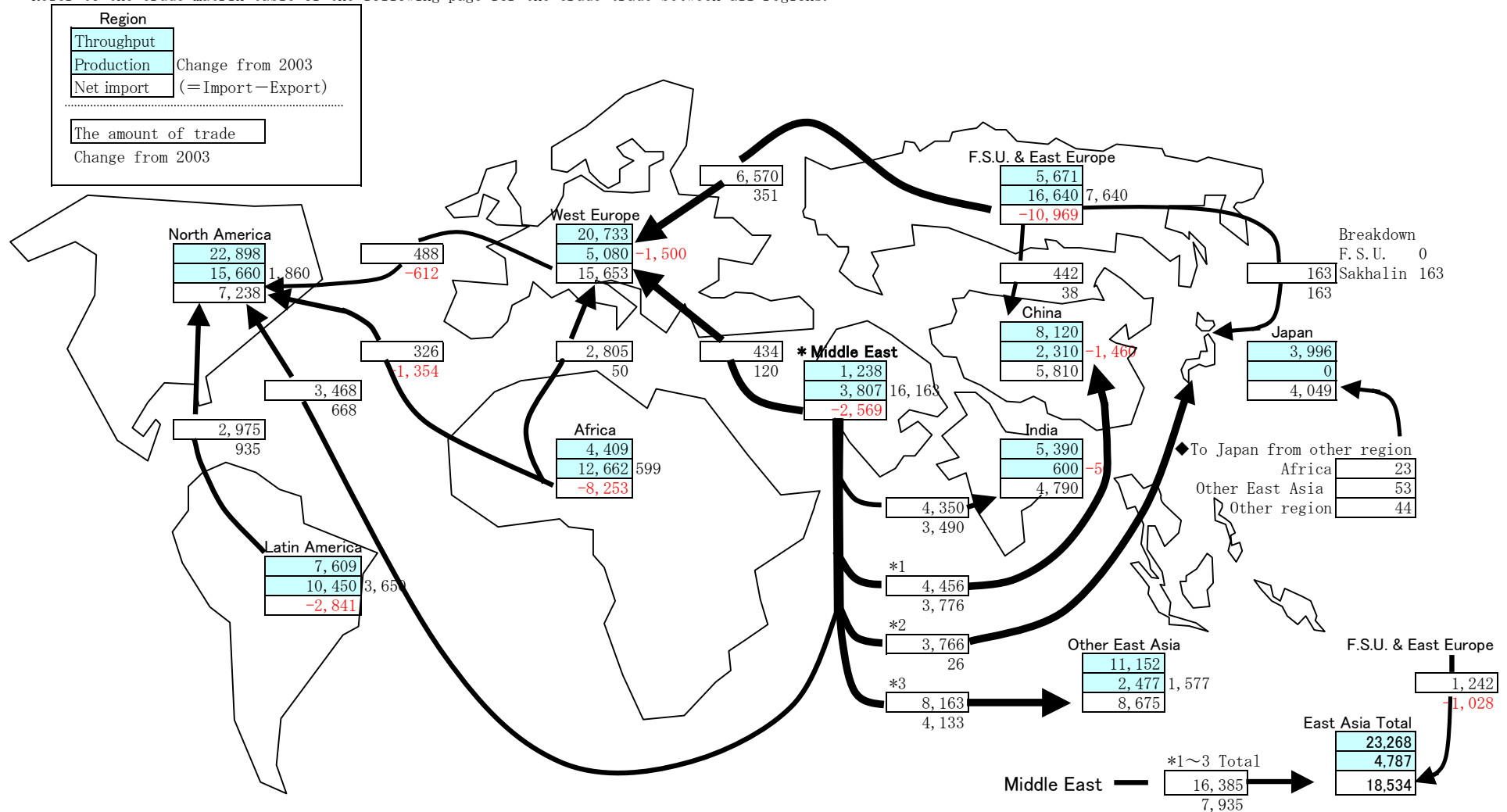
**Petroleum Products Balances in East Asia**  
( India Expansion Case )

