Asia Outlook
of
Supply and Demand Trends of Petroleum Products and Crude Oil

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Supply and Demand Trends of Petroleum Products and Crude Oil by using Econometric Model

1. Research background and objective

Prior to the economic crisis that struck the Asian region in 1997, the demand for oil in East Asia outside Japan grew at a rapid pace averaging on the order of 7% annually. This growth was a major concern as viewed from the aspect of assuring a stable supply of oil to Japan. However, in 1998, directly after the outbreak of the crisis, the situation rapidly worsened. The Asian demand for oil declined and created a surplus supply of petroleum products. More recently, the rapid expansion of demand accompanying economic growth in China is causing apprehensions about another tightening of the product supply. This year, too, there have surfaced developments with a big impact on the oil industry, including record-high crude oil prices and the continuing fighting in Iraq.

In this climate of sweeping change, it will presumably continue to be increasingly vital to conduct analyses, incorporating the latest energy and economic information, of the petroleum product supply and demand in East Asia, which has an especially big impact on the supply and demand in Japan.

Furthermore, the long-term outlook holds the prospect of an expanding demand for oil products and crude oil in Asia in general and China in particular. Under these circumstances, it is surely of great worth to Japan's energy security to make a quantitative analysis of the changes in the mix of crude oil sources and related possibilities, followed by an estimate of the impact on Japan's crude oil import.

This research was implemented by the Institute of Energy Economics Japan (IEEJ) on commission from the Ministry of Economy, Trade and Industry under the provisions for investigative research of the oil industry (FY2004 study of the trend of petroleum product supply and demand using econometric models). The research was promoted by organizing an international working group (WG) to pursue the studies in a committee.

2. Issues presented by the international working group in FY2004

(1) China is expected to continue achieving economic growth on the 8% order over the coming years. The jump in its oil demand in correspondence with this rate and the lifting of restrictions on trade in petroleum products along with its admission into the World Trade Organization (WTO) are anticipated to have a major influence on all of East Asia given the magnitude of its demand. The most important consideration in forecasting the petroleum product demand is the trend of increase in China's refining capacity. It is difficult to predict this trend because of the many variables involved. For this reason, as in last year, the WG placed a separate case of higher CDU capacity in China for a diversified analysis.

(2) The outlook for the sustainability of China's economic growth is clouded by numerous factors of uncertainty, including the appreciation of the renminbi (RMB) and domestic gaps in respect of advancement. A slowing of growth around 2010 would undoubtedly affect other Asian countries, and the degree of decrease in the oil demand accompanying the deceleration of economic growth in Asia would come to the fore as a key point. For these reasons, the WG also considered the case of lower economic growth in Asia.

(3) There are also apprehensions about a rapid rise in import of crude oil in China and other parts of East Asia. It may also be noted, however, that oil development is moving ahead in the Russian Federation and other areas outside the Middle East and near Asia. The WG therefore decided to make a forecast of the long-term trend of crude oil supply and demand in the world as a whole in 2020 and 2030 based on the long-term trend of production of both Middle East and non-Middle East crude oil, and investigate the effect on Japan's crude oil import.

(4) More specifically, the WG focused on the East Asian region for the crude oil supply and demand as well, and made an analysis of the prospective change in degree of dependence on the Middle East for supply in China and Japan, and the trend of competing crude oil, as of 2030. It also made an analysis of the impact of a higher average heaviness in crude oil production worldwide and expansion of API index differentials.

This awareness formed the backdrop for the WG study of the future trend of crude oil and petroleum product supply and demand in East Asia.

II. Course of the studies of the international working group

1. Activities of the international working group in FY2004

(1) Beginning in December 2004, the WG was convened three times for analysis of the international petroleum product supply and demand in 2010 and 2015, and the international crude oil supply and demand in 2020 and 2030, mainly in East Asia* (here and below, excluding Japan unless noted otherwise).

*As used in this report, the term "East Asia" refers to the countries (or territories) of China, Korea (i.e., the Republic of Korea), Taiwan, Hong Kong, Singapore, Brunei, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam.

(2) As for the analytical methodology, the WG applied the world energy demand estimate model (econometric model) and world oil refining and trade flow model (linear programming model) of the IEEJ's Energy Data and Modeling Center. Based on the problem awareness described above, studies focused on the oil supply and demand in East Asia, and proceeded by pooling the knowledge of the WG members. (For an outline of the models and analytical methodology, see the attachment.)

2. Case development and major premises

(1) GDP growth rate forecast

Gross domestic product (GDP) growth rates were set on the levels shown in Table 1 based on the forecasts announced by the Asian Development Bank (ADB), the planning figures released by national governments, and information from field studies.

Table 1 Forecast of GDP growth rates in East Asian countries (average annual growth rates; %)

Average annual growth rate; %

Asia	Existing CDU plan case				Case of lower economic growth in Asia		
	2010/2002	2015/2010	2020/2015	2030/2020	2015/2010	2020/2015	2030/2020
China	8.0	6.6	6.6	5.1	5.6	5.6	4.1
Hong Kong	4.5	4.6	4.5	4.4	3.6	3.5	3.4
Taiwan	4.6	4.0	3.4	2.6	3.0	2.4	1.6
Korea	4.8	3.6	3.3	2.7	2.6	2.3	1.7
Singapore	4.0	3.7	3.7	3.9	2.7	2.7	2.9
Brunei	4.4	3.9	3.7	3.5	2.9	2.7	2.5
Indonesia	4.5	4.5	4.5	4.2	3.5	3.5	3.2
Malaysia	5.0	5.0	5.0	4.8	4.0	4.0	3.8
Philippines	4.1	4.9	4.9	4.6	3.9	3.9	3.6
Thailand	5.5	5.0	5.0	4.8	4.0	4.0	3.8
Vietnam	7.0	6.0	6.0	5.6	5.0	5.0	4.6
East Asia total (excluding Japan)	7.6	6.3	6.3	5.0	5.3	5.3	4.0
Japan	2.0	1.7	1.7	1.2	1.2	1.2	0.7
India	6.1	5.5	5.5	5.3	4.5	4.5	4.3
Other Asian countries	6.4	6.1	6.1	4.9	5.1	5.1	3.9
Asia total (base demand)	6.1	5.4	5.5	4.5	4.4	4.6	3.5

Source: prepared with reference to data from long-term economic plans and outlooks prepared by the ADB and the related institutions of national government in the countries in question.

* In the case of lower economic growth in Asia, the GDP growth rate forecast values for 2011 and succeeding years were set 1% lower in other Asian countries, and 0.5 % lower in Japan, than in the existing plan case.

(2) Crude oil price

The study applied to the crude oil price forecasts from "Annual Energy Outlook 2005" prepared by the U.S. Department of Energy (DOE).

Table 2 Forecast of crude oil prices ($/bbl)

(US$/bbl)

	2002	2004	2007	2010	2015	2020	2025
Real 2001 prices	22.7	33.0	25.7	23.6	25.7	28.3	31.6
Nominal prices	23.7	35.7	29.5	28.7	34.6	42.0	51.9

Source: "Annual Energy Outlook 2005 (Early Release)" by DOE/EIA

(3) Cases studied

(Factors of fluctuation and case development)

There are various factors of fluctuation to be considered in forecasts of the crude oil and petroleum product supply and demand, and the absolute forecast figures will vary depending on changes in the premises (preconditions) regarding them. As such, in studies for future policy-making, a proper apprehension of the conceivable changes that could possibly occur and quantitative analysis of their occurrence possibility and degree of influence are thought to be more important than a weighing of the highness or lowness of the absolute forecast values. The WG consequently developed several cases (noted below) which were judged to have a high possibility of occurrence and a high degree of influence.

(Notable item: perspective on supply capacity in China)

In the following cases, the factor with the greatest influence on the petroleum product supply and demand in Asia is the outlook on refining capacity in China. The 2015 capacity resulting from implementation of existing plans for capacity increase would not be large enough to meet the demand increase forecast to that year. There is consequently thought to be a good possibility of the addition of new plans for capacity increase to the level in the case of a high supply (refining) capacity (10.4 million b/d), provided that the demand remains firm.

1) Summary of cases in the study of petroleum product supply and demand (the details are presented in later sections)

Table 3 Overview of cases applied in the study

	Case	Subject years	Differences from the base case
1	Existing CDU plan case[1]	2010, 2015	
2	Case of higher CDU capacity in China (10.4 million b/d)[2]	2015	CDU capacity of 10.4 million b/d, 1 million more than the base case level of 9.4 million b/d
3	Case of lower economic growth in Asia[3]	2015	Downward revision of the GDP growth rate, etc., beginning in 2010 (see the following page)

* The expanded refining capacity would consist of crude distillation units (CDUs) and secondary equipment.

2) Summary of cases in the study of long-term crude oil supply and demand (the details are described in Chapter IV, "Analysis of crude oil supply and demand")

Table 4 Overview of cases applied in the study

	Case	Subject years	Differences from the base case
1	Base case	2020, 2030	
2	Case of heavier crude oil mix	2030	Increase in the share of crude oil production occupied by heavy crude oil from Saudi Arabia, Canada, and other countries
3	Case of an expanded API disparity	2030	Expansion of the price disparity for a ten-degree API disparity from three dollars to five dollars

[1] Hereinafter referred to as "**Existing plan case**"
[2] Hereinafter referred to as "**Higher capacity case**"
[3] Hereinafter referred to as "**Lower growth case**"

(3) Petroleum product supply and demand - comparison of other cases with the existing plan case

While the existing plan case is the same throughout the study, the following is a description of it as compared to each of the other cases.

Differences between the existing plan case and the case of higher capacity in China

Existing plan case (case of plans known at the present time, serving as the basis of comparison) The factor of fluctuation with the strongest influence on the oil supply and demand in East Asia is the outlook on refining capacity in China. Because it is difficult to predict the trend of this capacity, the existing plan case is premised on one of 7.9 million b/d in 2010 and 9.4 million b/d in 2015, based on the sums of planning figures from the findings of interviews with China's major oil companies (SINOPEC and CNPC) and the addition of the capacity of independent refiners. (Note: The possibility of this case becoming the actual supply capacity is regarded as low.) While the extent of expansion in the demand in China over the years 2010 - 2015 is estimated to reach 1.84 million b/d, the existing plans add up to a corresponding addition of only 1.5 million b/d, for a substantial shortage of 340,000 b/d. It is therefore thought that China will prepare additional plans for a further increase close to that in the case of a high supply capacity there. As such, this case is thought to have little possibility of actualization. This is why it was termed the "existing plan case" instead of the "base case."
Higher capacity case It is also fully possible that the supply capacity in China will expand substantially as the demand increases, such that the country will have a self-sufficient supply of gas oil, which accounts for about 40% of its product demand. The WG therefore also studied the case of a higher capacity in China. The premise here is an increase of 1 million b/d (to 10.4 million b/d) in CDU capacity, with a commensurate increase in the capacity of secondary equipment as well. (Note: This case of supply capacity in China is thought to have the highest possibility of actualization.) It was assumed that any additional refineries would each have a capacity of around 300,000 b/d. This case would be realized with addition of three or four more refineries than in the existing plan case. It is thought to have the highest possibility of actualization, considering the anticipated tightening of the supply in Asia.

Differences between the existing plan case and the low growth case

Existing plan case

The forecast rate of economic growth is one of the premises of the forecast of the demand for petroleum products. The WG estimated these rates while considering economic outlooks prepared by national governments in the concerned countries, international institutions, and other such entities. For East Asia as a whole (excluding Japan), it projected an average annual growth rate of 7.6 % over the years 2002 - 2010 and 6.3% over the years 2010 – 2015, and forecast the petroleum product demand on this basis. For supply, it applied levels in those refining capacity plans thought to have the best prospects for actualization in each country.

Lower growth case

- Possibility of a slowing of economic growth in China (the engine of economic growth in the region) beginning in 2010, and accompanying deceleration of growth in the rest of Asia

This case assumes an economic growth rate in Asia that is 1.0 % (0.5% in Japan's case) lower than in the existing plan case over the years 2010 - 2015. In this case, China and India would have annual average growth rates of 5.6 and 4.5%, respectively. As the projected rates in the existing plan case are on the conservative side, this case is thought to be fully possible as well.

On the supply side, the WG made a review of the refining capacity in each country, and applied the same levels as in the existing plan case for China, Taiwan, and Vietnam, but made downward revisions relative to the existing plan case for other countries.

III. Analysis of petroleum product supply and demand (2010 and 2015)

1. Forecast of petroleum product demand in East Asia and Asia as a whole

- Increase of about 5.8% in the demand for oil in East Asia; Asia accounts for about 40% of the increase in the world oil demand

(1) Existing plan case

The demand for petroleum products in East Asia, which slumped under the influence of the economic crisis in 1998, is projected to recover and increase at an annual average rate of 4.1% over the years 2002 – 2010. After that period, the demand will continue to increase at 3.5% annually over the years 2010 - 2015 with the support of firm economic growth.

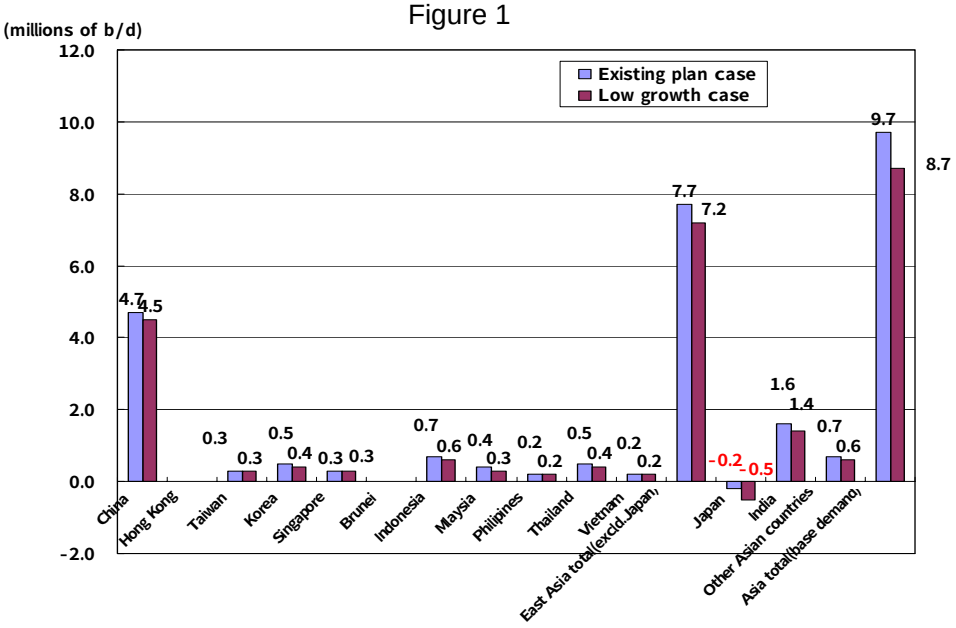
In addition, the world oil demand is projected to increase by 12.20 million b/d over the years 2002 - 2010, and the demand in Asia, by 5.50 million b/d. If so, Asia would account for about 46% of the amount of increase in the world demand. This trend should continue virtually unchanged over the years 2010 - 2015, and give Asia about 40% of the worldwide demand.

Table 5 Trend of petroleum demand in East Asia and Asia

Unit: million of b/d		Existing plan case								Lower growth case	
		Amount of demand			Amount of increase			AAGR		Amount of demand	Amount of increase
		2002	2010	2015	02-10	10-15	02-15	10/02	10/15	2015	10-15
China		4.8	7.7	9.5	2.9	1.8	4.7	6.0	4.4	9.3	1.6
Hong Kong		0.3	0.3	0.4	0.0	0.0	0.0	1.7	1.8	0.3	0.0
Taiwan		0.9	1.1	1.2	0.2	0.1	0.3	2.2	1.0	1.2	0.1
Korea		2.3	2.6	2.8	0.3	0.2	0.5	1.3	1.4	2.7	0.1
Singapore		0.8	1.0	1.1	0.2	0.1	0.3	2.6	2.5	1.1	0.1
Brunei		0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.8	0.0	0.0
Indonesia		1.2	1.6	1.9	0.4	0.3	0.7	3.4	3.3	1.8	0.2
Malaysia		0.5	0.7	0.8	0.2	0.2	0.4	4.5	4.4	0.8	0.1
Philippines		0.3	0.4	0.5	0.1	0.1	0.2	3.0	4.2	0.5	0.1
Thailand		0.8	1.0	1.3	0.3	0.2	0.5	3.7	4.4	1.2	0.2
Vietnam		0.2	0.3	0.4	0.1	0.1	0.2	6.2	5.1	0.4	0.1
East Asia total (excld. Japan)		12.2	16.7	19.9	4.6	3.1	7.7	4.1	3.5	19.4	2.7
Japan		5.6	5.4	5.3	-0.2	0.0	-0.2	-0.5	-0.2	5.1	-0.3
India		2.4	3.1	3.9	0.8	0.8	1.6	3.6	4.6	3.8	0.7
Other Asian countries		0.7	1.1	1.4	0.4	0.3	0.7	5.1	4.8	1.3	0.2
Asia total (base demand)		20.8	26.3	30.5	5.5	4.2	9.7	3.0	3.0	29.5	3.2
World total (base demand)		77.8	90.1	100.1	12.2	10.1	22.3	1.8	2.1	99.2	9.1
Share (%)	East Asia (excld. Japan)	15.6	18.6	19.8	37.3	31.1				19.5	
	Asia	26.7	29.2	30.4	46.2	41.3				29.8	
Refining capacity in Asia		21.2	25.1	28.7	3.9	3.6	7.5	2.2	2.7	2.8	3.1

Share of the global increase occupied by East Asia/Asia

Figure 1



(2) Lower growth case

In this case, which places rates of GDP growth in Asian countries that are 1.0% (0.5% in Japan) lower than in the existing plan case, the 2015 demand for petroleum products would be about 1 million b/d less than in the existing plan case in Asia, and about 500,000 b/d less in East Asia (excluding Japan).

2. Refining capacity in East Asia and Asia as a whole

- Expansion of capacity led by China, with increases planned in Indonesia, Vietnam, and India as well

(1) Refining capacity in Asia

Addition of the figures in existing plans for capacity increase indicates that the refining capacity in East Asia will increase by about 2.8 million b/d over the years 2002 - 2010. The WG put the increase over the years 2010 - 2015 at 2.6 million b/d on the assumptions shown in Table 6. Although plans for construction in the years leading up to 2015 are not clear in many respects, the WG added figures in plans thought to have the best prospects for actualization based on information collected in the countries in question. The assumption that capacity would be increased in correspondence with the rate of growth in the regional demand formed another premise of the forecast for the 2015 capacity. Table 6 shows the breakdown of the regional capacity in terms of atmospheric distillation units (CDUs). The WG also assumed that secondary equipment capacity would increase in response to plans for environmental regulation of fuel oil on the regional level.

Table 6 Refining capacity in Asia (breakdown)

Unit: 1000 of b/d

	CDU capacity				Increase		
Country/region	2002	2010	2015 (Existing plan)	2015 (Low growth)	02-10	10-15 (Existing plan)	10-15 (Low growth)
China	5,619	7,900	9,400	9,400	2,281	1,500	1.500
Taiwan	1,220	1,310	1,376	1,376	90	66	66
Korea	2,750	2,750	2,951	2,892	0	201	142
Singapore	1,269	1,337	1,337	1,337	68	0	0
Brunei	9	9	9	9	0	0	0
Indonesia	1,073	1,273	1,573	1,448	200	300	175
Malaysia	515	545	677	670	30	132	125
Philippines	420	335	335	335	-85	0	0
Thailand	991	1,075	1,334	1,294	84	259	219
Vietnam	0	130	270	270	130	140	140
East Asia (excluding Japan)	13,865	16,663	19,260	19,029	2,798	2,597	2,366
Japan	4,767	4,736	4,736	4,736	-31	0	0
India	2,135	3,029	3,794	3,629	894	765	600
Other Asian countries	442	720	909	864	278	189	144
Asia total	21,209	25,148	28,700	28,258	3,939	3,552	3110

* Assumptions

- Figures for CDU capacity in 2010 are additions based on various documentation and information obtaine d from oil companies in the various countries. In the case of secondary equipment, the forecast incorporated plans for nationwide instatement of the Euro 3 standard in China and India in 2010, and assumed expansion into an equipment composition (especially as regards desulfurization equipment) on a par with that in Europe at present beginning in that year in neighboring countries as well.
- Figures for 2015 are set on the level of current plans in the case of China, India, and Indonesia. In other countries where demand is anticipated to increase, it was assumed that the overall refining capacity would increase in step with the rate of demand increase. No increase was foreseen in Singapore, the Philippines, and Brunei.
- In the lower Asian growth case, figures for 2015 are reduced by a margin commensurate with the lower demand. In the case of India and Indonesia, the WG estimated the amount of decrease from plans. The figures for China, Taiwan, and Vietnam are the same as in the existing plan case.

(2) Forecast of refining (CDU) capacity in China

In China, there are independent refiners that help to fill the supply shortage for gas oil, which accounts for about 40% of the petroleum product demand. They perform mainly vacuum distillation of imported heavy fuel oil and produce low-quality gas oil to fuel on-premise power generation as well as asphalt and other petroleum products. They have strong ties with local governments and could survive as suppliers of products in China for the foreseeable future.