	2003 ( Actual )							2010					2015								
	Demand	(share)	2002/80	Production	(share)	2002/80	Net Export	Demand	(share)	10/02	Production	(share)	10/02	Net Export	Demand	(share)	15/02	Production	(share)	15/02	Net Export
	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d	thou.b/d	%	%/Y	thou.b/d	%	%/Y	thou.b/d
<b>India</b>																					
Products Total	2,483	(100.0)	6.0	2,585	(100.0)	7.2	102	3,135	(100.0)	3.4	3,548	(100.0)	4.6	413	3,784	(100.0)	3.8	4,785	(100.0)	6.2	1,001
Gasoline	176	(7.1)	7.6	245	(9.5)	9.2	69	224	(7.2)	3.5	245	(6.9)	0.0	20	257	(6.8)	2.7	649	(13.6)	21.5	392
Naphtha	266	(10.7)	7.9	236	(9.1)	7.4	-30	350	(11.2)	4.0	567	(16.0)	13.4	217	436	(11.5)	4.5	544	(11.4)	-0.8	108
Kero/Jet	278	(11.2)	4.0	317	(12.3)	6.7	39	341	(10.9)	3.0	355	(10.0)	1.6	14	412	(10.9)	3.9	479	(10.0)	6.2	66
Gas oil	882	(35.5)	5.9	970	(37.5)	7.7	88	1,068	(34.1)	2.8	1,384	(39.0)	5.2	316	1,236	(32.7)	3.0	1,866	(39.0)	6.2	630
Heavy Fuel	344	(13.9)	3.4	378	(14.6)	4.6	34	454	(14.5)	4.0	454	(12.8)	2.7	0	579	(15.3)	5.0	635	(13.3)	7.0	56
Fuel Oil Total	1,946	(78.4)	5.4	2,145	(83.0)	6.9	200	2,438	(77.8)	3.3	3,004	(84.7)	4.9	567	2,920	(77.2)	3.7	4,173	(87.2)	6.8	1,253
LPG	284	(11.4)	12.5	191	(7.4)	10.8	-93	343	(10.9)	2.7	319	(9.0)	7.6	-24	432	(11.4)	4.7	431	(9.0)	6.2	-2
Other Products	253	(10.2)	7.6	249	(9.6)	8.2	-4	354	(11.3)	4.9	224	(6.3)	-1.5	-130	432	(11.4)	4.0	181	(3.8)	-4.2	-250
CDU capacity	2,135	thou.b/d			Oper. Rate:	121.1 %		3,316	thou.b/d			Oper. Rate:	107.0 %		4,472	thou.b/d			Oper. Rate:	107.0 %	
<b>Other Asia</b>																					
Products Total	635	(100.0)	4.4	323	(100.0)	1.9	-313	863	(100.0)	4.5	507	(100.0)	6.7	-356	1,092	(100.0)	4.8	737	(100.0)	7.8	-355
Gasoline	66	(10.3)	2.7	48	(14.8)	1.8	-18	89	(10.3)	4.4	120	(23.7)	14.0	31	103	(9.4)	3.0	109	(14.9)	-1.8	7
Naphtha	4	(0.6)	0.0	18	(5.5)	2.8	14	4	(0.4)	0.0	4	(0.7)	-20.2	0	4	(0.3)	0.0	8	(1.1)	16.9	4
Kero/Jet	71	(11.1)	1.8	41	(12.7)	1.1	-30	94	(10.9)	4.2	51	(10.0)	3.1	-44	125	(11.5)	5.8	125	(17.0)	19.8	0
Gas oil	310	(48.8)	5.5	102	(31.6)	2.5	-208	413	(47.9)	4.2	137	(27.0)	4.3	-276	523	(47.9)	4.8	206	(27.9)	8.5	-317
Heavy Fuel	142	(22.4)	4.7	82	(25.4)	1.0	-60	212	(24.5)	5.8	144	(28.5)	8.4	-67	277	(25.4)	5.6	221	(30.0)	8.9	-56
Fuel Oil Total	593	(93.3)	4.3	291	(90.0)	1.8	-302	811	(94.0)	4.6	456	(89.9)	6.6	-356	1,032	(94.5)	4.9	669	(90.9)	8.0	-362
LPG	23	(3.7)	7.1	12	(3.8)	4.2	-11	26	(3.1)	1.7	26	(5.1)	11.3	0	30	(2.8)	2.8	30	(4.1)	3.1	0
Other Products	19	(3.1)	2.7	20	(6.2)	2.5	1	25	(2.9)	3.7	25	(5.0)	3.5	0	30	(2.8)	3.7	37	(5.0)	7.8	7
CDU capacity	477	thou.b/d			Oper. Rate:	67.6 %		512	thou.b/d			Oper. Rate:	98.9 %		744	thou.b/d			Oper. Rate:	99.0 %	