1) Refining capacity to 2015

(CDU capacity to 2010)

Based on the findings of interviews with them as well as other documentation for facility additions and expansions whose year of completion is fairly certain, it is estimated that the combined refining capacity of the two big oil firms (SINOPEC and CNPC) will expand from about 5.3 million b/d at present to about 7.3 million b/d by 2010. The forecast for total refining capacity in China in 2010 is 7.9 million b/d based on addition of 600,000 b/d as the estimated CDU capacity of independent refiners (to be described below).

As shown in Table 7, an increase of about 7.6 million b/d is planned over the years leading up to 2010, but about 600,000 b/d of this increase could be postponed to later years. In light of this possibility, the WG put the base case figure for 2010 at the mean of 7.3 million b/d.

Table 7 CDU facility additions and expansions by major oil firms in China

Company / Refinery	Additions/ expansions (thousands of tons)	Additions/ expansions (thousands of b/d)	Planned year of completion	Notes
CNPC				
Dalian Petrochemical	10,000	200	2005	Expansion in step with the China-Russia PL
West Pacific Petrochemical	2,000	40	2005	
Lanzhou Petrochemical	5,000	100	2004	
Dushanzi Petrochemical	4,000	80	2005	Refining of Kazakhstan crude oil
Jinxi Petroleum Processing and Chemical Company	4,500	90	2005	
SINOPEC				
Maoming Refining	4,500	90	2004	Accompanying construction of the Maoming-Kunming PL
Guangzhou Phase 1	2,300	46	2005	Provisional
Guangzhou Phase 2	8,000	160	2008	
Shanghai Petrochemical/BP JV	5,200	104	2005	Complex with 900,000-ton ethylene facility
Yangzi Petrochemical/BASF JV	500	10	2005	Complex with 700,000-ton ethylene facility
Zhenhai Refining	6,000	120	2006	
Luoyang	2,000	40	2005	
Qingdao Huangdao	10,000	200	2007	Policy to close 21 small refineries in the province upon completion of new projects with Shandong province
Jinling	2,500	50	2005	
SINOPEC/Guangxi province JV	8,000	160	2008 (target)	Agreement with the province; start of construction in 2004
Fujian: SINOPEC/ExxonMobil/ Aramco JV	8,000	160	2008	Complex with 800,000-ton ethylene facility
CNOOC				
Huizhou: CNOOC/Shell JV	12,000	240	2007	Complex with 800,000-ton ethylene facility
Tianjin: CNOOC/Dow Chemical JV	20,000	400	2010	Complex with 600,000-ton ethylene facility
Total addition	114,500	2,290		Based on plans to 2010
Existing total	265,800	5,316		
Grand total	380,300	7,606		About 7 million b/d with postponement of 160,000 b/d in the SINOPEC/Guangxi project and 400,000 b/d in the CNOOC/Dow project to 2010.

Source: Based on the 2004 edition of "Oil and Petrochemical Industry in China," published by Tozai Boeki Tsushinsha, and interview data.

(CDU capacity to 2015)

(Existing plan case)

The facility construction in plans over the years leading up to 2015 would give the major refiners a combined capacity of 440 million tons per year (about 8.8 million b/d).

Although there is some uncertainty about the firmness of the plans and years of completion, the WG estimated the standard CDU capacity in 2015 at 9.4 million b/d on the assumption that the whole plans would be completed by 2015 and that there would be no decrease in the 600,000-b/d CDU capacity of the independent refiners.

(Case of higher capacity)

There is some uncertainty about the expansion of refining capacity as of 2015, and the currently disclosed plans would leave a shortage of 340,000 b/d relative to the demand increase over the years 2010 - 2015. For these reasons, there is a high possibility of the construction of three or four refineries in the 300,000-b/d class over the coming years. For 2015, the WG placed an addition increase of 1 million b/d in CDU capacity. Because the independent VDU refiners would lose competitiveness in this case, it was assumed their capacity would be halved to 200,000 b/d.

Table 8 Premises in the forecast of refining capacity in China to 2015

Unit: 1000 of b/d

	Existing capacity estimate	Existing plan case		High supply capacity case (increase of 1 million b/d in CDU capacity)
	2003	2010	2015	2015
Major refiners (two oil majors and others)	5,300	7,300	8,800	9,800
Independent refiners (with CDUs)	600	600	600	600
CDU total	5,900	7,900	9,400	10,400
Heavy fuel oil VDU capacity (asphalt plants)	400	400	400	200

Source: Based on various materials and interview data with SINOPEC/CNPC etc.

2) Refining capacity of small independent refiners

From the information gained from Chinese oil companies and trading firms as well as other sources, independent refiners nationwide are estimated to have a combined capacity of about 1 million b/d and to number in the range of 80 - 100. Those that do not have the right to import crude oil import heavy fuel oil and process it with VDUs to produce low-quality gas oil and asphalt (at asphalt plants). There are estimated to be from 30 to 50 such plants, mainly in Shandong and Guangdong provinces. These plants conduct a marginal operation in that they suspend production if prices for foreign heavy fuel oil are too high, and have operating rates averaging no more than around 50 or 60% for the year.

The national government is planning for facility additions and expansions at the two Chinese majors and the closure of small-scale independent refiners. The latter, however, are tied to local governments and provide jobs. It is consequently thought that they will remain in operation as long as their business is paying.

Estimate of the VDU capacity of independent refiners from the heavy fuel oil feed

China's import of heavy fuel oil came to 25 million tons in 2003 and more than 30 million tons in 2004. Some 18 - 22 million tons of this total is thought to be directed to power plants and industry. Application of 20 million tons for this subtotal as the mean figure would leave about 10 million tons (200,000 b/d) for the independent refiners in 2004. Assuming an average operating rate of 50% at their plants, their heavy fuel oil refining capacity would come to about 400,000 b/d, and their CDU capacity was put at 600,000 b/d.

Table 9 Types and estimated capacities of independent refiners

Unit: 1000 of b/d

Type	Capacity	Comments
1. With CDUs (and a crude oil processing quota)	600	50 - 60 plants, with a capacity of a few thousand - 20,000 b/d per plant
2. Heavy fuel oil vacuum distillation Asphalt plants (operating rate of 50%)	400	Premise: 200,000 b/d of heavy fuel oil for independent refiners
		Great fluctuation in operating rates depending on heavy fuel oil prices and the gas oil spread
1 + 2 = Independent refiner total	1,000	Estimated number nationwide: 80 - 100

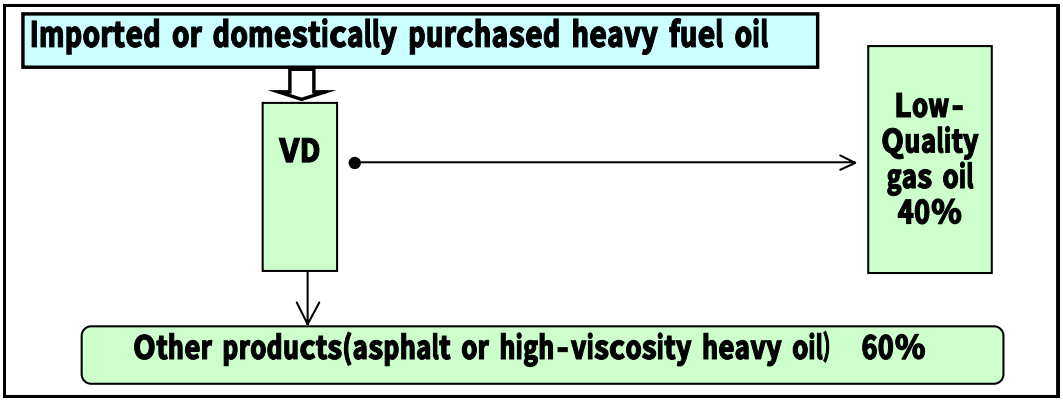
Source: estimates based on field studies and various information

Incorporation of heavy fuel oil VD refiners (asphalt plants) into the LP model

Based on the aforementioned premises and assumptions, a distinction was drawn between conventional crude oil refining and heavy fuel oil VD refining (at asphalt plants). The flow shown in Figure 2 was added to the existing Chinese refining model for more accurate reflection of the situation of each type of refining.

Based on the findings of interviews with SINOPEC, the rate of production through VD of imported heavy fuel oil was put at 40% for low-quality gas oil and 60% for other petroleum products (e.g., asphalt).

Figure 2



3. Balance of petroleum product supply and demand in East Asia

(1) Existing plan case

- The balance of petroleum product supply and demand in East Asia (excluding Japan) is forecast to amount to a net import of 1.44 million b/d in 2010 and 2.00 million b/d in 2015. This suggests the need for a further increase in supply capacity in China.

1) Supply-demand balance

The increase in supply (refining) capacity from 2002 to 2010 is expected to cover about 60% of the demand increase. Although operating rates would rise by about 9%, the supply-demand gap would widen to a 1.44-million-b/d import position.

In 2015 as well, the petroleum product demand would exceed the refining capacity, and refinery-operating rates are forecast to rise further to 92%. At this point, the refineries would be operating at their full capacity, but would nevertheless be unable to fill the demand, and the import position would expand to 2.06 million b/d.

This level of import would be 1.04 million b/d larger than the record-high import in 1995 (640,000 b/d), and would presumably present a problem of supply stability (to be described below).

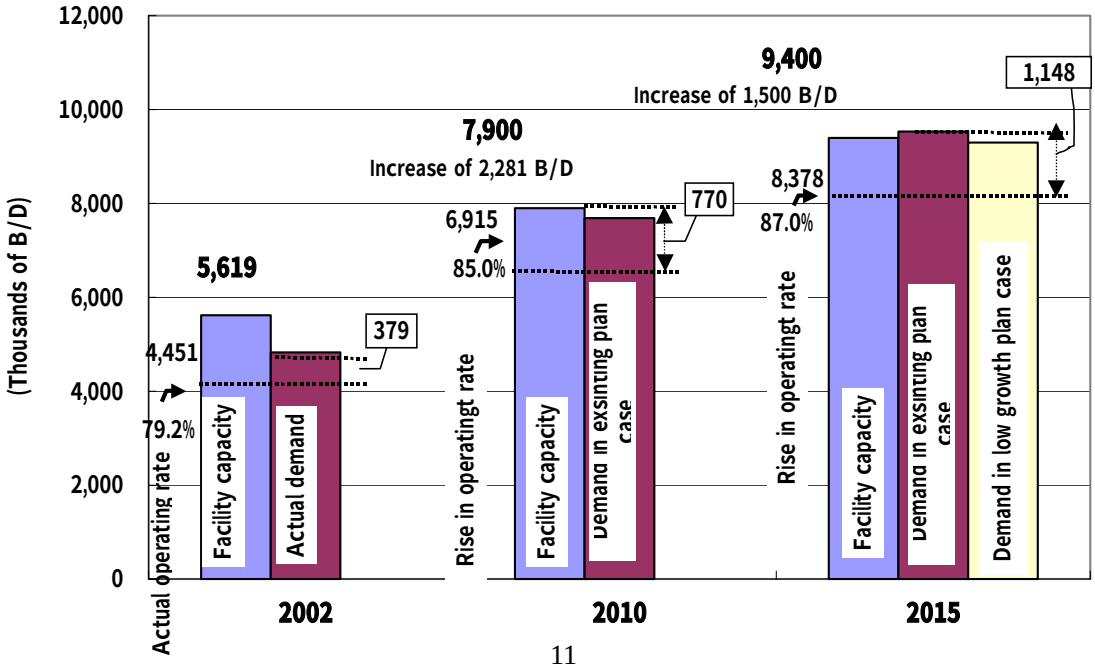
Table 10 Petroleum product supply-demand balance in East Asia (excluding Japan) and Asia as a whole (existing plan case)

				Amount of increase	
Unit: millions of b/d	2002	2010	2015	02-10	10-15
Petroleum product demand	12.2	16.7	19.9	4.7	3.1
Petroleum product production	11.4	15.3	17.8	3.9	2.5
Supply-demand gap	-0.8	-1.4	-2.1	-0.9	-0.6
Subtotal: supply-demand gap in China	-0.4	-0.8	-1.2	-0.6	-0.4
Refining capacity	13.9	16.7	19.3	2.8	2.6
Refining facility operating rate	82.2%	91.7%	92.4%	9.5%	0.7%

2) Refining capacity and supply-demand balance in China

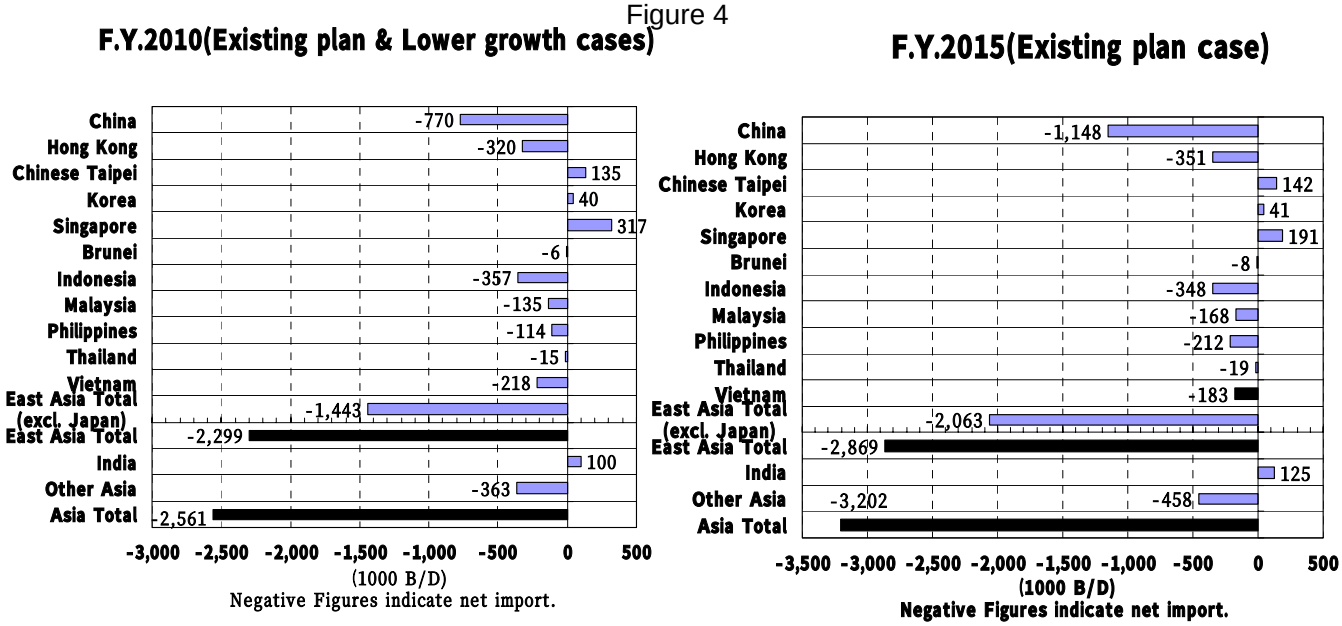
The supply-demand gap in China would account for about half of that in East Asia. China is going to construct new large-scale refineries over the coming years, and average-operating rates therefore should rise. According to information from the two major oil companies, however, the effective ceiling for the average operating rate is forecast at 85% in 2010 and 87% in 2015. Assuming an expansion in the net import of products in Asia as a whole, it would be doubtful whether China could actually import to cover its supply shortage. As such, the WG considered the case of a higher supply capacity in China (i.e., a further increase in its refining capacity; to be described below).

Figure 3



A look at the forecast balance in each country reveals that the only Asian countries in an export position in both 2010 and 2015 are Taiwan, Korea, Singapore, and India. Margin for export in Singapore, where refining capacity is not expected to increase, is likely to decline with the approach of 2015. All of the other countries are in an import position. The import position of China including Hong Kong is forecast to rise from 1.09 million b/d in 2010 to 1.49 million b/d in 2015.

Figure 4



Analysis of China's import and export in each product category in the existing plan case

- Considering the net import position of 1.15 million b/d in the existing plan case and the balance outside Asia, China is forecast to move in the direction of supply capacity expansion in 2015.

In comparison between 2010 and 2015, when China's net import is forecast to expand further, the forecast envisions import from the Middle East and Russia to meet this increase. The import from Russia should increase by the greatest extent.

Russia has shipment facilities for products other than LPG and produces straight run heavy fuel oil with little heavy metal content. For this reason, it is preferred as a supplier for on-premise power generation fuel and independent VD refiners of imported heavy fuel oil. At present, shipments are carried to ports from inland refineries by rail. From the ports, they are carried by tanker to the sites of demand in southern China (where there are many such independent refiners).

However, it is questionable whether Russia will be able to export just under 400,000 b/d in 2015. Therefore, Chinese policy-makers and the two major oil companies will presumably effect a bigger expansion in product capacity by 2015 in order to avoid such an import position, which would be marked by deep uncertainty. Because there are no such concrete plans at present, however, the WG placed an additional case of a higher supply capacity in China, i.e., a CDU capacity of 1 million b/d more than in the existing plan case.

Table 11 Existing plan case - China's product import and export in 2010

Unit: 1000 of b/d

China	Import breakdown					Export	Net export
Type of product	* Four countries	Middle East	Russia	Other countries	Import total		
Gasoline	0	0	0	0	0	0	0
Naphtha	14	100	34	15	163	0	-163
Kerosene/Jet	0	0	0	0	0	0	0
Gas oil	13	22	0	0	35	0	-35
Heavy fuel oil	253	0	144	0	397	0	-397
LPG	43	132	0	0	175	0	-175
Other	0	0	0	0	0	0	0
Total	323	254	178	15	770	0	-770

* Four countries: Korea, Japan, Taiwan, Singapore

Breakdown of China's independent asphalt plants

Input of imported heavy fuel oil	Low-quality gas oil 40%	Asphalt 60%
200	80	120

Table 12 Existing plan case - China's product import and export in 2015

Unit: 1000 of b/d

China	Import breakdown					Export	Net export
Type of product	* Four countries	Middle East	Russia	Other countries	Import total		
Gasoline	0	0	0	0	0	0	0
Naphtha	0	126	67	71	264	0	-264
Kerosene/Jet	0	52	37	0	89	0	-89
Gas oil	186	22	0	0	207	0	-207
Heavy fuel oil	160	0	239	0	398	0	-398
LPG	12	148	34	0	193	0	-193
Other	0	0	0	0	0	3	3
Total	357	348	376	71	1,152	3	-1,148

* Four countries: Korea, Japan, Taiwan, Singapore

Breakdown of China's independent asphalt plants

Input of imported heavy fuel oil	Low-quality gas oil 40%	Asphalt 60%
200	80	120

(2) Change in the supply-demand balance in the case of higher capacity (CDU and secondary equipment) in China in 2015

- Even in the case of a higher capacity in China, the East Asian region would be in a net import position of about 1.3 million b/d. Expansion of China's supply capacity is a vital key for stabilization of the product supply and demand in East Asia.

1) Analysis of the case of higher capacity in China

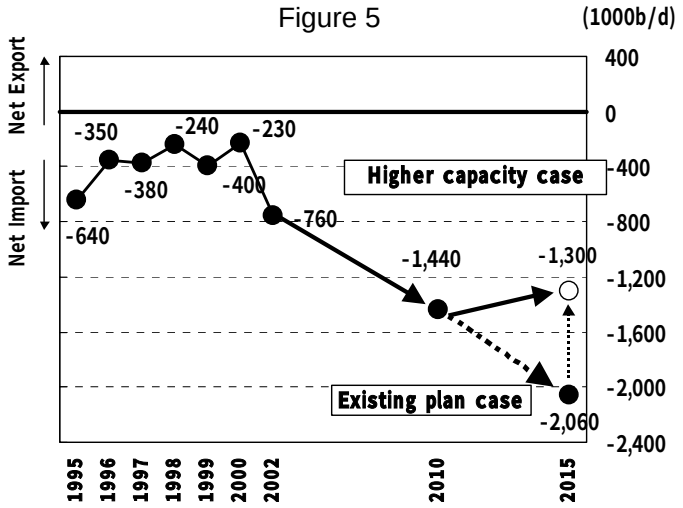
This case places a CDU capacity that is 1 million b/d higher than in the existing plan case. In it, the 2010 gap with the demand would decrease from 770,000 to 380,000 b/d in China and to 1.4 million b/d in East Asia. The existing plan case assumes production at the maximum operating rate in all East Asian countries. In the case of higher capacity in China, too, it is assumed that production in these other countries will stay on this maximum level and that the supply-demand balance will be the same as in the existing plan case.