<b>Asia (excluding Japan)</b>																					
Products Total	15,885	(100.0)	5.4	14,566	(100.0)	5.1	-1,318	20,567	(100.0)	3.8	18,876	(100.0)	3.8	-1,691	24,459	(100.0)	3.5	22,804	(100.0)	3.9	-1,656
Gasoline	2,124	(13.4)	6.5	2,268	(15.6)	6.5	144	2,938	(14.3)	4.7	2,854	(15.1)	3.3	-85	3,599	(14.7)	4.1	3,634	(15.9)	5.0	35
Naphtha	1,877	(11.8)	10.7	1,525	(10.5)	8.4	-352	2,714	(13.2)	5.4	2,318	(12.3)	6.2	-396	3,200	(13.1)	3.4	2,558	(11.2)	2.0	-642
Kero/Jet	1,365	(8.6)	4.3	1,465	(10.1)	4.7	101	1,710	(8.3)	3.3	1,646	(8.7)	1.7	-64	2,102	(8.6)	4.2	2,171	(9.5)	5.7	69
Gas oil	4,975	(31.3)	6.3	4,814	(33.0)	6.6	-161	6,446	(31.3)	3.8	6,607	(35.0)	4.6	160	7,914	(32.4)	4.2	8,090	(35.5)	4.1	176
Heavy Fuel	3,150	(19.8)	2.3	2,397	(16.5)	1.2	-752	3,685	(17.9)	2.3	2,632	(13.9)	1.3	-1,053	4,084	(16.7)	2.1	3,045	(13.4)	3.0	-1,039
Fuel Oil Total	13,491	(84.9)	5.1	12,470	(85.6)	4.9	-1,021	17,493	(85.1)	3.8	16,056	(85.1)	3.7	-1,437	20,899	(85.4)	3.6	19,499	(85.5)	4.0	-1,401
LPG	1,472	(9.3)	10.2	1,049	(7.2)	8.7	-423	1,547	(7.5)	0.7	1,360	(7.2)	3.8	-187	1,777	(7.3)	2.8	1,388	(6.1)	0.4	-389
Other Products	923	(5.8)	5.5	1,048	(7.2)	6.0	125	1,527	(7.4)	7.5	1,460	(7.7)	4.9	-67	1,783	(7.3)	3.1	1,917	(8.4)	5.6	134
CDU capacity	16,092	thou.b/d			Oper. Rate:	90.5 %		20,454	thou.b/d			Oper. Rate:	92.3 %		24,887	thou.b/d			Oper. Rate:	91.6 %	
<b>Asia</b>																					
Products Total	21,274	(100.0)	3.6	18,926	(100.0)	3.4	-2,348	25,703	(100.0)	2.7	23,314	(100.0)	3.0	-2,389	29,556	(100.0)	2.8	27,242	(100.0)	3.2	-2,314
Gasoline	3,118	(14.7)	4.9	3,230	(17.1)	4.9	112	3,952	(15.4)	3.4	4,013	(17.2)	3.1	61	4,601	(15.6)	3.1	4,593	(16.9)	2.7	-8
Naphtha	2,682	(12.6)	6.5	1,830	(9.7)	5.0	-852	3,519	(13.7)	4.0	2,562	(11.0)	4.9	-957	4,006	(13.6)	2.6	2,802	(10.3)	1.8	-1,204
Kero/Jet	2,105	(9.9)	3.3	2,115	(11.2)	3.4	11	2,430	(9.5)	2.1	2,334	(10.0)	1.4	-96	2,817	(9.5)	3.0	2,859	(10.5)	4.1	42
Gas oil	6,224	(29.3)	5.1	6,052	(32.0)	5.3	-172	7,532	(29.3)	2.8	7,761	(33.3)	3.6	228	8,995	(30.4)	3.6	9,244	(33.9)	3.6	249
Heavy Fuel	3,849	(18.1)	0.3	3,083	(16.3)	-0.4	-766	4,167	(16.2)	1.1	3,075	(13.2)	0.0	-1,092	4,537	(15.4)	1.7	3,534	(13.0)	2.8	-1,003
Fuel Oil Total	17,977	(84.5)	3.4	16,310	(86.2)	3.2	-1,667	21,601	(84.0)	2.7	19,745	(84.7)	2.8	-1,855	24,956	(84.4)	2.9	23,033	(84.5)	3.1	-1,924
LPG	2,092	(9.8)	5.4	1,349	(7.1)	5.6	-743	2,069	(8.0)	-0.2	1,621	(7.0)	2.7	-448	2,312	(7.8)	2.2	1,788	(6.6)	2.0	-524
Other Products	1,205	(5.7)	4.1	1,267	(6.7)	4.6	62	2,034	(7.9)	7.8	1,948	(8.4)	6.3	-86	2,288	(7.7)	2.4	2,422	(8.9)	4.4	134
CDU capacity	20,794	thou.b/c	0		Oper. Rate:	91.0 %		25,126	thou.b/c	0		Oper. Rate:	92.8 %		29,559	thou.b/c	0		Oper. Rate:	92.2 %	

### World crude oil trade flows among major regions (2020)

(Unit: 1,000 B/D)

\*Refer to the crude matrix table of the following page for the crude trade between all regions.



\*Other East Asia=Korea, Chinese Taipei, Hong Kong, Singapore, Malaysia Thailand, Phillipines, Vietnam, Brunei

## The Crude trade matrix between main regions (2020)

Unit:1,000 of b/d

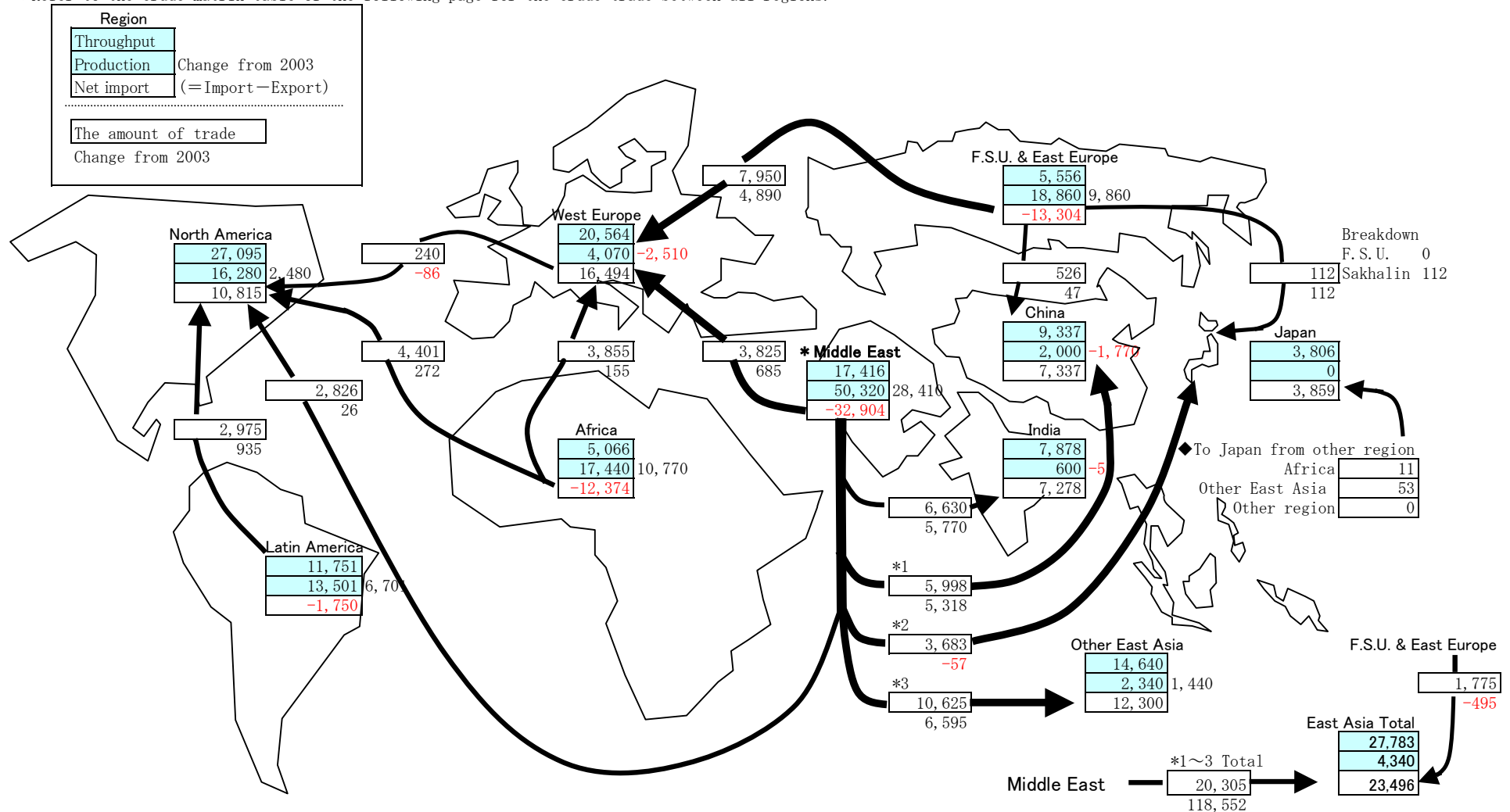
	TO Region	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
	FROM Region	North America	Latin America	OECD Europe	F.S.U and Non OECD Europe	Africa	Middle East	Oceania	China	Japan	Other East Asia	India	Other Asia	East Asia Total	Total Export	
A	North America	2,834		1,881						44				44	4,759	North America
B	Latin America	2,975		860				372	744				537	744	5,488	Latin America
C	OECD Europe	488		87			314								889	OECD Europe
D	F.S.U and Non OECD Europe	1,193	1,964	6,570					442	163	637			1,242	10,969	F.S.U and Non OECD Europe
E	Africa	326	683	2,805			3,390		587	23		440		610	8,253	Africa
F	Middle East	3,468		4,339				213	4,456	3,766	8,163	4,350	638	16,385	29,392	Middle East
G	Oceania	140						76					85	85	301	Oceania
H	China	482													482	China
I	Japan															Japan
J	Other East Asia	90						3	64	53	835			952	1,045	Other East Asia
K	India															India
L	Other Asia															Other Asia
M	East Asia Total	573						3	64	53	835				1,528	East Asia Total
N	Total Import	11,997	2,648	16,542			3,703	664	6,293	4,049	9,720	4,790	1,174	20,062	61,579	
O	Total Export	4,759	5,488	889	10,969	8,253	29,392	301	482		1,045			1,528		
P	Throughput	22,898	7,609	20,733	5,671	4,409	12,384	1,103	8,120	3,996	11,152	5,390	1,174	23,268		
Q	Production	15,660	10,450	5,080	16,640	12,662	38,073	740	2,310	0	2,477	600	0	4,787		
R	Net Import	7,238	-2,841	15,653	-10,969	-8,253	-25,689	363	5,810	4,049	8,675	4,790	1,174	18,534		