Table 13 Petroleum product supply-demand balance in East Asia (excluding Japan) (case of higher capacity in China)

				Amount of increase	
(Unit: millions of b/d)	2002	2010	2015	02-10	10-15
Petroleum product demand	12.2	16.7	19.8	4.7	3.0
Petroleum product production	11.4	15.3	18.5	3.9	3.2
Supply-demand gap	-0.8	-1.4	-1.3	-0.9	0.1
Subtotal: supply-demand gap in China	-0.4	-0.8	-0.4	-0.6	0.4
Refining capacity	13.9	16.7	20.3	2.8	3.6
Refining facility operating rate	82.2%	91.7%	91.1%	9.5%	-0.6%

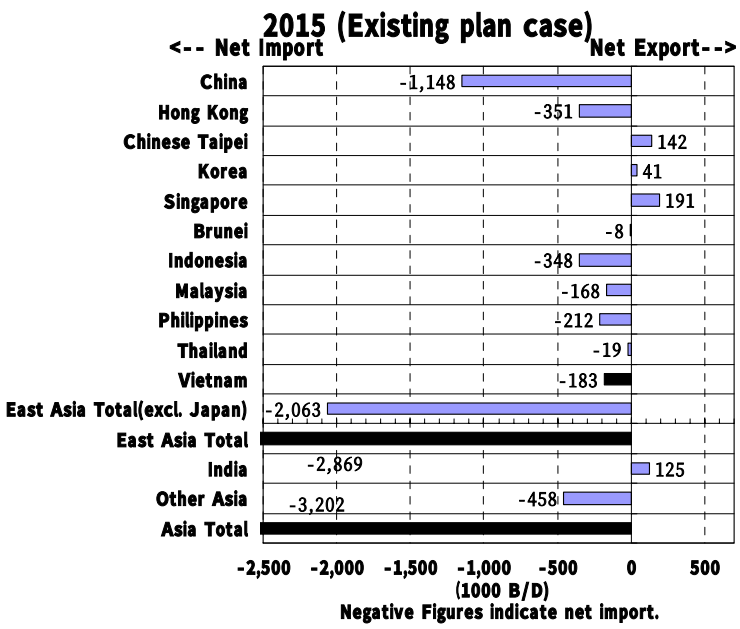
In the case of higher capacity in China in 2015, the supply-demand balance in East Asia would amount to a net import of 1.3 million b/d, 760,000 b/d less than in the existing plan case. In this case, the average operating rate in Chinese refineries would decline by 1%, and production of gas oil by cracking imported heavy fuel oil would decline by 40,000 b/d. Petroleum product production would increase by 670,000 b/d, and China's net import position would shrink to about 380,000 b/d. Due to the increase in demand in other Asian countries, import would be 700,000 b/d higher than in 1995, when the highest import over the last ten years was recorded.

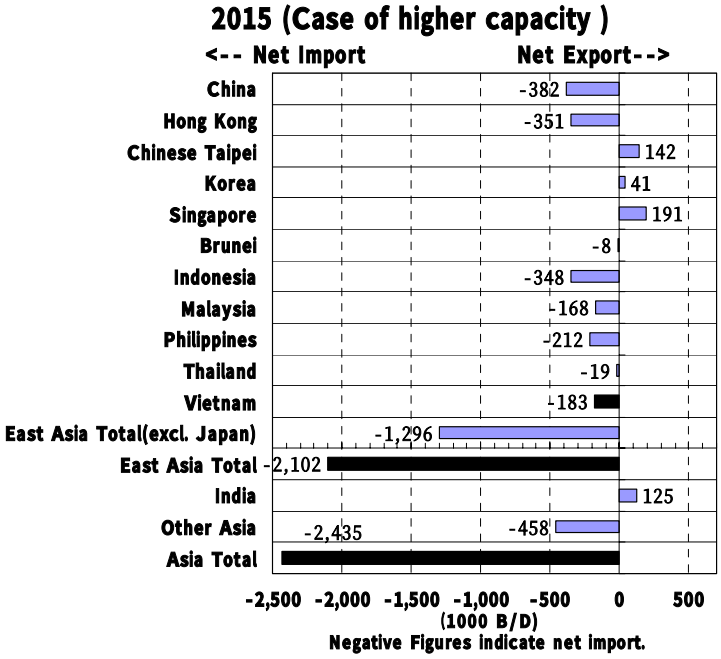
Figure 5



As compared to the existing plan case, the amount of net import is lower in China, but there is not any change in the supply-demand balance for other countries because of the lack of change in demand and facility operating rates. As such, the situation of only four countries being in a net export position (Taiwan, Korea, Singapore, and India) would be the same as in the existing plan case.

Figure 6





2) Analysis of product import and export results in the case of higher capacity in China
- Self-sufficient supply of gas oil as a possibility in 2015.

In the case of higher capacity, a decrease in product import (relative to the existing plan case) commensurate with the increased capacity would appear in the case of the four countries Korea, Japan, Taiwan, and Singapore as well as in the Middle East and Russia.

This case is premised on the construction of new and expansion of existing competitive refineries by the two majors and other large refineries in China. It is therefore thought that about half of the asphalt plants would go out of business. As a result, the decrease factors include import of 100,000 b/d in heavy fuel oil for VD. The reduction would consequently have the biggest impact on Russia, the main exporter of heavy fuel oil.

In this case, China would basically achieve a self-sufficient supply of gas oil, which accounts for just under 40% of its fuel consumption. Meanwhile, the demand for heavy fuel oil would continue to be met by import. Augmentation of refining capacity to the level in this case as a downstream measure by Chinese oil companies would stabilize petroleum product trade in Asia and be desirable for Japan, Korea, and other consumer countries as well as for China.

Table 14 Existing plan case - China's product import and export in 2015

Unit: 1000 of b/d

China	Import breakdown					Export	Net export
Type of product	* Four countries	Middle East	Russia	Other countries	Import total		
Gasoline	0	0	0	0	0	0	0
Naphtha	0	126	67	71	264	0	-264
Kerosene/Jet	0	52	37	0	89	0	-89
Gas oil	186	22	0	0	207	0	-207
Heavy fuel oil	160	0	239	0	398	0	-398
LPG	12	148	34	0	193	0	-193
Other	0	0	0	0	0	3	3
Total	357	348	376	71	1,152	3	-1,148

* Four countries: Korea, Japan, Taiwan, Singapore

Breakdown of China's independent asphalt plants

Input of imported heavy fuel oil	Low-quality gas oil 40%	Asphalt 60%
200	80	120

Table 15 Case of higher capacity in China - China's product import and export in 2015

Unit: 1000 of b/d

China	Import breakdown					Export	Net export
Type of product	* Four countries	Middle East	Russia	Other countries	Import total		
Gasoline	0	0	0	0	0	0	0
Naphtha	0	55	0	0	55	0	-55
Kerosene/Jet	0	53	57	0	110	0	-110
Gas oil	13	0	0	0	13	0	-13
Heavy fuel oil	148	0	0	0	148	0	-148
LPG	0	57	0	0	57	0	-57
Other	0	0	0	0	0	0	0
Total	161	165	57	0	382	0	-382

* Four countries: Korea, Japan, Taiwan, Singapore

Breakdown of China's independent asphalt plants

Input of imported heavy fuel oil	Low-quality gas oil 40%	Asphalt 60%
100	40	60

(3) Lower growth case

- This case places economic growth in Asia that is 1% lower than in the existing plan case beginning in 2010. In this case, the petroleum product demand in East Asia (excluding Japan) would decline by 540,000 b/d (relative to the existing plan case), and the supply-demand balance would amount to an import position of 1.75 million b/d.

1) Outline of forecast results

In this case, the rate of GDP growth in Asian countries beginning in 2010 is 1% (0.5% in Japan) lower than in the existing plan case. In 2015, the demand would be 910,000 b/d less in Asia as a whole, and 540,000 b/d less in East Asia, than in the existing plan case. The supply-demand gap in East Asia would expand by 310,000 b/d relative to that in 2010 and amount to a net import position of 1.75 million b/d. There would consequently be a big supply-demand gap even in the lower growth case, and this is cause for apprehension about supply shortage in East Asia.

Table 16 Comparison of demand in the existing plan and lower growth cases

Unit: millions of b/d	Actual	Existing plan case		Lower Asian growth case	Lower growth - existing plans
	2002	2010	2015	2015	
East Asia (excl. Japan)	12.2	16.7	19.9	19.3	-0.5
Asia total	20.8	26.3	30.5	29.5	-0.9

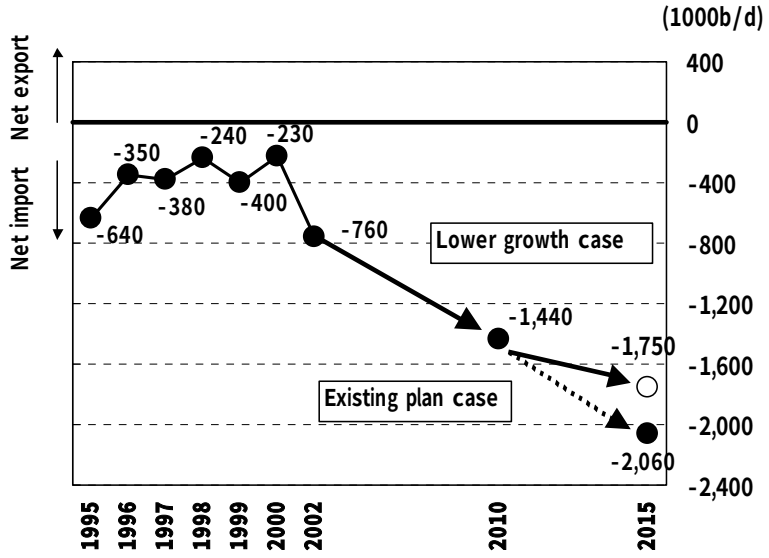
Table 17 Petroleum product supply-demand balance in East Asia (excluding Japan)

(Lower growth case)

				Amount of increase	
Unit: millions of b/d	2002	2010	2015	02-10	10-15
Petroleum product demand	12.2	16.7	19.3	4.7	2.6
Petroleum product production	11.4	15.3	17.6	3.9	2.3
Supply-demand gap	-0.8	-1.4	-1.8	-0.9	-0.3
Subtotal: supply-demand gap in China	-0.4	-0.8	-0.9	-0.6	-0.1
Refining capacity	13.9	16.7	19.0	2.8	2.4
Refining facility operating rate	82.2%	91.7%	92.3%	9.5%	0.6%

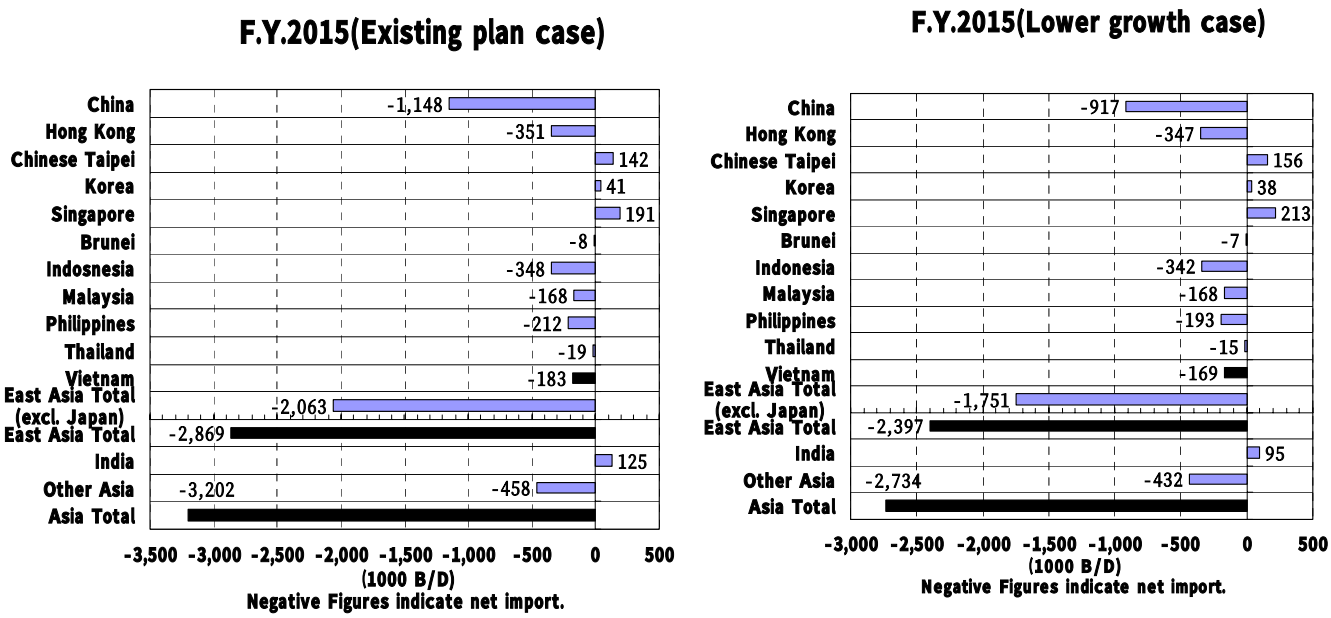
In this case, the supply-demand gap in China would be 210,000 b/d less than in the existing plan case, and that in East Asia would narrow by 310,000 b/d. In Asia as a whole, the net import would be 470,000 b/d less than in the existing plan case.

Figure 7



The level of net import in the supply-demand balance would be lower than in the base case because the demand would decline without a change in the facility operating rates. The lack of substantial change in the supply-demand balance in Korea, Malaysia, and Indonesia and the decline in the net export position in India derive from the assumption of a hold on plans for facility expansion in step with the relative demand recession. The countries in a net export position would be the same as in the existing plan case, i.e., Taiwan, Korea, Singapore, and India.

Figure 8



(4) Implications for product supply capacity to Asia from other regions (dependence on the Former Soviet Union and the Middle East)

- Outside Asia, the major suppliers of petroleum products to Asia are the Middle East and the Former Soviet Union. A lack of margin for export in them could induce a jump in product prices and spot supply shortages in Asia.
-

In China, where the demand is expected to exhibit rapid growth, the product supply should become tighter. This would assure the earnings of the two major oil companies, which would probably attach priority to upstream investment funded with these earnings. As such, product import could expand, depending on the future course of the demand.

Other Asian countries (excluding Japan) are liable to be cautious about augmenting their refining capacity due to the lessons of the Asian economic crisis. This points to a high possibility of a decline in margin for supply in Korea, Taiwan, and Singapore as the domestic demand expands. In Japan, the domestic demand is anticipated to decline over the long term, and this may suggest reduction of some capacity in refineries.

As a result, an increase in product import by China could make the Middle East and Former Soviet Union into major supply sources for Asia. Shrinkage of margin for supply to Asia from these two regions could result in a short balance, jumps in product prices, and spot supply deficiencies. To counter this risk, the consumer countries must collect demand outlook information and cooperate with each other in efforts to prevent a disruption of the overall supply-demand balance for petroleum products in Asia.

Import-export balance in the Former Soviet Union and Middle East in 2015 (Unit: thousands of b/d)

Table 18 Existing plan case - Former Soviet Union's product import and export

Former Soviet Union	Export			Import	Net export
Type of product	To China	To other countries	Export total		
Gasoline	0	8	8	0	8
Naphtha	67	283	350	0	350
Kerosene/jet	37	231	268	0	268
Gas oil	0	244	244	0	244
Heavy fuel oil	239	961	1,200	0	1,200
LPG	34	26	59	0	59
Other	0	19	19	0	19
Total	376	1,772	2,148	0	2,148

Table 19 Higher capacity case -Former Soviet Union's product import and export

Former Soviet Union	Export			Import	Net export
Type of product	To China	To other countries	Export total		
Gasoline	0	21	21	0	21
Naphtha	0	227	227	0	227
Kerosene/jet	57	0	57	0	57
Gas oil	0	209	209	0	209
Heavy fuel oil	0	1,031	1,031	0	1,031
LPG	0	0	0	0	0
Other	0	0	0	0	0
Total	57	1,488	1,545	0	1,545

Table 20 Existing plan case - Middle East's product import and export

Middle East	Export			Import	Net export
Type of product	To China	To other countries	Export total		
Gasoline	0	0	0	14	-14
Naphtha	126	408	534	0	534
Kerosene/jet	52	135	187	0	187
Gas oil	22	400	421	0	421
Heavy fuel oil	0	147	147	0	147
LPG	148	598	746	0	746
Other	0	1	1	0	1
Total	348	1,688	2,036	14	2,022

Table 21 Higher capacity case - Middle East's product import and export

Middle East	Export			Import	Net
Type of product	To China	To other countries	Export total		
Gasoline	0	0	0	3	-3
Naphtha	55	518	573	0	573
Kerosene/jet	53	196	250	0	250
Gas oil	0	476	476	0	476
Heavy fuel oil	0	135	135	0	135
LPG	57	534	590	0	590
Other	0	1	1	0	1
Total	165	1,859	2,024	3	2,022

4. Balance of Japanese import and export, and future prospects

(1) Import-export balance

In each case, the WG assumed that the refining (CDU) capacity would remain on the current level of 4.74 million b/d. In the situation of shortage coloring production in Asia, Japanese CDUs would operate at capacity rates (95%) in all cases. Even in the case of higher capacity in China, there was almost no change in Japan's import-export balance.

In the case of lower Asian growth, it was assumed that the rate of Japanese GDP growth would be 0.5% lower than in the existing plan case over the years 2011 - 2015, and that Japan's demand for oil would be about 160,000 b/d lower. The increased margin for export would lead to increased export of mainly gasoline and heavy fuel oil.

Japan's import-export balance in 2015 (Unit: thousands of b/d)

Table 22 Existing plan case, Japan's import-export balance in 2015

Japan	Export			Import	Net export
Type of product	To China	To other countries	Export total		
Gasoline	0	10	10	0	10
Naphtha	0	0	0	442	-442
Kerosene/jet	0	0	0	22	-22
Gas oil	0	0	0	0	0
Heavy fuel oil	13	0	13	10	3
LPG	0	0	0	353	-353
Other	0	0	0	2	-2
Total	13	10	23	828	-806

Table 23 Lower growth case, Japan's import-export balance in 2015

Japan	Export			Import	Net export
Type of product	To China	To other countries	Export total		
Gasoline	0	73	73	0	73
Naphtha	0	0	0	419	-419
Kerosene/jet	9	13	23	22	1
Gas oil	0	0	0	0	0
Heavy fuel oil	63	0	63	10	53
LPG	0	0	0	353	-353
Other	0	0	0	1	-1
Total	72	86	158	805	-646

(Factors of fluctuation in the product supply and demand in Japan)

1) Gasoline

In the demand aspect, the spread of hybrid vehicles and other fuel-saving vehicles is anticipated to reduce the demand for gasoline. Gasoline consumption could decline further with the blending of renewable energy sources into gasoline as an environmental (CO2) measure. In this forecast as well, it was found that gasoline would be exported as the domestic demand decrease.

In fact, it is unclear whether or not gasoline export would be feasible. There is the additional option of removing aromatic fractions from gasoline and increasing the supply for manufacture of high value added petrochemicals, which could yield higher earnings. In this case, Japan would not necessarily be in an export position for gasoline.

2) Heavy fuel oil

High-sulfur heavy fuel oil is a by-product instead of an object product like gasoline. The yield rate for heavy fuel oil in Japan in the forecast came to 13.5% in the existing plan case and 14.1% in the lower growth case. The rate could vary depending on the selection of crude oil and operation of equipment. It must not be overlooked that the export quantity for heavy fuel oil could decline with accelerated use for power generation as oil companies enter the power sector. Furthermore, in the demand aspect, there is room for fluctuation owing to power company approaches to oil-fired plants (e.g., the construction of new such plants for response to emergencies). Meanwhile, while low in sulfur content, imported heavy fuel oil should continue to be directed mainly to power plants, and this import could fluctuate depending on the power source mix.

(2) Future prospects for the oil industry in Japan

- The rise of supply of sulfur-free gasoline and gas oil suggests that investment in desulfurization equipment run its course for the time being. There is, however, a possibility of a widening of competitive gaps between refineries, depending on the course of the heavy fuel oil supply-demand balance and the development of free trade agreements.

Although the WG assumed that Japanese refining capacity would stay on the current level in all cases, the following possibilities exist.

1) Future trend of refinery facility investment

In Japan, the shift in production to sulfur-free gasoline and sulfur-free gas oil has been basically completed. Future investment for refining equipment would concern production of gasoline with an octane number of 95, which is now undergoing studies led by the Petroleum Association of Japan. This production would require investment of hundreds of billions of yen in reformers and other such units. There is the additional possibility of a widening of gaps between types of crude oil in terms of API, depending on the rise of heavier crude oil, and this could lead to further investment in cracking equipment for considerations of economic rationality.

2) Polarization of cost competitiveness

The heavy fuel oil supply-demand balance could change with measures taken on the demand side, i.e., by power companies in regard to oil-fired plants. If tariffs on import of heavy fuel oil are lifted with the spread of free trade agreements, the price competitiveness of Japanese-made heavy fuel oil would fall. This would present refineries that have a high rate of C heavy fuel oil yield, mainly of the straight run type, with difficulties in the aspects of both profit and the supply-demand balance.

Therefore, these refineries could conceivably promote increased sales of heavy fuel oil, consumption by integrated gasification combined-cycle (IGCC) power generation, purchase of lighter types of crude oil, and investment in more secondary equipment. Such action, however, could only be taken with those that have attained fairly high levels of scale and sophistication and are competitive. As long as the domestic demand declines, there would presumably not be any incentive to expand refining capacities.

5. Implications

- There are apprehensions about a shortage of supply capacity in East Asia. Would a more self-sufficient supply of products in China help to stabilize the product supply and demand in all of Asia?

(1) Assurance of product supply capacity in East Asia

In all cases, there are apprehensions about a shortage of supply capacity in East Asia. The forecast found that East Asia as a whole would be in a net import position of 1.44 million b/d in 2010 (in the existing plan case). The 2015 figure is 1.3 million b/d even in the case of a high supply capacity in China, which places the smallest supply-demand gap. Countries that are historically net importers must consider facility plans for the future.

(2) Determination of margin for product supply outside East Asia

1) Possibility of investment in the downstream division in the Middle East

In the event of a shortage of product supply capacity in Asia, the Middle East would probably be the biggest supply source mainly for naphtha and LPG. Some Middle Eastern/Gulf countries are eager to supply petroleum products as well as crude oil in order to attain higher value added levels, and are planning to construct refineries for export.

Possibility of construction of new refineries in Asia

This trend is not confined to construction of export-oriented refineries in the Middle East; it includes the prospect of refinery construction in Asia through capital participation. Saudi Arabia is planning to construct a new refinery in India, but it is not clear whether the output will be for consumption in India or for export.

To assure the presence of buyers for their crude oil, oil-producing countries could build new refineries in East Asia. If so, the balance of product supply and demand in the region could be loosened by an amount commensurate with the production increase.

2) Possibility of product export by the Former Soviet Union (and particularly Russia)

At present, the main product supply from Russia is the approximately 90,000 b/d of heavy fuel oil shipped from Nakhodka. The supply could rise with an expansion of refining capacity in Russia. Because the heavy fuel oil is of the straight run type with a low heavy metal content, it is ideal for China, whose demand centers around power generation.

Refineries in the Former Soviet Union will have to make substantial investment for conformance with the tough product standards in the international community. It is doubtful that the countries have enough margin for the investment, including conditioning of the shipment infrastructure, needed for expansion of their product export.

In addition, even if sources are preferred for reasons of supply capacity and geographical proximity in the LP, it is not clear how they will actually be rated in the market, because this will also depend on whether measures are taken to meet environmental regulations for petroleum products other than heavy fuel oil.

(3) Improvement of the accuracy of statistical information

- Accurate apprehension of supply and demand data is essential for stabilization of the international petroleum product supply and demand. Promotion and active utilization of JODI to share statistical information is effective for energy security.

1) Factors behind the recent surge in crude oil and petroleum product prices

Without an accurate grasp of demand information, it will be difficult for the supply side to react promptly even in the actual onset of a supply squeeze. Expansion of supply capacity requires a certain amount of lead-time and therefore entails a time lag. The result is a supply shortage that triggers a rise in oil prices and worries about future supply.

Recent years have seen the emergence of fewer margins for supply even in the case of OPEC crude oil. This is being compounded by numerous factors on the demand side, including repeated upward revisions of product demand data, especially in China; increased demand and damage to refineries by hurricanes in the United States of America; and speculative input of funds in unforeseen situations such as damage to refineries by hurricanes and refinery accidents. The combination is causing crude oil prices to soar and driving up prices for light oil products.

As far as the crude oil supply is concerned, the problem cannot be resolved unless the producing countries open up their lots and the major companies increase their investment in exploration and production. In contrast, the tightness in product supply could be relieved over the short term with a sufficient period of preparation and accurate information, provided that it is within the scope of the current supply capacity.

2) Joint Oil Data Initiative (JODI)

The JODI has a membership of 93 countries and six international institutions including the International Energy Agency (IEA), and covers about 90% of the oil demand. Its promotion is of paramount importance in this connection.

The IEA rates oil-related data from various countries on a scale of three grades. The supply of data is rated as insufficient in almost 40% of the countries. Among these are countries of great importance to studies of the international oil supply and demand. They include China and India on the demand side and the major OPEC producers on the supply side.

It is very difficult to obtain statistics for China in particular. The IEA has frequently revised its estimate of the demand for oil in China. The notion that China's stock is hitting bottom is also a cause of oil price rises that consequently have an adverse impact on the Chinese economy as well. China notified the IEA and the Asia Pacific Economic Cooperation (APEC) organization of its intention to submit inventory data in the first half of 2005, and India promised to make a disclosure on a par with China's. If they are made, these disclosures will help to stabilize the market. Apprehension of accurate statistical data for China and India will enable timely supply-side measures and undoubtedly contribute to stabilization of the product supply-demand balance and prices.

(Determination of statistical data for China, etc.)

Even if China's national government is eager to get a firm grasp of statistical information on demand, tantalizations will differ greatly from the reality without submission of accurate data by provincial governments. Such phenomena were encountered with past statistics on coal; provincial governments either did not get an accurate picture of the closure of mines on the village level or (in some cases) deliberately reported lower levels. It is no easy task to get accurate statistical information especially in regions with a strong self-government instinct, such as Guangdong and other parts of southern China.

In the field of oil refining, independent refiners have strong ties to local government and continue to produce in spite of the national policy to close them. Even today, accurate data on their activities are not available.

(4) Japan's technical contribution to Asia

Japan ranks first in Asia for technology in areas such as combustion, cracking and desulfurization. It introduced sulfur-free fuel representing the most stringent fuel quality standard in the world in 2005. Technology resulting from the Japan Clean Air Program (JCAP) project of development with the auto industry and other Japanese technology related to automobiles and fuel could make a vital contribution to environmental problems throughout Asia.

(5) Conclusion

The following measures are thought to be effective for stabilization of the supply of petroleum products.

1. Sharing of information on product supply capacity

Sharing of information on petroleum product supply capacity in East Asia, and particularly on the prospects for expansion of refining capacity and import from other regions

2. Promotion of JODI

Promotion and active utilization of JODI as a means of acquiring accurate demand data; the timely sharing of statistical information is indispensable for stabilization of the petroleum product supply and demand in Asia, where information accuracy tends to be low.

3. Technical assistance in energy consumption

Assistance involving Japanese energy conservation technology; a particular focus is programs of exchange of information and technical assistance with China, which has great potential for energy conservation.

4. Technical assistance in energy supply

Technical assistance in the areas of combustion technology and cracking/desulfurization technology

The measures noted above require collaboration between the public and private sectors. The government must take the initiative in providing venues for corporate discussion of cooperative approaches to energy conservation and environmental problems, and attempt to induce the transition to concrete action.

Ⅳ. Analysis of crude oil supply and demand (2020 and 2030)

1. Major premises

- The world crude oil production will increase up to our forecast demand growth of 2% annually to 2030

(1) Premises of crude oil production capacity

(Basic perspective)

There are both optimistic and pessimistic outlooks for the capacity of crude oil production over the long term (to 2030). The WG made the forecast of the crude oil supply and demand on the assumption that the production capacity would be sufficient to meet the demand in the subject year. A long- term increase in the capacity requires higher levels of investment for exploration than has been made thus far through liberalization of the upstream sector and rationalization of the investment regime in producer countries.

The US Department of Energy (DOE) forecasts crude oil production in a number of cases, from low reserve case to high reserve case. As shown in Table 1, in the event of a 2% increase in the oil demand, it foresees a peak production of just under about 150 million b/d in the average case.

Table 1 US DOE forecast of long-term crude oil production

Reserves	Ultimate recoverable reserves (trillions of barrels)	Oil demand AAGR	Peak production	
			Year	Production (hundreds of millions of b/d)
Case of low reserves	2.248	2%	2026	1.17
		3%	2021	1.33
Case of average reserves (average with case of high reserves)	3.003	2%	2037	1.46
		3%	2030	1.73

Source: Long-term world oil supply and demand scenario released in September 2004 by the Energy Information Agency (EIA) of the DOE
Note: Figures for ultimate recoverable reserves are estimates by the US Geological Survey.

(Additional types of crude oil in this forecast)

For this year's forecast, the WG added the following three types of crude oil.

1. East Siberia Crude: a low-sulfur, light crude oil expected to be the focus of strong needs in Asia in the future
2. Qatar Condensate: condensate associated with gas production for LNG
3. Venezuela Synthetic Crude: a synthetic crude oil upgraded by thermal cracking of heavy crude oil; it was added as a new type in light of the current administration's stance toward the United States and policy for expansion of sales to Europe and other regions. (As a result, a total of 70 crude oils were selected for the forecast.)

Table 2 Properties and production capacity premises for the newly added types of crude oil

Crude oil	Region/country of production	API index	Sulfur content (W%)	2030 production maximum (thousands of b/d)
East Siberia Crude	Russia	40.0	0.2	1,000
North Field Condensate	Qatar	55.3	0	1,500
Venezuela Syn- Crude	Venezuela	35.0	0.1	2,000

To widen the degree of freedom in selection of crude oils for the LP calculation in the forecast to 2030, the WG used the forecast values for crude oil production capacity in 2025 from the US DOE. As shown in Table 3, it set the 2030 production capacity at about 140 million b/d based on the amount of proven reserves, ratio of reserves to production (R/P), and data for various items as well as the findings of interviews.

Table 3 shows the premise levels for crude oil production capacity in each major region and country to 2030.

Table 3 Crude oil production to 2030

Unit: millions of b/d

		2001 Oil production	2010 Oil production	2020 Oil production	2030 Oil production
North America	North America total	14.0	17.4	18.7	20.1
	USA	7.7	9.5	8.9	8.6
	Canada	2.7	3.5	4.8	6.5
	Mexico	3.6	4.4	5.0	5.0
Central and South America	South America total	6.9	9.2	11.7	14.0
Western Europe	North Sea and Western Europe	6.9	5.9	5.1	4.2
Former Soviet Union	Former Soviet Union total	9.0	13.1	16.1	18.0
	Former Soviet Union	9.0	12.7	15.3	17.0
	Sakhalin	0.0	0.4	0.8	1.0
Africa	Africa total	7.9	12.1	16.4	19.5
Middle East	Middle East total	22.2	30.7	44.8	57.0
	Saudi Arabia	9.0	13.2	18.2	23.5
	Iran	3.7	4.0	7.0	8.0
	Iraq	2.4	3.6	6.0	7.5
	Kuwait	2.1	3.3	4.5	6.0
	UAE	2.4	3.6	4.5	6.5
	Other Middle East countries	2.6	3.0	4.6	5.5
Oceania	Australia	0.7	0.8	0.8	0.8
Asia	Asia total	6.9	7.3	6.7	6.6
	China	3.3	3.6	3.5	3.4
	Indonesia	1.4	1.1	0.5	0.5
	Other Asian countries	2.2	2.6	2.7	2.7
Grand total		74.5	96.5	120.3	140.2

Source: Prepared with reference to the International Energy Outlook 2004 released by the DOE/EIA, BP statistics, and other information

(2) Product yield rates and sulfur content rates for each of 70 types of crude oil

For the LP calculations, the WG set values for rates of sulfur content and product yield distinctive to each of the 70 types of crude oil, and rates of sulfur content for the semi-processed products derived from refining equipment. In the model, the rates were set on levels for optimal production at minimal total cost, assuming a balance with the demand for each type of crude oil and petroleum product as well as satisfaction of sulfur content regulations in the 30 regions (including countries and territories).

In the cost aspect, the object was to calculate the cost - minimum production in the 30 regions by totaling fluctuating costs for refining equipment in each, inclusive of crude oil and product freight, CDUs/VDUs, catalytic reforming, and other costs of secondary equipment.

Table 4 Examples of crude oil product yield and sulfur content rates (for all 70 types are shown in the attachment)

No	Crude oil	Producer country	API	S content (%)	Yield (%)					Straight kerosene S content (%)	Straight gas oil S content (%)	CD residual oil S content (%)	VD gas oil S content (%)	VD residual oil S content (%)
					LPG	Gasoline	Kerosene	Gas oil	CD residual oil					
1	Arabian XL (Berri)	Saudi Arabia	36.6	1.2	1.1	20.4	21.4	17.8	39.3	0.06	0.60	2.53	1.88	4.04
2	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

(3) Demand forecast in the base case in 2020 and 2030

- In 2030, the East Asian demand will amount to 36.7 million b/d, or about 28% of the world total. This would represent an increase of 19.3 million b/d from 2002, or about 35% of the world increase over the same period.

The 2030 forecast for the crude oil demand in East Asia resulting from simulation using the energy demand model was 19.3 million b/d larger than the 2002 figure. The corresponding increase for China came to 12.1 million b/d, more than 60% of this total. The forecast for India, too, was a substantial increase of 5.4 million b/d. For Asia as a whole (including Pakistan and other countries), the corresponding increase was about 26.4 million b/d.

In other regions, the biggest increase is for North America at 9.8 million b/d. East Asia and North America would therefore be the main markets. In 2030, these two markets would have a combined demand of 80 million b/d, or 60% of the world total. Their combined increase from 2002 would amount to 36.2 million b/d, or 65% of the world total.

Table 5 Forecast of demand in 2020 and 2030 in the base case

Unit: millions of b/d

	2002	2020	2030	Increase from 2002 to 2030
North America	23.2	30.1	33.0	9.8
Central and South America	4.6	7.2	9.1	4.6
Western Europe	15.8	17.1	17.8	2.0
Former Soviet Union	4.3	5.0	4.9	0.6
Africa	2.7	5.1	7.5	4.8
Middle East	4.9	9.3	12.0	7.1
Oceania	0.8	1.1	1.3	0.5
China	4.8	11.8	16.9	12.1
Japan	5.5	5.2	5.0	-0.5
Other East Asian countries	7.2	11.7	14.9	7.6
East Asia total	17.5	28.6	36.7	19.3
India	2.3	4.9	7.7	5.4
Other Asian countries	0.7	1.7	2.4	1.7
Asia total	20.5	35.3	46.9	26.4
World total	76.7	110.1	132.5	55.8

(4) Refining capacity in 2020 and 2030

As a general rule, the 2015 forecast figures for CDU capacity served as the basis, and it was assumed that refinery production would meet the increase in demand from 2015 to 2020 and 2030 (except for the United States; see the next section).

Because the shift to light oil would lead to a shortage of secondary equipment, the forecast was premised on a secondary equipment mix that would enable optimal production and minimum import- export cost for the sulfur content regulations and demand structure in each region.

Refining capacity in the United States

In the United States, the construction of additional refineries has become more difficult due to environmental restrictions, and it is consequently thought that a capacity increase would be achieved mainly by expanding existing refineries. The Annual Energy Outlook 2005 released by the DOE likewise envisions a capacity increase to cover about 70% of the demand increase through expansion of the existing refineries in its base case.

Although additional refineries have not been constructed in the United States over the last 30 years, the US refining capacity increased by some 1.9 million b/d (or an average of 190,000 b/d per year) over the last ten years. In 2003, it increased by about 140,000 b/d.

Because actual decisions on investment are left to the management of private companies, it is uncertain whether the CDU capacity will in fact be increased as the forecast by the DOE. The WG assumed that US CDU capacity would meet about 70% of the demand increase and that the remaining roughly 30% of the requisite capacity increase would be made in Central and South America.

In this forecast, the capacity increase of 5 million b/d by 2030 amounts to an average annual increase of just under 190,000 b/d per year, in line with the trend over the last ten years.

Table 6 US refining capacity in the LP model Unit: millions of b/d

	2003	2010	2020	2030	Change from 2003 to 2030
1. Demand	20.0	22.1	25.0	27.2	7.2
2. CDU capacity	16.8	18.3	20.3	21.8	5.0
2 - 1 difference	-3.2	-3.8	-4.7	-5.4	

Table 7 DOE forecast in the base case (reference) Unit: millions of b/d

	2003	2025	Change
Demand	20.0	27.9	7.9
CDU capacity	16.8	22.3	5.5

Source: DOE Annual Energy Outlook 2005

2. Forecast of crude oil supply and demand in the base case

(1) Crude oil production in each region

- In 2030, crude oil production will be 58 million b/d higher than in 2001, and the Middle East will account for 25 million b/d of this increase.

Table 8 shows the forecast for crude oil production in 2030 based on the demand premises presented above.

Crude oil production is forecast to reach about 55 million b/d in the entire Middle East and more than 46 million b/d in South America, Africa, and the Former Soviet Union taken together. Decreases are expected in North Sea production in Western Europe and Indonesian production in Asia.

To widen the degree of freedom in selection of crude oils, the WG gave the production capacity for each type fairly substantial margin within the scope of possibility. This left a surplus in crude oil production in Central and South America and Africa as well as in the Middle East. In contrast, the forecast envisioned no surplus and capacity production for crude oil in the Former Soviet Union. This is because of the mounting needs for it in neighboring East Asia as well as the rising preferences for it due to its relative lightness and low sulfur content as compared to other types.

Table 8 Crude oil production in each region in 2030

Unit: millions of b/d

	2001 production capacity	2001 production	2003 production	Increase from 2001 to 2030	Production surplus	2030 production capacity
North America total	15.4	14.0	20.1	6.1	0.0	20.1
USA	9.0	7.7	8.6	0.9	0.0	8.6
Canada	2.8	2.7	6.5	3.8	0.0	6.5
Mexico	3.6	3..6	5.0	1.4	0.0	5.0
South America total	7.2	6.9	11.9	5.0	2.1	14.0
Venezuela	3.2	3.2	7.0	3.8	0.0	7.0
Other Central and South American countries	4.0	3.7	4.9	1.2	2.1	7.0
North Sea and Western Europe total	7.1	6.9	4.2	-2.7	0.0	4.2
Former Soviet Union total	9.0	9.0	17.7	8.7	0.3	18.0
Former Soviet Union	9	9.0	16.2	7.2	0.3	16.5
Sakhalin	0	0.0	1.5	1.5	0.0	1.5
Africa total	8.5	7.9	16.6	8.7	2.9	19.5
Algeria	1.6	1.6	2.5	0.9	0.5	3.0
Libya	1.7	1.4	4.8	3.4	0.2	5.0
Nigeria	2.2	2.2	3.8	1.6	0.7	4.5
Other African countries	3	2.7	5.5	2.8	1.5	7.0
Middle East total	24.4	22.2	54.8	32.6	2.2	57.0
Saudi Arabia	10.2	9.0	22.5	13.5	1.0	23.5
Iran	3.7	3.7	8.0	4.3	0.0	8.0
Iraq	2.8	2.4	7.5	5.1	0.0	7.5
Kuwait	2.4	2.1	6.0	3.9	0.0	6.0
UAE	2.7	2.4	6.0	3.6	0.5	6.5
Other Middle East countries	2.6	2.6	4.8	2.2	0.8	5.5
Australia	0.7	0.7	0.6	-0.1	0.2	0.8
Asia total	7.0	6.9	6.6	-0.3	0.1	6.7
China	3.3	3.3	3.5	0.1	0.0	3.5
Indonesia	1.5	1.4	0.5	-0.9	0.0	0.5
Other Asian countries	2.2	2.2	2.7	0.5	0.0	2.7
	79.3	74.5	132.5	58.0	7.8	140.3

Source: Prepared with reference to the International Energy Outlook 2004 released by the DOE/EIA, BP statistics, and other information

(2) OPEC and non-OPEC crude oil production

- In 2030, the OPEC share of world crude oil production will reach 54%, up 16 points from 2002. Saudi Arabia will have to produce 22.5 million b/d (about 14 million more than in 2002).

OPEC crude oil

Increased OPEC production would be indispensable for supply of the forecast demand of about 135 million b/d in 2030. This applies particularly to Middle East OPEC production, which would have to total about 54 million b/d (about 35 million more than in 2002). It would be necessary for Saudi Arabia to produce more than 22.5 million b/d (about 14 million more than in 2002), and this would give it a 42% share of the total Middle East OPEC crude oil production.

Dependence on OPEC for this increase would appear to be inevitable. Of the production increase beginning in 2002, the Middle East OPEC producers are forecast to account for about 59%, and OPEC as a whole, 75%. Furthermore, attainment of the forecast production would presumably require the Middle East OPEC producers to open up their lots and apply the technology and investment of the oil majors.

Non-OPEC crude oil

For non-OPEC production, the biggest increase (about 8 million b/d as compared to 2002) is in the Former Soviet Union, where production increases are anticipated in Eastern Siberia and along the Caspian Sea. Increases are also foreseen for production in the North America (Canada and Mexico), Central and South America, and Africa. Owing to the expected decline in the North Sea production, however, the increase (relative to 2002) in non-OPEC production should be held to just under 15 million b/d, less than half as high as that in OPEC production.

Table 9 OPEC and non-OPEC crude oil production by region

Unit: millions of b/d

	Producer countries	2002 Actual	2020 Production volume	2030 Production volume	Change from 2002 to 2030 Change	Component ratio
OPEC production	Middle East OPEC total	18.9	41.4	53.6	34.7	59%
	Saudi Arabia	8.4	17.1	22.5	14.1	24%
	Iraq	2.0	6.0	7.5	5.5	9%
	Iran	3.4	7.0	8.0	4.6	8%
	Kuwait	1.6	4.5	6.0	4.4	8%
	Qatar	0.8	1.5	1.9	1.2	2%
	UAE	2.2	4.2	6.0	3.9	7%
	Neutral territories	0.5	1.2	1.6	1.1	2%
	Non-Middle-East OPEC total	9.6	13.2	18.6	9.0	15%
	OPEC total	**28.5**	**54.7**	**72.2**	**43.7**	**75%**
	OPEC share	**38%**	**50%**	**54%**	**16%**	
Non-OPEC production	USA, Canada, Mexico	14.0	17.6	20.1	6.1	10%
	North Sea	6.2	5.1	4.2	-2.0	-3%
	Former Soviet Union	9.9	15.3	17.7	7.8	13%
	Central and South America	3.7	4.3	4.9	1.2	2%
	Middle East (Non-OPEC)	2.0	1.2	1.2	-0.8	-1%
	Africa	2.9	5.2	5.5	2.6	4%
	Asia, Oceania	6.9	6.8	6.7	-0.2	0%
	Non-OPEC total	**45.6**	**55.5**	**60.3**	**14.8**	**25%**
	World total	**74.1**	**110.2**	**132.5**	**58.4**	**100%**

(3) Results of the forecast of crude oil production and import - export balance

- Net crude oil import of 26.4 million b/d in East Asia in 2030, for a decline in the self-sufficiency rate from 73% in 2002 to 16% in 2030.