The numerical value of diagonal line inside the thick frame is the amount of trade in an area.  
The amount of trade of a net credit portion is added up to a "world main crude-oil flow" figure.  
East Asia sum total = China + Japan +Other East Asia, Other Asia

### World crude oil trade flows among major regions (2030)

(Unit: 1,000 B/D)

\*Refer to the crude matrix table of the following page for the crude trade between all regions.



\*Other East Asia=Korea, Chinese Taipei, Hong Kong, Singapore, Malaysia Thailand, Phillipines, Vietnam, Brunei

## The Crude trade matrix between main regions (2030)

Unit:1,000 of b/d

	TO Region	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
	FROM Region	North America	Latin America	OECD Europe	F.S.U and Non OECD Europe	Africa	Middle East	Oceania	China	Japan	Other East Asia	India	Other Asia	East Asia Total	Total Export	
A	North America	3,994		1,506											5,500	North America
B	Latin America	2,975		1,148				399			968	265	351	968	6,108	Latin America
C	OECD Europe	240					1,550								1,790	OECD Europe
D	F.S.U and Non OECD Europe	1,568	2,009	7,950				1	526	112	1,137			1,775	13,304	F.S.U and Non OECD Europe
E	Africa	4,401	2,349	3,855			617		599	11		383	160	610	12,374	Africa
F	Middle East	2,826		3,825				213	5,998	3,683	10,625	6,630	1,273	20,305	35,072	Middle East
G	Oceania	170						9							179	Oceania
H	China															China
I	Japan															Japan
J	Other East Asia	141						22	214	53	792			1,059	1,221	Other East Asia
K	India															India
L	Other Asia															Other Asia
M	East Asia Total	141						22	214	53	792				1,221	East Asia Total
N	Total Import	16,315	4,357	18,284			2,168	644	7,337	3,859	13,522	7,278	1,784	24,717	75,548	
O	Total Export	5,500	6,108	1,790	13,304	12,374	35,072	179			1,221			1,221		
P	Throughput	27,095	11,751	20,564	5,556	5,066	17,416	1,235	9,337	3,806	14,640	7,878	1,784	27,783		
Q	Production	16,280	13,501	4,070	18,860	17,440	50,320	770	2,000	0	2,340	600	0	4,340		
R	Net Import	10,815	-1,750	16,494	-13,304	-12,374	-32,904	465	7,337	3,859	12,300	7,278	1,784	23,496		

The numerical value of diagonal line inside the thick frame is the amount of trade in an area.

The amount of trade of a net credit portion is added up to a "world main crude-oil flow" figure.

East Asia sum total = China + Japan +Other East Asia, Other Asia