(The attachments present crude oil trade matrix for all regions and flow charts for the key ones.)

Table 10 shows the forecast results for production and the import-export balance in 2030 in the base case.

In East Asia, the jump in the demand and the drop in crude oil production such as Minas Crude in Indonesia would require a net import of about 26.4 million b/d in 2030. Among the key regions, East Asia would have the lowest rate of self-sufficiency in crude oil supply, at only about 16%. This is much lower than the corresponding forecast rates of about 63% for North America and 25% for Western Europe.

Because of its rapidly rising import of crude oil, China is forecast to have a self - sufficiency of 21%, far below that of 73% in 2002. China's current strategy of making extensive investments in crude oil development projects overseas obviously derives from this outlook.

Table 10 Crude oil production and import-export balance in 2030

Unit: millions of b/d

	Crude oil processing	Regional crude oil production	Net import	Import	Export	* Rate of self-sufficiency in crude oil supply
North America	29.5	20.1	9.4	15.4	6.0	63%
Central and South America	9.5	11.9	-2.4	1.7	4.0	136%
Western Europe	19.6	4.2	15.4	15.7	0.3	25%
Former Soviet Union	6.6	17.7	-11.1	0.0	11.1	377%
Africa	7.9	16.6	-8.8	0.6	9.4	231%
Middle East	17.2	54.8	-37.6	0.0	37.6	476%
Oceania	1.3	0.6	0.7	0.9	0.1	50%
China	12.4	3.4	9.0	9.0	0.0	21%
Japan	4.5	0.0	4.5	4.5	0.0	0.0%
Other East Asian countries	15.0	2.2	12.8	14.3	1.4	15%
India	7.2	1.0	6.2	6.2	0.0	13%
Other Asian countries	1.7	0.0	1.7	1.7	0.0	0%
East Asia total	31.9	5.6	26.4	27.8	1.4	16%
World total	132.5	132.5	0.0	69.9	69.9	100%

* The rate of self-sufficiency in crude oil supply was calculated by dividing the regional crude oil production by the regional demand.

(4) Summary of changes in the crude oil trade flow in East Asia

- Even with an increase in crude oil export from the Former Soviet Union to 3.5 million b/d, import of Middle East crude oil by East Asia in 2030 would come to just over 13 million b/d, or about 77% of the total import of about 17 million b/d. Replacement of 1 million b/d of crude oil from the Former Soviet Union by that from the Middle East would increase the region's dependence on the latter to 80%.

The forecast envisions a crude oil import of about 3.5 million b/d from the Former Soviet Union by East Asia by 2030. The maximum level is 3.7 million b/d, consisting of 1.7 million b/d that could possibly be shipped from Nakhodka, 1.5 million b/d from Sakhalin, and 500,000 b/d by pipeline from Kazakhstan to China. A slowing of crude oil import from the Former Soviet Union and replacement of 1 million b/d of it with Middle East crude oil would increase the region's dependence on the latter to 80%.

As shown in Table 11, even assuming that crude oil import from the Former Soviet Union reaches 3.5 million b/d, or 19% of the import of 17.3 million b/d forecast for 2030, East Asian dependence on Middle East crude oil would be 76%, up one point from 2002. The supply of crude oil from the Former Soviet Union would increase its worldwide export by a total of about 7.1 million b/d, with some 3.5 million b/d (or about half) of this increase going to East Asia.

The grounds for this forecast include the cost of freight to East Asia, which is the lowest in shipment from Nakhodka and Sakhalin (the prospective Pacific Coast terminals in the Former Soviet Union), and the low sulfur content of the crude oil.

Table 11 Change in the composition of crude oil import sources in East Asia

Unit: thousands of b/d

Major import sources for East Asia		2002	2020	2030	Change from 2002 to 2030
Total import		10,461	21,324	27,783	17,322
	Middle East	7,909	16,397	21,227	13,318
	Africa	906	1,177	1,398	492
	Former Soviet Union	147	2,090	3,514	3,367
	South America	61	184	85	24
	Other	1,438	1,476	1,559	121
Middle East share		76%	77%	76%	1%
	Middle East share in Northeast Asia	77%	73%	73%	-3%

* Northeast Asia = China, Korea, and Japan

Former Soviet Union crude oil: Premises on smooth conditioning of supply infrastructure to East Asia

- In the economic aspect, crude oil from the Former Soviet Union would be fully competitive at a price in the range of 25 - 30 dollars per barrel. Everything depends on infrastructural conditioning and Russian policy on sales to Asia.

The most important factors for the future course of the East Asia crude oil market are the trend of crude oil production in Eastern Siberia and Sakhalin, and the sufficiency of infrastructural conditioning for supply of Russian crude oil to Asia.

Over the long term, it is thought that Russia will expand production of crude oil, including development in East Siberia, in order to earn foreign currency. Sale of Russian crude oil to Asia represents a major business prospect, and its entry into the East Asian market would have a big impact as competition for Middle East crude oil. As for the supply infrastructure, construction of a pipeline to Nakhodka has virtually been decided. The preconditions for sale to the Far East are therefore falling into place. Conversely, a delay in East Siberia development or pipeline construction would inevitably result in a rise in East Asian dependence on Middle East crude oil.

1) Premises regarding shipment volume

A. Pipeline to Nakhodka

The volume of pipeline supply to Nakhodka, which is currently estimated at 1.6 million b/d, could increase to 2 million b/d in 2030. By deducting the Russian demand at about 300,000 b/d, the shipment ceiling would be about 1.7 million b/d, and the WG put the export to East Asia at about 1.6 million b/d.

B. Sakhalin crude oil

Sakhalin crude oil, which resembles Murban, the typical Middle East crude oil, is being developed with the Sakhalin 1 and 2 projects. The WG assumed that about half of the remaining four projects will be implemented by 2020, and estimated the supply at 800,000 b/d. It also assumed that all projects will basically be completed by 2030, and put the supply in that year at a maximum of 1.5 million b/d. Almost all of this supply would be directed to China, Korea, Japan, Taiwan, and other East Asian countries.

Table 12 Export of crude oil from the Former Soviet Union to East Asia

Unit: thousands of b/d

Export of crude oil from the Former Soviet Union		2002	2020	2030	Change from 2002 to 2030
Total export		44	2,090	3,514	3,470
East Asia	Sakhalin	0	800	1,500	1,500
	Nakhodka	40	984	1,608	1,568
	Kazakhstan PL	0	300	400	400
	Rail transport	4	6	6	2
	Other	0	0	0	0

2) Economic assessment of Russian crude oil shipped from Nakhodka

The cost of production of Russian crude oil is estimated at 5 dollars per barrel for Yukos and 9 dollars average nationwide. However, large-scale shipment from Nakhodka would require development of Eastern Siberia. Reservoirs of Eastern Siberian crude oil have a low concentration and would require drilling over a wide area. In consideration of the cost increase associated with such drilling, the cost was estimated at about 15 dollars per barrel, 50% more than the nationwide average. Even with a 15% ROI, the pipeline cost was estimated at about 5 dollars. As such, the export from Nakhodka was thought to be payable at a price of 20 dollars per barrel. Therefore, even with crude oil costs in the range of 25 - 30 dollars per barrel, sales could be made to the Asian market. Eastern Siberian crude oil is of good quality, with the API of 40 degrees and sulfur content of 0.3%. It could become highly preferred in Asia along with the shift in demand to light products. The crude oil shipped from Nakhodka is anticipated to be a blend with Western Siberian crude oil, but would probably still have a lower sulfur content than Middle East crude oil.

(5) Change in the flow of Japan's crude oil trade

- Decrease in Japan's dependence on the Middle East to 84% in 2030 by 2 points from 2002 because of the increase in import from the Former Soviet Union to 530,000 b/d.

Viewed on the basis of the domestic demand, Japan still has a surplus capacity of refining facilities, and its refining capacity could be revised downward along with the consolidation of the less efficient refineries. However, it was decided to apply the current capacity in 2020 and 2030.

As a result, the forecast found that Japan's total crude oil import would increase by 320,000 b/d along with a rise in the CDU operating rate to 95% in response to the expanded demand in China and other Asian countries. If there is another wave of refinery consolidation accompanied by scrapping of additional facilities, the import would decline by the same amount.

In 2030, the decline in production capacity of Sumatra Light from the Minas field in Indonesia and increase in import from the Former Soviet Union would result in a reduced import of about 270,000 b/d for other types.

At the same time, the forecast places shipments of 530,000 b/d from the Former Soviet Union and increased import from Africa. As a result, Japan's rate of dependence on the Middle East would decline by 2 points, from 87% in 2002 to 84% in 2030.

The Nakhodka pipeline is the subject of prospective inter-governmental cooperation whereby Japan participates in the construction and investment required for development of Siberian crude oil. Ultimately, the export volume would be shaped by Russian policy on sales, including the price.

The future holds the prospect of an increase in shipments of heavy crude oil from the Azadegan field in Iran. If this requires additional secondary equipment, increased import of Russian crude oil, which is thought to be lighter and low in sulfur, would be another option. There is also the prospect of a resumption of im ports from Iraq, and this raises the possibility of changes in the structure of import from the Middle East by country.

In the unlikely event of a decline in the total crude oil import due to a downward revision of refining capacity, it was assumed that the decrease would come mainly from shipments of Middle East crude oil. This would create a need for consideration of the balance of import from the key Middle East sources at present, including the UAE and Saudi Arabia.

As it increases the share of its crude oil import from regions other than the Middle East, Japan must take care to avoid a radical change in its import from the Middle East, which will continue to be the main source.

Table 13 Change in Japan's crude oil import by source

Unit: thousands of b/d

Major import sources for Japan		2002	2020	2030	Change from 2002 to 2030
Total import		4,034	4,555	4,533	499
	Middle East	3,501	3,829	3,823	322
	Africa	8	102	81	73
	Former Soviet Union	153	429	530	377
	South America	4	0	0	-4
	Other	368	195	99	-269
Middle East share		87%	84%	84%	-2%
Excluding crude oil combusted without processing		3,934	4,499	4,499	565
Refining capacity		4,767	4,736	4,736	-31
Operating rate		83%	95%	95%	12%

(6) Change in China's crude oil trade flow

- Possible increase in share of imported oil from the Middle East to 68% in 2030 (up 18 points from 2002) and in the share of the oil supply by imported oil to 70% (up 40 points from 2002).

China's demand for crude oil is expected to increase by 2030. The shipment from the Former Soviet Union should increase by about 1.7 million b/d, the import from the Middle East is forecast to expand by about 5.4 million b/d, such that the Middle East share wou ld increase by about 18 point.

Even supposing a shift of 500,000 b/d in shipments of African and South American crude oil to China, it would still have an import of about 5.6 million b/d (up 4.9 million b/d from 2002) from the Middle East, for a dependence rate of 62%, up 12 points from 2002. A corresponding shift of 1 million b/d would nevertheless leave an import of about 5.1 million b/d from the Middle East, and China would have to rely on the Middle East for about 57% of its crude oil import.

Table 14 China's crude oil import by source

Unit: thousands of b/d

Major import sources for China		2002	2020	2030	Change from 2002 to 2030
Total import		1,388	6,808	8,982	7,594
	Middle East	689	4,643	6,083	5,394
	Africa	318	587	893	575
	Former Soviet Union	80	1,100	1,776	1,696
	South America	0	0	0	0
	Other	301	479	231	-70
Middle East share		50%	68%	68%	18%
African/Former Soviet Union share		29%	25%	30%	1%
Dependence on imported crude oil		30%	66%	70%	40%
Dependence on Middle East crude oil		15%	45%	47%	32%

Of the approximately 1.8 million b/d forecast for China's import from the Former Soviet Union, it is estimated that Sakhalin crude oil will account for about 900,000 b/d, and the shipments from Nakhodka, about 470,000 b/d. The pipeline shipments from Kazakhstan to China are estimated at 400,000 b/d.

Table 15 China's crude oil import from the Former Soviet Union

Unit: thousands of b/d

	2002	2020	2030	Change from 2002 to 2030
Total import	1,388	6,808	8,982	7,594
Breakdown of crude oil from the Former Soviet Union	44	1,101	1,777	1,733
Sakhalin	0	484	905	905
Nakhodka	40	311	466	426
Kazakhstan PL	0	300	400	400
Railway transport	4	6	6	2
Former Soviet Union crude oil share	3%	16%	20%	17%

(7) Change in India's crude oil trade flow

- Increase in dependence on Middle East crude oil to 80% in 2030, up 23 points from 2002; need for import of more than 11 million b/d (9.6 million b/d more than in 2002) from the Middle East by China and India taken together.

By 2030, India's demand for crude oil will have increased by the greatest margin after that of China. Its import from the Middle East is forecast to increase by about 5 million b/d, and expand the share of the total import occupied by that region by about 23 points.

Even with a shift to India of 1 million b/d in African crude oil, which India is working to develop, the import from the Middle East would nevertheless come to about 4 million b/d (3.9 million b/d more than in 2002), and the rate of dependence on that region, to 64%, 7 points higher than in 2002.

Saudi Arabia is considering a move into India in the downstream division (construction of refineries, etc.). This evidences its position stance about acquiring sales points in India as well as East Asia.

Table 16 India's crude oil import by source

Unit: thousands of b/d

Major import sources for India		2002	2020	2030	Change from 2002 to 2030
Total import		1,220	4,047	6,177	4,957
	Middle East	700	3,027	4,965	4,265
	Africa	438	1,020	1,211	773
	Former Soviet Union	0	0	0	0
	South America	5	0	0	-5
	Other	77	0	0	-77
Middle East share		57%	75%	80%	23%

3. Perspectives on the crude oil situation on the supply side

(1) Trend of supply of crude oils competing with Middle East crude oil to East Asia

- Shipment of most of the increased production in Africa and South America to North America and Western Europe, and few prospects for a big increase in shipments to East Asia.

For Middle East crude oil, the most attractive markets will be East Asia and India. In the case of East Asia, this is because it does not have a powerful export rival except for the crude oil from the Former Soviet Union. Capacity for production and shipment in the Former Soviet Union is expected to increase, even in the western part of the country (on the Caspian Sea coast), and this points to an increase in export, especially to Western Europe.

With the completion of pipelines to China and other infrastructural conditions, the Former Soviet Union should be able to export a total of 3.5 million b/d to East Asia from Nakhodka, Sakhalin, and Kazakhstan. Even in this case, however, export of Middle East crude oil to East Asia should increase by about 13 million b/d.

Table 17 shows the forecast for supply of major types of crude oil to East Asia. Except for that from the Former Soviet Union, the share occupied by East Asia is likely to hover around the same level.

Table 17 Supply of major types of crude oil to East Asia

Unit: thousands of b/d

Export of major types of crude oil to East Asia	2002	2020	2030	Change from 2002 to 2030
Middle East	14,785	31,174	37,601	22,816
To East Asia	7,909	16,397	21,227	13,318
East Asian share	53%	53%	56%	3%
Africa	5,850	7,999	9,366	3,516
To East Asia	906	1,177	1,398	492
East Asian share	15%	15%	15%	-1%
Former Soviet Union	3,976	7,774	11,080	7,104
To East Asia	147	2,090	3,514	3,367
East Asian share	4%	27%	32%	28%
South America	2,531	3,824	4,005	1,474
To East Asia	61	184	85	24
East Asian share	0%	5%	2%	2%

Supply of non-Middle East crude oil to major regions

The supply of African crude oil to East Asia is anticipated to increase somewhat due to upstream development by India and other factors, but not by a wide margin. This is because, like that for South American crude oil, most of the increase should be exported to North America and Western Europe, its major markets.

Table 18 Export destinations of African crude oil

Unit: thousands of b/d

Major export destinations of African crude oil	2002	2020	2030	Change from 2002 to 2030
Total export	5,850	7,999	9,366	3,516
East Asia	906	1,177	1,398	492
India	438	1,020	1,211	773
North America	1,530	2,245	2,375	845
Western Europe	2,347	2,873	3,681	1,334
Other regions	629	683	701	72
East Asian share	15%	15%	15%	-1%

Table 19 Export destinations of South American crude oil

Unit: thousands of b/d

Major export destinations of South American crude oil	2002	2020	2030	Change from 2002 to 2030
Total export	2,531	3,824	4,005	1,474
East Asia	61	184	85	24
India	5	0	0	-5
North America	2,094	2,975	2,975	881
Western Europe	188	266	642	454
Other regions	183	400	302	119
East Asian share	2%	5%	2%	0%

Table 20 Export destinations of Former Soviet Union crude oil

Unit: thousands of b/d

Major export destinations of the Former Soviet Union	2002	2020	2030	Change from 2002 to 2030
Total export	3,976	7,774	11,080	7,104
East Asia	147	2,090	3,514	3,367
India	0	0	0	0
North America	83	46	1,280	1,197
Western Europe	3,695	5,531	6,084	2,389
Other regions	51	106	202	151
East Asian share	4%	27%	32%	28%

(2) Policy on sales of Middle East crude oil to East Asia

Many Middle East oil-producing countries have curtailed discontent and movements for democratization thus far by priority allocation of a portion of oil revenues for preferential tax treatment of their citizens and provisions in the fields of residential facilities, education, and medical care.

In the Middle East, too, population is projected to grow at an annual average rate on the order of 2%. To secure and increase their oil revenues, the Asian market, with its rapidly increasing demand for crude oil, will be the most important one in the context of sales policy.

In the North American and Western European markets, on the other hand, their strategy will probably be aimed at keeping their sales volume on the current level and selling enough to prevent a surplus of competing African and South American crude oil from flowing into the Asian market.

Table 21 Export destinations of Middle East crude oil

Unit: thousands of b/d

Major export destinations of Middle East	2002	2020	2030	Change from 2002 to 2030
Total export	14,785	31,174	37,601	22,816
East Asia	7,909	16,397	21,227	13,318
India	700	3,027	4,965	4,265
North America	2,396	3,570	3,271	875
Western Europe	2,663	4,562	4,540	1,877
Other regions	1,117	3,618	3,597	2,480
East Asian share	53%	53%	56%	3%

(3) Crude oil supply and demand in the West European and North American markets

A. Export to the North American market

The forecast envisions increases in the range of 900,000 - 1.2 million b/d in export of the major types of crude oil to the North American market by 2030. In actuality, there is room for adjustment of the relative competitiveness of these crude oils through marketing measures in that market, but the share composition is not expected to change radically, except for crude oil from the Former Soviet Union.

(Factor of uncertainty: conditioning of the infrastructure for crude oil shipments from the Former Soviet Union to North America)

An increase of about 1.2 million b/d in shipment of crude oil from the Former Soviet Union to the North American market would require conditioning of the related infrastructure. Like those for shipment from Nakhodka, prospects for such conditioning would not be nil if oil prices stay on the level of 30 dollars per barrel over the long term, but there is uncertainty about the plans for construction of a crude oil terminal for shipment from the ice-free port of Murmansk even at present. Without such infrastructure, the share of shipments to North America by regions other than the Former Soviet Union may be expected to rise. Although the matter depends partly on US policy, the share expansion would belong mainly to Middle East crude oil, which has the most margins for increased production.

Table 22 Major import sources of North America

Unit: thousands of b/d

Major import sources of North America	2002	2020	2030	Change from 2002 to 2030
Total import	10,520	12,517	15,370	4,850
Middle East	2,396	3,570	3,271	875
Africa	1,530	2,245	2,375	845
Former Soviet Union	83	46	1,280	1,197
South America	2,094	2,975	2,975	881
Other regions	4,417	3,680	5,468	1,051
Middle East share	23%	29%	21%	-1%
African/South American share	34%	42%	35%	0%

B. Export to the West Europe market (Trend of Africa/Former Soviet Union crude oil)

In 2030, the West Europe market is forecast to have a crude oil import about 16 million b/d (5.1 million more than in 2002) due to the decline in North Sea production, which has passed its peak, and corresponding decline in the intraregional supply by West Europe oil producers. A production increase is foreseen in the Caspian Sea area, and export from the Former Soviet Union should increase the most, to about 6.1 million b/d (3.2 million more than in 2002), owing to the geographical proximity. It should be noted, however, that this expansion will require further conditioning of the infrastructure. The forecast also contains a big increase in import of African crude oil, whose lightness and low sulfur content match the Western European demand structure.

The 2030 crude oil production in the Former Soviet Union is forecast to approach its upper limit at 17.8 million b/d. An increase in its export to Western Europe would mean a decrease in that to East Asia. It is estimated that this decrease would be covered by export from the Middle East. Without further conditioning of the infrastructure for export to East Asia, a decline in the share held by crude oil from the Former Soviet Union in the West Europe market would lead to a decrease in the production volume.

Table 23 Major import sources of Western Europe

Unit: thousands of b/d

Major import sources of Western Europe	2002	2020	2030	Change from 2002 to 2030
Total import	10,638	15,015	15,728	5,090
Middle East	2,663	4,562	4,540	1,877
Africa	2,347	2,873	3,681	1,334
Former Soviet Union	2,930	5,531	6,084	3,154
South America	164	266	642	478
Other regions	2,534	1,782	781	-1,753
Middle East share	25%	30%	29%	4%
African/Former Soviet Union share	50%	56%	62%	12%

4. Long-term viewpoint in crude oil supply and demand in Asia (2030)

(1) Prospective long-term crude oil supply-demand climate and related measures

Future changes in the supply-demand climate

Demand side: shift to light products

Expansion of the light products demand due to the rapid increase in automobile ownership, especially in Asia, and expansion of the demand for low-sulfur, light crude oil due to the tightening of environmental regulations

Widening of crude oil price disparities based on API or sulfur content due to the mismatch between supply and demand

Supply side: increase in crude oil gravity and sulfur content

Expansion of the share occupied by high - sulfur, medium-to-heavy crude oil in Saudi Arabia and other countries in the Middle East, which has ample margin for production increase

Measures for adaptation to these climate changes

Downstream measures: expansion of investment in cracking and desulfurization equipment

Expansion of the advantage of refining heavy crude oil accompanying the widening of the API differentials
Increase in cracking and desulfurization equipment installation for conformance with environmental regulations

Upstream measures: Upgrading of heavy crude oil

Promotion by Venezuela of investment in next-generation processes to upgrade heavy crude oil in order to expand its sales routes outside the United States and expand its export of sweet crude oil

(2) Future course (sensitivity analysis)

1) Sensitivity analysis cases

For analysis of the long-term crude oil supply and demand, the WG studied the following cases of heavier crude oil and expansion of API differentials in 2030.

Table 24 Sensitivity analysis cases and outline

Case	Outline
Base case	Standard price differentials of 3 dollars per 10 points of API (Saudi AXL and AH), and slight increase in heavy crude oil
Case of an increase in heavier crude oil	Increase in the share of Saudi's heavy crude oil, and increase in the share by Canadian and other heavy crude oil relative to the base case
Case of an expansion of API differentials	Case of an expansion of the price differentials per 10 points of API to $ 5.6 as opposed to $ 3 in the base case

2) Base case and case of an increase in heavier crude oil

(Change in crude oil properties)

- Increase in heavier crude oil and sulfur content toward 2030

The base LP case confirmed an increase in heavier crude oil, as evidenced by a decline of 1.4 points in the API index relative to 2001 in 2030. It also confirmed an increase in the average sulfur content.

The case of even heavier crude oil incorporating the prospect of a higher share for heavy crude oil from Saudi Arabia and other countries would also be characterized by high sulfur content, as shown in Table 25.

Table 25 Trend of average API and sulfur content for 70 types of crude oil

	Trend of API and S content (W%)				Change	
	2001	2020	2030	2030 Heavier crude oil case	From 2001 to 2030	From 2001 to 2030 Heavier crude oil case
Average API	35.6	34.0	34.2	33.4	-1.4	-2.2
Average sulfur content (W%)	1.19	1.26	1.24	1.33	0.05	0.14

(Change in refining equipment capacity)

- Rise in the rate of desulfurization and cracking equipment relative to CDUs in 2030 due to the tightening of environmental regulations and increase in heavier crude oil

Table 26 shows the trend of refining equipment capacity to 2030. It can be seen that capacity in each category is expected to rise along with demand growth. Because it is impossible to set forecast values for the mix of secondary equipment, the WG applied the optimal mix for the cost minimum adopted in the LP model. As a result, the biggest increase over the long term was given to kerosene/gas oil desulfurization equipment owing to the tightening of environmental regulations.

The calculation confirmed that, in the case of heavier crude oil, there would have to be a considerable increase in the installation rate for desulfurization and cracking equipment relative to CDUs. The actual investment would be based on the selection of crude oil with consideration of the long -term trend of differentials in respect of API and sulfur content.

Table 26 Trend of equipment capacity and secondary equipment capacity to 2030

Unit: millions of b/d

		Trend of equipment capacity				Change from 2007 to 2030	
Category	Equipment	2007	2020	2030 Base case	2030 Heavier crude oil case	2030 Base case	2030 Heavier crude oil case
Distillation	CDU	86	123	147	147	61	61
	VDU	28	31	40	59	12	31
	Distillation total	114	154	187	206	73	92
Desulfurization	Hydro-desulfurization	5	10	11	17	6	12
	Hydro-cracking	5	6	8	12	2	7
	Naphtha desulfurization	24	23	32	52	8	28
	Kerosene desulfurization	13	30	42	41	29	28
	Desulfurization total	47	70	93	121	46	74
Cracking	R-FCC	4	5	7	11	3	7
	Thermal cracking	9	13	18	18	9	9
	FCC	11	13	16	25	5	14
	Cracking total	24	31	41	54	17	30
Secondary equipment rate relative to CDUs	Desulfurization equipment	55%	57%	63%	83%	8%	27%
	Cracking equipment	28%	25%	28%	37%	0%	9%

Source: Figures for 2007 are based on consolidation of more detailed figures from the O&GJ 2004 edition.

3) Standard case and case of expanded API differentials

(Description)

In the base case, the price differentials for the approximately 10 points of API between the Saudi Arabian crude oils Arabian Extra Light (AXL) and Arabian Heavy (AH) was put at 3 dollars (the average figure for the period October 2003 - March 2004). To ascertain the impact of an API differentials expansion alone, it was assumed that there would be no need for installation of additional secondary equipment.

In the case of wider API-based price differentials, the premise is an increase to 5.6 dollars (the average figure for the period April 2004 - January 2005). A sensitivity analysis was conducted to ascertain the degree of promotion of heavy crude oil selection as compared to the base case in the event of expanded differential and relative decline in prices for heavier crude oil.

LP calculation result: selection of heavier crude oil at the level of a few million b/d and average API decline of 1.7 points

Table 27 shows the results of the LP calculation for selection of crude oil. The case of expanded API (and price) differentials would be accompanied by a relative increase in selection of heavier crude oil and decline in consumption of sweet crude oil. Substantial change is exemplified by the drop of about 1 million b/d in production of sweet crude oil from Libya and increase of about 1.5 million b/d in selection of heavy crude oil from Central and South America.

It must be noted, however, that there is a tendency for changes in LP selection to be biased toward a single type of crude oil and that the types undergoing change would not be the same with a change of preconditions. In other words, the results could be interpreted as indicating the possibility of a change in crude oil selection amounting to a few millions of barrels per day total.

Table 27 Comparison of base case and expanded API differentials case

Unit: thousands of b/d

Crude oil	Country of production	API	S content (wt%)	Production volume in the expanded API differentials case (1)	Production volume in the base case (2030) (2)	Difference
Arabian XL (Berri)	Saudi Arabia	36.6	1.2	3,300	2,310	990
Qatar	Qatar	42.0	1.2	700	490	210
Marlin, etc.	Central and South American countries	24.7	0.7	6,476	4,900	1,576
Es Sider	Libya	39.1	0.4	2,800	3,808	-1,008
Sirtica	Libya	41.1	0.4	700	1,000	-300
Synthetic Crude Sweet Blend	Canada	34.4	0.1	3,150	4,500	-1,350

In the case of an expanded API differentials, the LP calculation found that the average API of crude oil selected even with the base case equipment mix decreased by about 1.7 points (indicating selection of heavier crude oil). This is because the calculation was premised on secondary equipment margin for selection of heavier crude oils.

In reality, it is unclear whether refineries have such a margin of existing secondary equipment. There is a strong possibility of increased installation of secondary equipment if the price differentials per 10 points of API widened to $5.6 on a long-term basis. It is consequently thought that refineries would take steps to accommodate heavier crude oil more than is placed in this case.

Table 28 Trend of average API and sulfur content of 70 types of crude oil

	Trend of API and S content (W%)				Difference	
	2001	2020	2030	2030 Expanded API differentials case	From 2001 to 2030	From 2001 to 2030 Expanded API differentials case
Average API	35.6	34.0	34.2	33.9	-1.4	-1.7
Average sulfur content (W%)	1.19	1.26	1.24	1.29	0.05	0.1

5. Summary of analysis results, and implications

(1) Dependence on the Middle East in East Asia and trend of crude oil export from the Former Soviet Union

The simulation indicated that the rate of crude oil dependence on the Middle East in East Asia would level off at about 76% over the years 2002 - 2030 (with supply from the Former Soviet Union accounting for about 3.4 million b/d of the total increase of about 4.0 million b/d in non-Middle East crude oil import over the same period).

Import from the Former Soviet Union is the most realistic option for avoidance of excessive dependence on the Middle East in East Asia and Japan. The completion of the infrastructure for shipment by pipeline to Nakhodka would have great significance for such increased import. To this end, Japan and the other Asian countries must do their utmost to determine the inclinations of the Russian government.

The construction of the pipeline to China, which is the subject of much discussion, would amount to the same as far as the total East Asian import is concerned. This is to say that, even if the pipeline is constructed only to Nakhodka, crude oil could probably be imported in large quantities by tanker to the Chinese coastal areas, where the big refineries are concentrated. While the development in Sakhalin involves mainly gas, it should progress over the long term, and this suggests good prospects for large-scale import of light, low-sulfur crude oil mainly to Asia, provided that there is no outbreak of political and economic problems with Russia.

(2) Differentials between heavy and light crude oils, and related measures

On the demand side, the progress of motorization in Asia, and particularly China and India, is anticipated to increase the demand for light products . In addition, controls on sulfur are anticipated to become tougher.

On the supply side, there is anticipated to be a rise in heavier crude oil and higher sulfur content due to an expansion of the share occupied by Middle East crude oil, which has the most supply capacity.

This mismatch between supply and demand in respect of crude oil properties should widen the price differentials based on API and sulfur content, and spur investment in the following two areas.

1) Investment for increased installation of secondary (mainly cracking and desulfurization) equipment in correspondence with expansion of the advantage of heavy crude oil refining due to the expanded API-based price differentials, and tighter environmental regulations
2) Investment in next-generation processes in producer countries to upgrade heavy crude oil

To cite a specific project for upgrading heavy crude oil in a producer country, Venezuela is anticipated to have a production of about 2 million b/d of this sort in 2030. This would amount to less than about 2% of the global crude oil supply of 133 million b/d. In Asia, which is projected to depend on the Middle East for just under 80% of its crude oil, augmentation of secondary equipment beyond the increase in CDU capacity would appear to be essential, especially in China and India. The crude oil produced in the Former Soviet Union is anticipated to be lighter and lower in sulfur content than that produced in the Middle East, and should be ideal for the demand in Asia, which is shifting to lighter products.

Japan has already installed a lot of secondary equipment to process Middle East crude oil, which occupies just under 90% of its crude oil import, and will probably not have to make additional investments for such equipment, unlike the other Asian countries. Although the outlook is still unclear, there remains the possibility that it will have to take action for higher octane numbers.

(3) Supply capacity for Middle East crude oil

- Saudi crude oil production of 22.5 million b/d to meet the 2030 world demand

1) Perspectives on production capacity in the Middle East and Saudi Arabia

In the demand model, the world demand for crude oil is projected to reach 132.5 million b/d in 2030. To increase the degree of freedom in crude oil selection in the LP model, the surplus production capacity was estimated at about 8 million b/d. The R/P ratio for the producing countries in the Middle East is high at about 100 years, and the production capacity in Saudi Arabia in particular is estimated at 23.5 million b/d. The LP model applied a supply volume of 22.5 million b/d from Saudi Arabia, but there are no grounds for actual achievement of this production capacity and volume.

2) Apprehensions about production capacity in Saudi Arabia

In reality, almost all the Middle East countries are reluctant to open concessions to the Western oil majors. They also have not been making the investments for exploration and other items in sums required for the production increase needed over the coming years.

In connection with excess production capacity as well, there are apprehensions about the decline of the major oil fields in Saudi Arabia. This is behind a growing concern about a contraction of oil production from them, even over the medium term.

3) Production scenario of Saudi Aramco over the next 50 years

Saudi Aramco has prepared a scenario for additional investment for development of 35 billion barrels of reserves in the case of production at a pace of 12 million b/d over the 50-year period beginning in 2004. The course after that period is unknown.

At 22.5 million b/d, the production figure applied in the LP calculation is more than 10 million b/d higher than that in the scenario. Even assuming that it is physically possible to supply such a volume due to the abundance of proven reserves, it is unclear whether companies could make the huge investment needed to meet the world demand increase to 2030.

It should be added that the Cambridge Energy Research Associates (CERA) estimates the 2015 production at about 14 million b/d. If the demand stays firm, it is thought that oil prices will remain high enough to encourage investment for development. As a result, Saudi Arabia should play the swing producers' role as the leader of OPEC provided that it is not affected by non-economic occurrences such as a sudden change of political system or inter-religious confrontation. Stability in respect of political system and relations between religions/sects is therefore a matter of concern not only for the supply of energy but also for worldwide stability, and requires constant efforts of international cooperation.

4) Case of inability to increase production sufficiently in Saudi Arabia

In 2030, the Middle East countries other than Saudi Arabia will also be producing a massive amount of crude oil. The forecast figures appear to be possible to attain in Kuwait, Iraq, and Iran to judge from the amount of proven reserves, but it would probably be difficult for them to increase production by 10 million b/d beyond the 2030 level.

A continued expansion of demand in a situation of inability to increase production in the Middle East is likely to drive up oil prices. There are considerable reserve of very heavy crude oil in Venezuela and Canada, and the higher prices could make the cost of cracking it fully feasible. This raises the possibility of the emergence of a few million b/d worth of such next-generation synthetic crude oil into the market.

(4) Perspectives on security in passage through the Strait of Malacca

- Emergencies in the Strait of Malacca (such as maritime accidents and terrorism) could be met by expansion of crude oil stockpile for the time being. The obstacle to the plan for construction of a pipeline across the Malay Peninsula is economic feasibility.

1) Problems surrounding passage

Division of the increase in the volume of crude oil carried through the Strait of Malacca in 2030 (about 432 million tons per year) by the average tanker capacity of 170,000 tons yields a figure of about 2,540 tankers per year. The increase in the number of tankers alone would therefore be held to just under 4% of the total number of passages. However, the aforementioned data are based on the number of tankers with a capacity of at least 300 tons, which are required to report passage. The February 1999 edition of the Far Eastern Economic Review presented an estimate that the total number of ships passing through the Strait of Malacca already exceeds 1,000 per day and 400,000 per year. The Strait is therefore fairly congested even at present, and an increase in the number of large tankers passing through it would definitely not be slight.

The future is bound to bring an increase in the number of LNG tankers from Qatar and other ports of the Middle East. There could also be an increase in the number of tankers carrying petroleum products to Asia. In addition, factors such as the spread of free trade agreements and the progress of globalization suggest that the prospects for an increase in the number of cargo ships, which are most numerous in absolute terms, are by no means negligible. In light of this congestion, passage through the Strait would certainly face problems larger than at present in emergencies such as disasters at sea.

In the event of occurrence of an accident involving tankers or other large ships in the Strait of Malacca and entailing a detour through the Strait of Lombok, the detour would lengthen the voyage by 2.5 - 3.5 days each way, for a total of 5 - 7 days (or about 15% of the total roundtrip voyage of about 40 days between the Middle East and Japan). Closure of the Strait of Malacca due to stranding or other occurrences, compelling detours by all ships, would have an immense economic impact. There are many Islamic countries in the vicinity, and closure could possibly become a new terrorism objective.

2) Crude oil stockpile as a countermeasure

An augmentation of crude oil stockpile would be an effective means of insurance against the risks described above. In East Asia, Japan and Korea are the only countries with crude oil reserves on the IEA level. National reserves are still in the planning stage in China, Taiwan, and Thailand. In other countries in the region, they are insufficient.

Crude oil stockpile require a huge investment that could probably not be made by certain countries on their own. It would be worthwhile for the East Asian countries to study ways of building up co-operative stocks in the region. Japan and Korea, which are IEA members and possess the related expertise, would have a vital role to play in this connection.

3) Perspectives on energy security in marine transport

The government of Thailand has worked out a plan for construction of a crude oil pipeline across the Malay Peninsula for avoidance of the highly congested Strait of Malacca. Thailand's PTT, which conducted the project feasibility study, concluded last year that the plan would be economically difficult to implement, but it could also be assessed from the macroscopic perspective including factors such as creation of employment. The PTT has asserted that the future course of the plan is up in the air. It will probably not be implemented without an agreement in respect of various factors (including the buildup of national reserves in Thailand and the governmental goal of transforming the country into a crude oil and products hub in the East Asian market) as well as a concurrence of inclinations among the oil producers on the supply side.

On the subject of the construction of a crude oil pipeline across the Malay Peninsula, most oil concerns in Singapore indicated an understanding of the strategic intentions of Thai Prime Minister Shinawatra Thaksin to stimulate the Thai economy, but believed it would be difficult for the country to transform itself into a hub capable of rivaling Singapore, which is at the crossroads of sea lanes to Asia and is already a center of world maritime trade. It might be added that, whereas some 140,000 vessels stop at the port of Singapore per year, the corresponding figure for Thailand is only about 7,000. Another negative factor is the prospective site of the pipeline construction in southern Thailand, where Moslems make up about 90% of the population and the political situation is unstable.

(5) Necessity of cooperation among Japan, China, and other Northeast Asian countries

If crude oil shipments commence from the Nakhodka pipeline in the Former Soviet Union and Japan begins importing just over 500,000 b/d including shipments from Sakhalin, it could lower its rate of dependence on the Middle East, which is currently about 87%, by 2 points. Nevertheless, it would still constantly depend on the Middle East for nearly 80% of its supply, and there would be no change in the importance of maintaining favorable relations with the region.

Assuming that the selling price is reasonable, the countries of East Asia, which are hoping to lower their dependence on Middle East crude oil, would have rising needs for receipt of shipments from Sakhalin and the Nakhodka pipeline. This points to the necessity of deepening cooperation, particularly with China and Korea, in purchase from the Former Soviet Union, also to strengthen the region's hand in negotiations with Russia.

In 2030, China will have to import about 9 million b/d, or about 7.6 million b/d more than in 2002. Of this total, it is estimated that Middle East crude oil would account for approximately 6 million b/d (or about 5.4 million more than in 2002). In the process, China's rate of dependence on the Middle East would reach 68%, 18 points higher than in 2002.

The anticipated rise in crude oil import from the Middle East, mainly by China, would demand a big increase in production by Saudi Arabia and other Middle Eastern OPEC members. Such production increases cannot be made over the short term, and this underscores the importance of deepening discussion of the long - term crude oil supply-demand balance through dialogue between producers and consumers.

In this context, there are concerns about the risk of religious and political upheaval occasioned by the movement for democratization in the Middle East, as well as a worsening of relations between Islamic societies and Western ones. Avoidance of such troubles will hinge on efforts by national governments to maintain sound ties with the Middle East and Islamic countries in general.

Fortunately, Japan both is a massive importer of Middle East crude oil and lacks the elements of confrontation, whether religious, political, or military, with the Middle East present in Western countries. As such, it could serve as a bridge between the producing and consuming countries, and actively lead dialogue aimed at improving relations with the Middle East countries. This, in turn, would presumably also contribute to its energy security.

As big importers of Middle East crude oil in 2020, Japan, China, and Korea will share policy objectives and should cooperate with each other in efforts to assure this import and other aspects of their security, with a shared awareness of the following tasks.

1. Maintenance of sound relations with the Middle East countries and promotion of dialogue between producer and consumer countries

2. Cooperation in promotion of crude oil import from regions other than the Middle East

3. Action on the problem of crude oil stockpile (construction of a system for common stockpile and mutual aid in emergencies in East Asia)

4. Resolution of security problems in passage through the Strait of Malacca

Ⅴ. Reference: Outline of models

The following two models were utilized for the forecasts in this report.
1. World energy demand estimation model
2. World oil refining and trade flow model (linear programming/LP model)
This section presents a simple description of each of these models.

1. Outline of the world oil model

This model integrates the world energy demand model and the oil refining and trade flow model mainly for the Asian region (see Figure 1). It is based on modeling of oil refining and premised on the solutions of a model for demand in each product category. It is a comprehensive analytical tool enabling calculation of the supply-demand balance in each product category and in each country in conformance with various premises as well as analysis of the international trade flow. In its application, the world was divided into a total of 30 regions (including countries and territories) in a manner enabling individual analysis of each of the 21 member countries of the Asia-Pacific Economic Cooperation (APEC) forum (see Table 1).

Figure 1 Conceptual diagram of the model

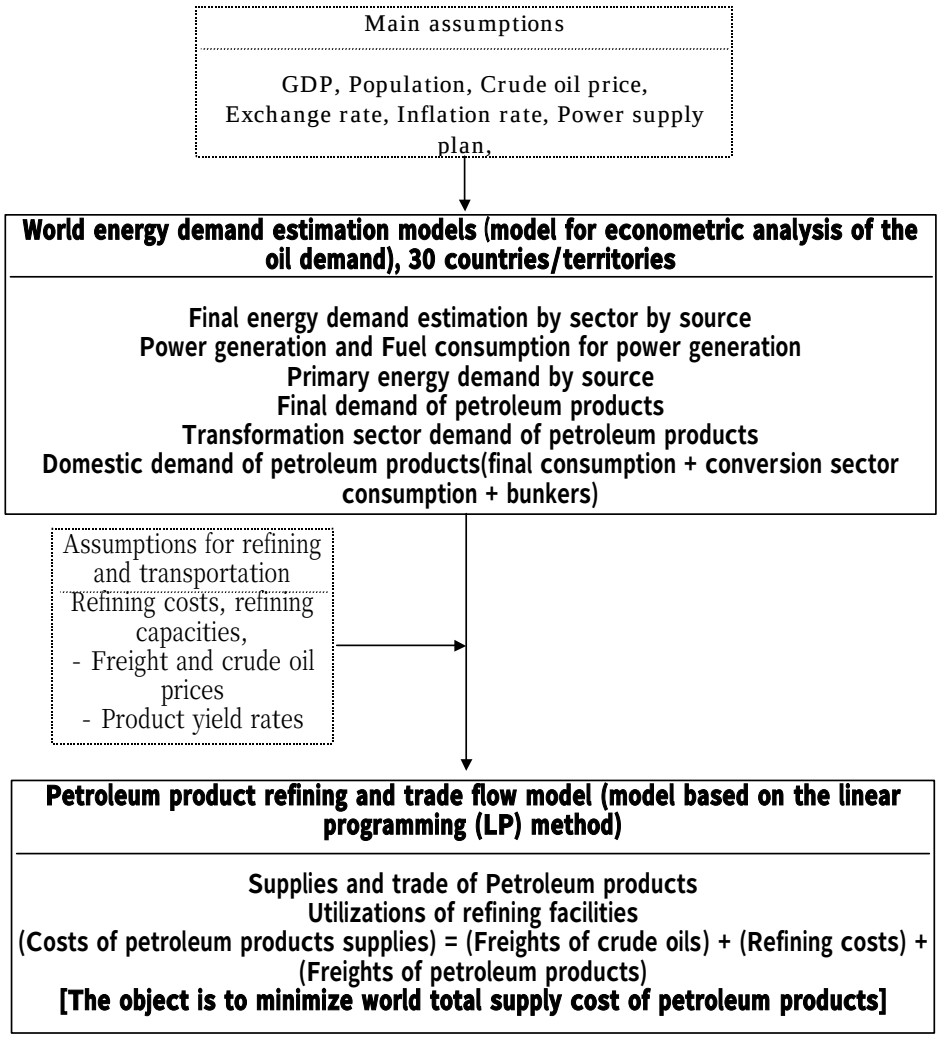


Table 1 Regional classification

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

The WG used this model for a simulation of the world energy demand and crude oil supply and demand in 2020 and 2030, and the demand for petroleum products, mainly in Asia, to 2015.

The forecast posited average annual rates of world economic growth amounting to 3.1% from 2002 to 2010, 3.0% from 2010 to 2015, and 2.8% from 2015 to 2030. For crude oil prices, it made reference to the figures from the "Annual Energy Outlook 2005" (DOE, 2004), and put the values per barrel at 23.6, 25.7, and 28.3 dollars (in real 2001 prices) for the years 2010, 2015, and 2020, respectively.

2. Structure of the energy demand model

Based on IEA tabular data for the energy balance in each country, the energy demand model consists of demand functions in each energy source category and sector. It serves as a metric analytical model for estimating the demand in each category of petroleum products. Because the estimation formula may vary with the country (or region, etc.) due to attributes of the energy supply and demand, the structure of the model is not exactly the same for all 30 regions. This reservation noted, Figure 2 shows the basic structure.

In this model, the energy demand is estimated from the bottom upward, in that the work proceeds in order from the final demand sectors in energy balance sheets to conversion sectors and further to primary energy supply sectors. In estimates, care is taken to see that there is a balance between the supply and demand.

The major exogenous variables for which values are given to the model consist of not only GDP, energy (crude oil) prices, and population but also levels for primary energy such as nuclear power, hydropower, and new energy.

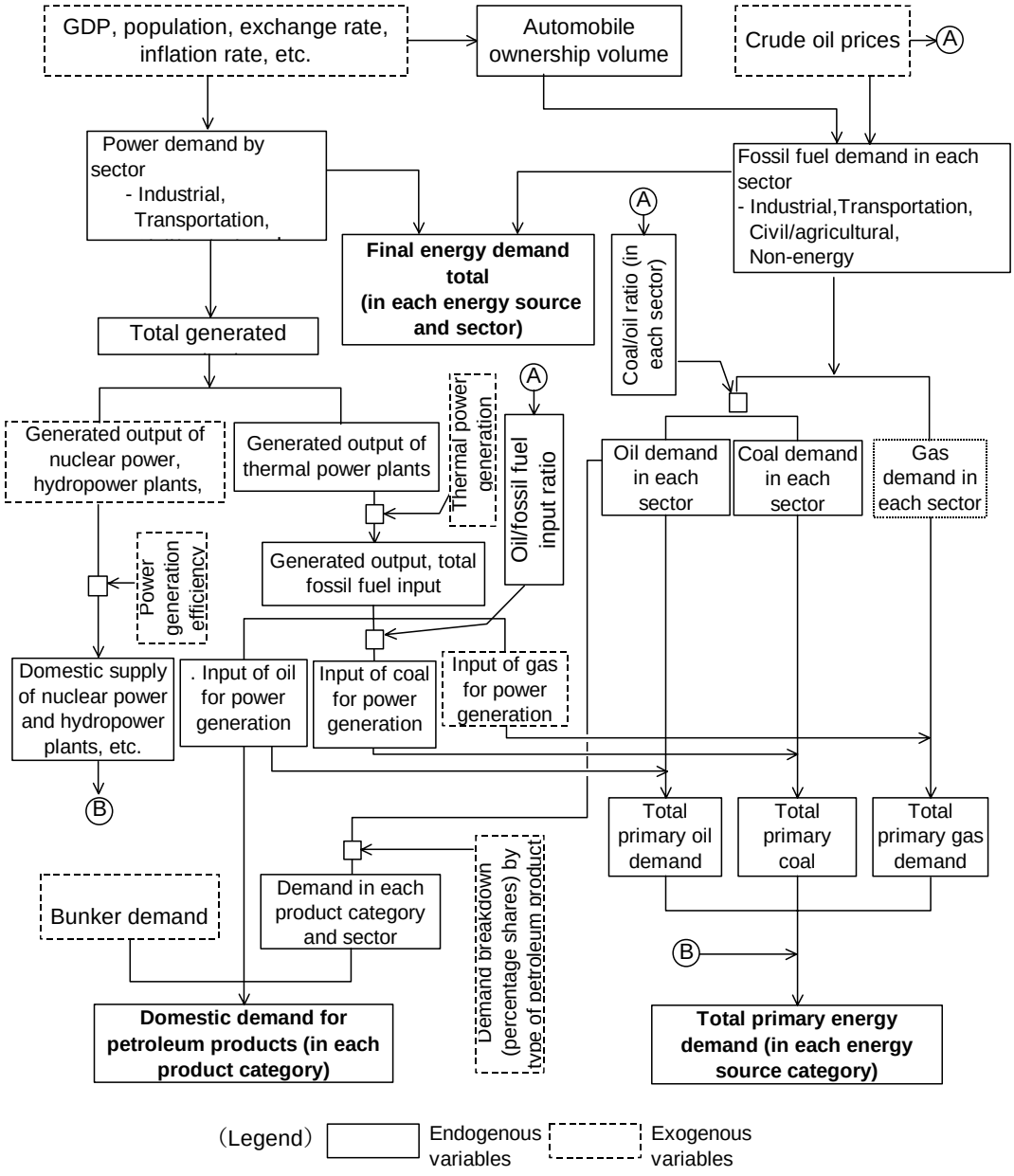
The major sectors of final energy consumption are the industrial sector, transportation sector, civil/agricultural sector, and non-energy sector. These are at the central part of the model.

In the conversion sectors, the total output generated by electric utilities to meet the power demand resulting from the final demand estimate is estimated as a function of the final power demand.

Furthermore, the output generated by thermal power plants (fired with fossil fuels) is obtained by subtracting the output of nuclear power, hydropower, geothermal power, and other power plants exogenously given as primary energy from this total generated output. The input of fossil fuels is estimated from the average efficiency of thermal power plants, which is another exogenous given. The breakdown of output by type of fuel is either estimated from share functions or obtained by estimation of the oil input share and use of natural gas as an exogenous variable. Lastly, the primary demand for fossil fuel in each energy source category is obtained by adding up the input for power generation and the demand in final consumption sectors.

Among the major exogenous variables, the WG adopted the perspective of the "Annual Energy Outlook 2004" (published by the U.S. DOE) for crude oil prices. Population figures were based on sources including forecasts prepared by the United Nations, projections by national governments in the concerned countries, and IEA outlooks.

Figure 2　Energy demand model flow chart



3. Structure of the oil refining and trade flow model

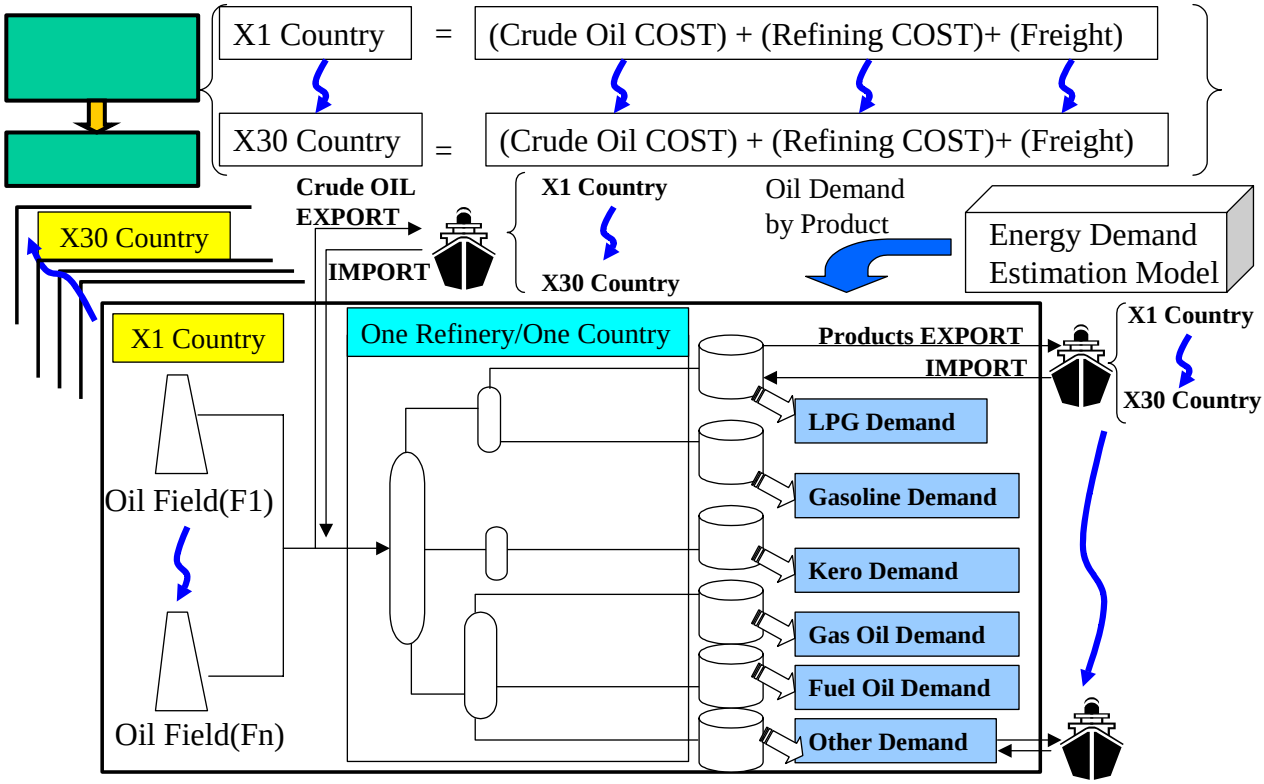
(1) LP calculation in the oil refining and trade flow model

The oil refining and trade flow model covers 30 countries corresponding with the subjects of the energy demand model outlined above.

As shown in Figure 3, the linear programming (LP) calculation performed in flow models for automobiles and other products begins with selection of crude oil. The model is designed to produce the optimal solution based on the minimum cost worldwide for crude oil processing and products trade taken together.

Figure 3 Conceptual diagram of LP calculation in the oil refining and trade flow model

* LP to obtain the best solution minimizing the total cost, taking crude oil selection, processing (production), and products trade together



(Main items for which values were set in LP)

- There are 67 types of crude oil, and values were set for the product yield rate and sulfur content of each type.
- Values were set for the facility (CDU plus secondary equipment) capacity and operating costs for refineries in each of the 30 regions.
- Freight charges were set for VLCCs and vessels in the long- and medium-range classes in operation among the 30 regions.

(Products standard levels)

- There are restrictions on gasoline octane number in each of the 30 regions.
- For gas oil, the WG applied a use-based classification into two categories: automotive use and "other". It input the sulfur content regulation values applied in each of the 30 regions for each of these two categories. The forecasts of oil refining and trade in this LP were made in such a way that the sulfur content would be below the regulation level and the total cost would be the minimum in crude oil processing (production) and products trade taken together.
- In the case of heavy oil, values were set for production and trade in each of two categories of sulfur content: low (LS; 0.2%) and high (HS; 3%).

To simplify the calculation, the model assumes that the refining in each region (or country) is concentrated in a single location. Figure 4 shows the flow of the refineries modeled.

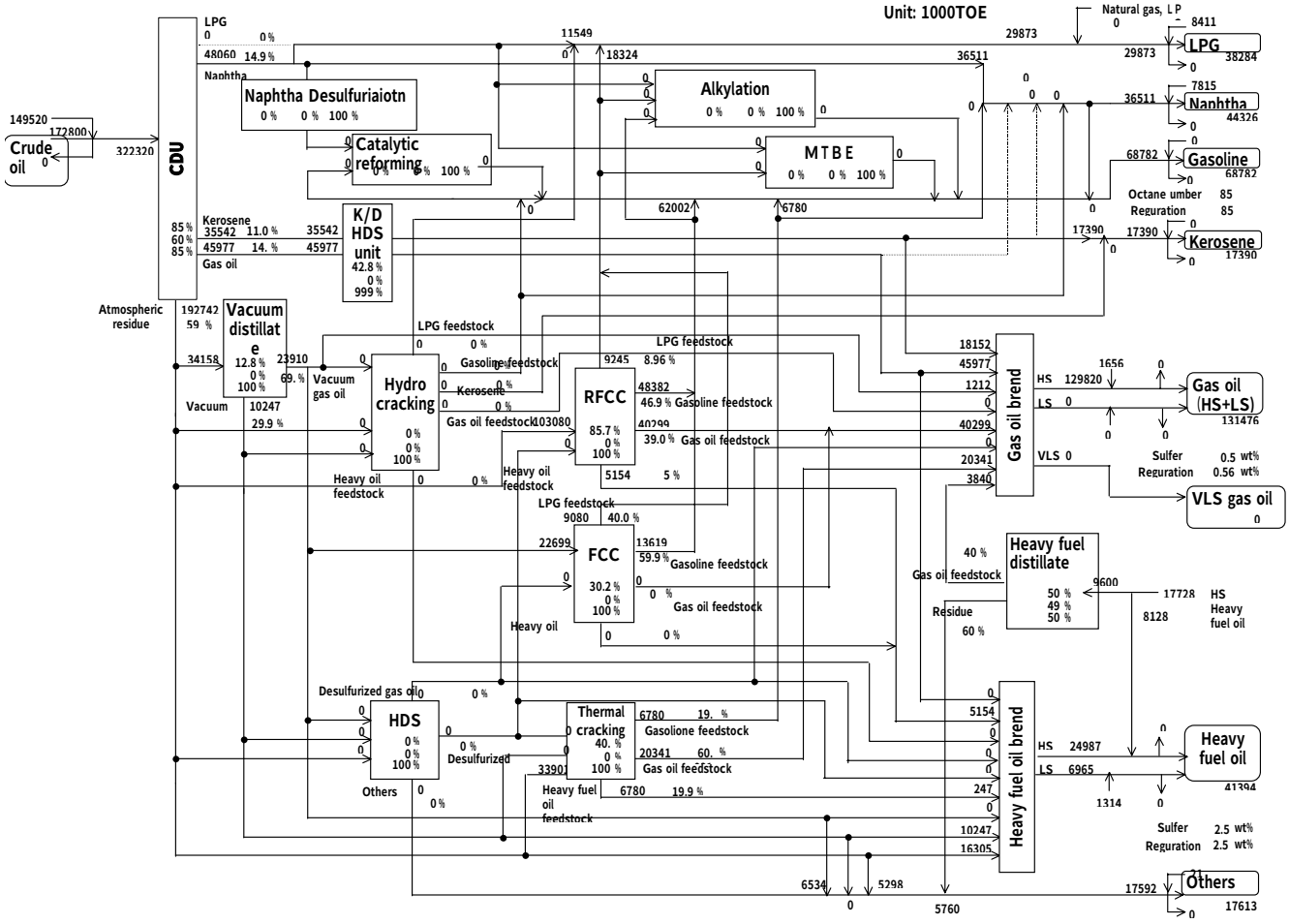
(2) Outline of the oil refining model

As shown in Figure 4, the flow encompasses CDUs and all main types of secondary equipment. Because of the anticipated acceleration in the shift to white (colorless and odorless) oil, the WG revised the assortment of secondary equipment by incorporating a hydro cracker, a catalytic cracker, and a thermal cracker, and dividing the catalytic cracker into the fluid catalytic cracker (FCC) and the reside fluid catalytic cracker (R-FCC).

As for the premised capacity of facilities of all types, values were set with reference to various data, based mainly on the forecast for each type in the Oil and Gas Journal. For Asia, the WG also took account of the findings of interviews with concerned parties in the countries in question to increase the degree of accuracy.

The WG also set operating costs for each type of equipment by calculating the amount of use of items (fuel, electricity, steam, and hydrogen) and cost of chemicals required for processing feedstock.

Figure 4 Refinery flow model



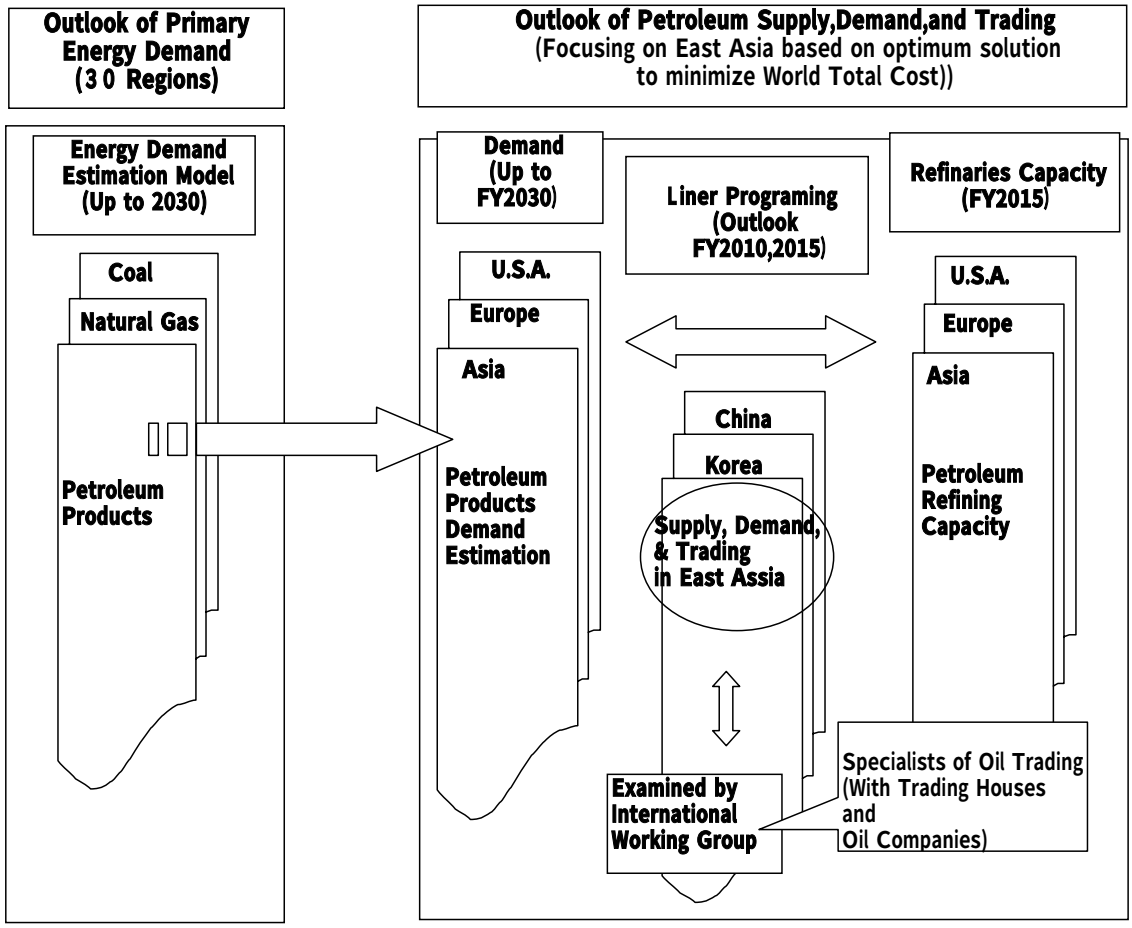
4. Flow leading up to forecast of petroleum products supply and demand in East Asia

Figure 5 summarizes the flow from the forecast of primary energy demand to that of the petroleum products supply and demand in East Asia.

First, the WG made a forecast of the oil supply and demand in the 30 regions by inputting the forecast for the oil demand derived from the energy demand model into the LP model along with the projected (premised) refining capacity in 2010 and 2015 in each.

To increase the forecast accuracy, the WG adjusted the forecast figures resulting from the calculation using the LP model in light of the results of confirmation and examination by industry experts, with a focus on East Asia
and India.

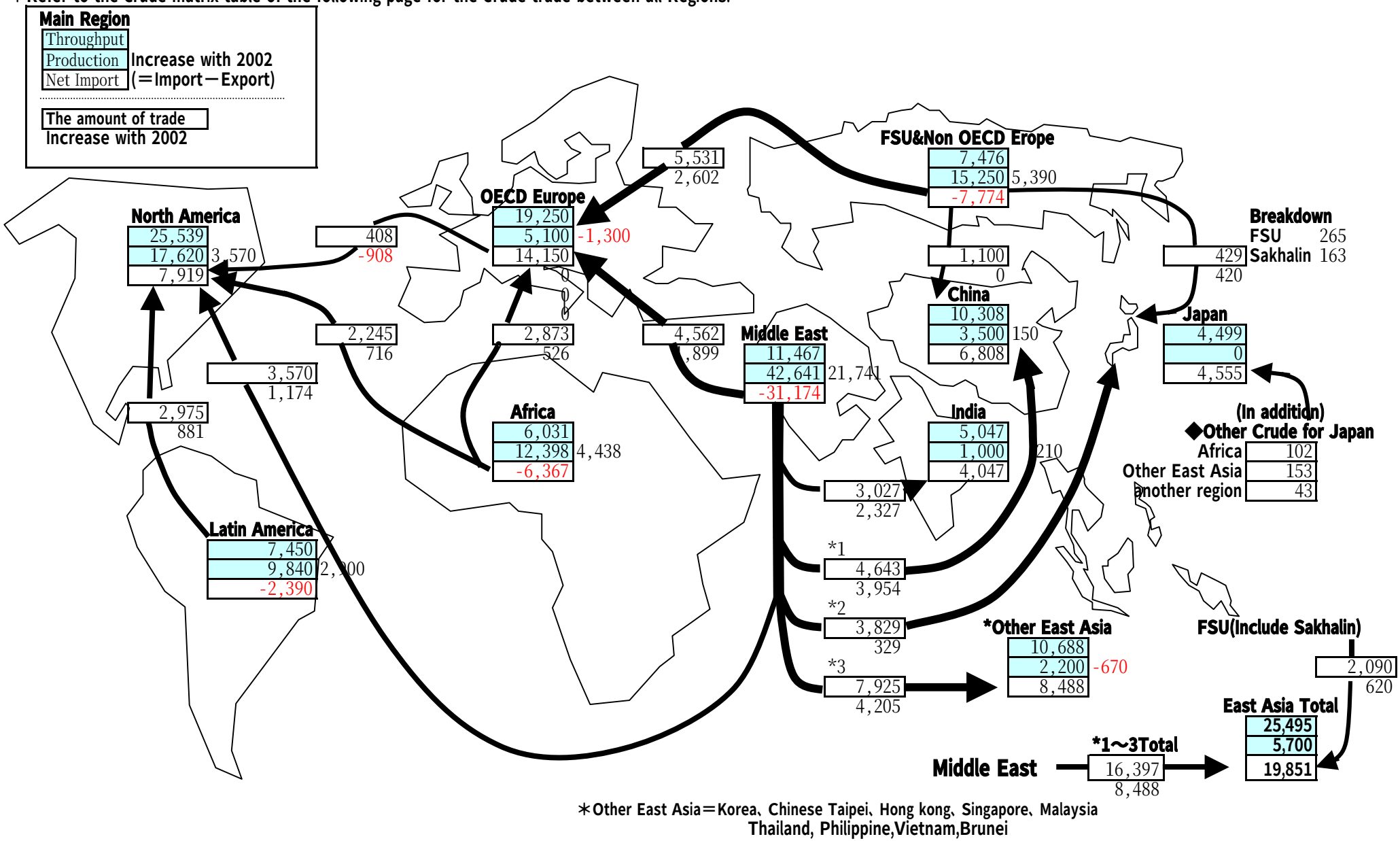
Figure 5　Flow leading up to forecast of the petroleum products supply-demand balance in East Asia



＊The Crude Trade Flow between main Regions (2020 Base Case)

(Unit:1,000 of 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, Philippine,Vietnam,Brunei

The Crude trade matrix between main regions (2020)

Unit:1,000 of b/d

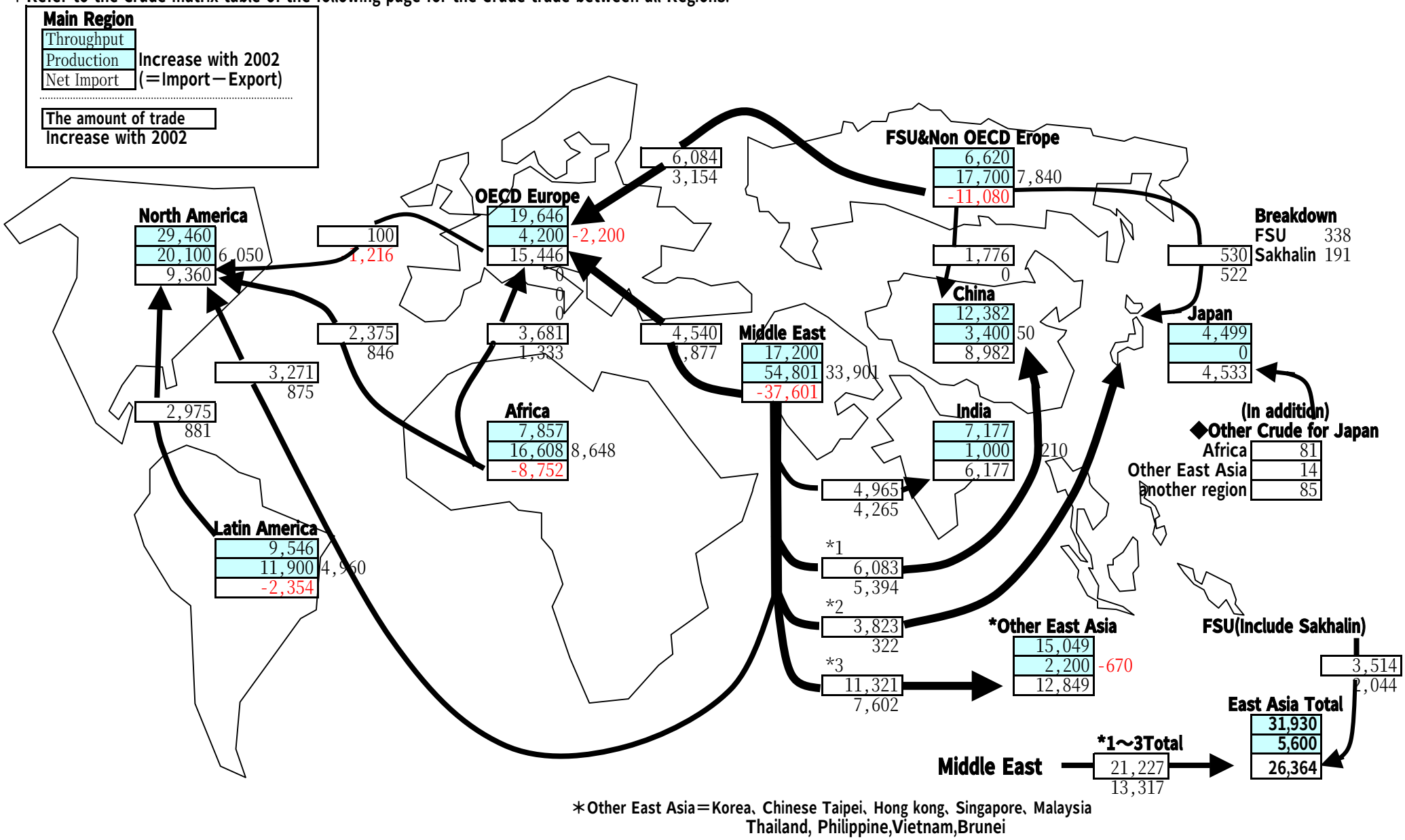
	TO Region	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
	FROM Region	North America	Latin America	OECD Europe	F.S.U and Non OECD Europe	Africa	Middle East	Oceania	China	Japan	Other East Asia	India	Other Asia	East Asia Total	Total Export	
A	North America	3,272		1,325											4,598	North America
B	Latin America	2,975	182	266				218			184			184	3,824	Latin America
C	OECD Europe	408		457											865	OECD Europe
D	F.S.U and Non OECD Europe	46	106	5,531					1,100	429	561			2,090	7,774	F.S.U and Non OECD Europe
E	Africa	2,245	683	2,873					587	102	489	1,020		1,177	7,999	Africa
F	Middle East	3,570	463	4,562		1,633		385	4,643	3,829	7,925	3,027	1,137	16,397	31,174	Middle East
G	Oceania									43	85			128	128	Oceania
H	China															China
I	Japan															Japan
J	Other East Asia							124	479	153	717			1,349	1,473	Other East Asia
K	India															India
L	Other Asia															Other Asia
M	East Asia Total							124	479	153	717				1,473	East Asia Total
N	Total Import	12,517	1,434	15,015		1,633		728	6,808	4,555	9,961	4,047	1,137	21,324	57,835	
O	Total Export	4,598	3,824	865	7,774	7,999	31,174	128			1,473			1,473		
P	Throughput	25,539	7,450	19,250	7,476	6,031	11,467	1,206	10,308	4,499	10,688	5,047	1,137	25,495		
Q	Production	17,620	9,840	5,100	15,250	12,398	42,641	605	3,500	0	2,200	1,000	0	5,700		
R	Net Import	7,919	-2,390	14,150	-7,774	-6,367	-31,174	601	6,808	4,555	8,488	4,047	1,137	19,851		

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

＊The Crude Trade Flow between main Regions (2030 Base Case)

(Unit:1,000 of 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, Philippine,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	5,368		599						43				43	6,009	North America
B	Latin America	2,975	194	642		3		106			85			85	4,005	Latin America
C	OECD Europe	100		182											282	OECD Europe
D	F.S.U and Non OECD Europe	1,280	202	6,084					1,776	530	1,208			3,514	11,080	F.S.U and Non OECD Europe
E	Africa	2,375	701	3,681					893	81	425	1,211		1,398	9,366	Africa
F	Middle East	3,271	554	4,540		612		727	6,083	3,823	11,321	4,965	1,705	21,227	37,601	Middle East
G	Oceania									43	85			128	128	Oceania
H	China															China
I	Japan															Japan
J	Other East Asia							30	231	14	1,144			1,389	1,419	Other East Asia
K	India															India
L	Other Asia															Other Asia
M	East Asia Total							30	231	14	1,144				1,419	East Asia Total
N	Total Import	15,370	1,651	15,728		615		862	8,982	4,533	14,268	6,177	1,705	27,783	69,890	
O	Total Export	6,009	4,005	282	11,080	9,366	37,601	128			1,419			1,419		

P	Throughput	29,460	9,546	19,646	6,620	7,857	17,200	1,340	12,382	4,499	15,049	7,177	1,705	31,930
Q	Production	20,100	11,900	4,200	17,700	16,608	54,801	605	3,400	0	2,200	1,000	0	5,600
R	Net Import	9,360	-2,354	15,446	-11,080	-8,752	-37,601	735	8,982	4,533	12,849	6,177	1,705	26,364

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

Petroleum Products Balances in East Asia
(Case of existing plans)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
China																					
Products Total	4,830	(100.0)	5.5	4,451	(100.0)	4.8	-379	7,685	(100.0)	6.0	6,915	(100.0)	5.7	-770	9,526	(100.0)	4.4	8,378	(100.0)	3.9	-1,148
Gasoline	819	(16.9)	6.3	939	(21.1)	6.6	120	1,433	(18.6)	7.3	1,433	(20.7)	5.4	0	1,755	(18.4)	4.1	1,755	(20.9)	4.1	0
Naphtha	517	(10.7)	11.8	517	(11.6)	10.5	0	923	(12.0)	7.5	761	(11.0)	4.9	-163	1,185	(12.4)	5.1	922	(11.0)	3.9	-264
Kero/Jet	192	(4.0)	4.3	180	(4.0)	3.6	-12	362	(4.7)	8.3	362	(5.2)	9.1	0	513	(5.4)	7.2	424	(5.1)	3.2	-89
Gas oil	1,632	(33.8)	7.3	1,656	(37.2)	6.9	24	2,739	(35.6)	6.7	2,705	(39.1)	6.3	-35	3,558	(37.4)	5.4	3,351	(40.0)	4.4	-207
Heavy Fuel	776	(16.1)	1.3	390	(8.8)	-2.0	-386	1,062	(13.8)	4.0	666	(9.6)	6.9	-397	1,152	(12.1)	1.6	754	(9.0)	2.5	-398
Fuel Oil Total	3,935	(81.5)	5.3	3,682	(82.7)	4.7	-253	6,520	(84.8)	6.5	5,926	(85.7)	6.1	-594	8,163	(85.7)	4.6	7,205	(86.0)	4.0	-958
LPG	569	(11.8)	11.6	425	(9.5)	10.1	-144	798	(10.4)	4.3	622	(9.0)	4.9	-175	947	(9.9)	3.5	754	(9.0)	3.9	-193
Other Products	325	(6.7)	3.1	344	(7.7)	3.3	19	367	(4.8)	1.5	366	(5.3)	0.8	0	416	(4.4)	2.5	419	(5.0)	2.7	3
CDU capacity	5,619	thou.b/d		Oper. Rate:	79.2 %			7,900	thou.b/d		Oper. Rate:	85.0 %			9,400	thou.b/d		Oper. Rate:	87.0 %		
Hong Kong																					
Products Total	281	(100.0)	3.6	0	(0.0)	0.0	-281	320	(100.0)	1.7	0	(0.0)	0.0	-320	351	(100.0)	1.8	0	(0.0)	0.0	-351
Gasoline	8	(2.9)	3.2	0	(0.0)	0.0	-8	11	(3.6)	4.4	0	(0.0)	0.0	-11	13	(3.8)	2.8	0	(0.0)	0.0	-13
Naphtha	14	(5.0)	9.1	0	(0.0)	0.0	-14	14	(4.3)	-0.2	0	(0.0)	0.0	-14	14	(3.9)	0.0	0	(0.0)	0.0	-14
Kero/Jet	77	(27.5)	6.7	0	(0.0)	0.0	-77	81	(25.2)	0.5	0	(0.0)	0.0	-81	84	(23.9)	0.7	0	(0.0)	0.0	-84
Gas oil	110	(39.1)	7.7	0	(0.0)	0.0	-110	127	(39.6)	1.8	0	(0.0)	0.0	-127	140	(39.9)	2.0	0	(0.0)	0.0	-140
Heavy Fuel	60	(21.5)	-1.2	0	(0.0)	0.0	-60	75	(23.4)	2.8	0	(0.0)	0.0	-75	87	(24.7)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	269	(96.0)	3.6	0	(0.0)	0.0	-269	308	(96.1)	1.7	0	(0.0)	0.0	-308	338	(96.1)	1.9	0	(0.0)	0.0	-338
LPG	8	(2.9)	5.6	0	(0.0)	0.0	-8	9	(2.8)	1.2	0	(0.0)	0.0	-9	10	(2.7)	1.4	0	(0.0)	0.0	-10
Other Products	3	(1.1)	2.3	0	(0.0)	0.0	-3	4	(1.1)	1.7	0	(0.0)	0.0	-4	4	(1.1)	1.8	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 %		
Chinese Taipei																					
Products Total	932	(100.0)	4.0	1,131	(100.0)	5.4	199	1,110	(100.0)	2.2	1,245	(100.0)	1.2	135	1,166	(100.0)	1.0	1,307	(100.0)	1.0	142
Gasoline	165	(17.6)	7.7	177	(15.6)	7.9	12	221	(19.9)	3.7	269	(21.6)	5.4	48	248	(21.3)	2.4	298	(22.8)	2.1	50
Naphtha	205	(21.9)	9.0	326	(28.8)	12.1	121	363	(32.7)	7.4	325	(26.1)	0.0	-38	363	(31.1)	0.0	341	(26.1)	1.0	-22
Kero/Jet	49	(5.3)	6.8	65	(5.8)	6.5	16	60	(5.4)	2.4	60	(4.8)	-1.1	0	69	(5.9)	2.7	69	(5.2)	2.7	0
Gas oil	114	(12.2)	3.6	178	(15.8)	4.9	64	124	(11.2)	1.0	252	(20.3)	4.4	128	133	(11.4)	1.5	268	(20.5)	1.2	135
Heavy Fuel	267	(28.6)	0.7	248	(22.0)	1.4	-18	200	(18.1)	-3.5	200	(16.1)	-2.6	0	205	(17.6)	0.4	196	(15.0)	-0.4	-9
Fuel Oil Total	799	(85.7)	3.7	994	(88.0)	5.3	195	968	(87.2)	2.4	1,106	(88.9)	1.3	138	1,017	(87.3)	1.0	1,172	(89.7)	1.2	154
LPG	65	(7.0)	3.8	54	(4.8)	3.4	-11	65	(5.9)	0.0	61	(4.9)	1.6	-4	66	(5.6)	0.1	57	(4.3)	-1.5	-9
Other Products	68	(7.3)	9.4	82	(7.3)	11.0	15	77	(6.9)	1.6	77	(6.2)	-0.8	0	82	(7.1)	1.5	78	(6.0)	0.3	-4
CDU capacity	1,220	thou.b/d		Oper. Rate:	92.7 %			1,310	thou.b/d		Oper. Rate:	95.0 %			1,376	thou.b/d		Oper. Rate:	95.0 %		
Korea																					
Products Total	2,315	(100.0)	6.9	2,427	(100.0)	7.3	111	2,573	(100.0)	1.3	2,613	(100.0)	0.9	40	2,762	(100.0)	1.4	2,803	(100.0)	1.4	41
Gasoline	170	(7.3)	10.9	204	(8.4)	11.7	34	222	(8.6)	3.4	209	(8.0)	0.3	-13	269	(9.7)	4.0	224	(8.0)	1.4	-45
Naphtha	658	(28.4)	12.0	438	(18.1)	10.1	-220	759	(29.5)	1.8	470	(18.0)	0.9	-289	799	(28.9)	1.0	505	(18.0)	1.4	-294
Kero/Jet	249	(10.7)	9.7	373	(15.4)	11.1	125	238	(9.2)	-0.6	246	(9.4)	-5.1	8	250	(9.0)	1.0	308	(11.0)	4.6	59
Gas oil	431	(18.6)	6.3	623	(25.7)	8.0	192	486	(18.9)	1.5	732	(28.0)	2.0	245	531	(19.2)	1.8	785	(28.0)	1.4	254
Heavy Fuel	514	(22.2)	2.7	565	(23.3)	3.4	51	529	(20.6)	0.4	695	(26.6)	2.6	166	549	(19.9)	0.8	701	(25.0)	0.2	152
Fuel Oil Total	2,022	(87.3)	6.5	2,204	(90.8)	7.1	182	2,234	(86.8)	1.3	2,351	(90.0)	0.8	117	2,398	(86.8)	1.4	2,523	(90.0)	1.4	125
LPG	234	(10.1)	12.5	134	(5.5)	10.1	-100	264	(10.3)	1.5	183	(7.0)	4.0	-81	286	(10.3)	1.6	196	(7.0)	1.4	-90
Other Products	59	(2.6)	9.8	89	(3.7)	11.6	30	75	(2.9)	3.0	78	(3.0)	-1.6	4	78	(2.8)	0.9	84	(3.0)	1.4	6
CDU capacity	2,750	thou.b/d		Oper. Rate:	88.2 %			2,750	thou.b/d		Oper. Rate:	95.0 %			2,951	thou.b/d		Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia
(Case of existing plans)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
Singapore																					
Products Total	775	(100.0)	6.3	785	(100.0)	0.9	11	953	(100.0)	2.6	1,270	(100.0)	6.2	317	1,079	(100.0)	2.5	1,270	(100.0)	0.0	191
Gasoline	15	(2.0)	3.3	82	(10.5)	0.8	67	17	(1.8)	1.6	152	(12.0)	8.0	135	18	(1.7)	0.9	152	(12.0)	0.0	134
Naphtha	87	(11.2)	20.8	81	(10.3)	2.6	-6	105	(11.0)	2.3	127	(10.0)	5.8	22	129	(12.0)	4.3	127	(10.0)	0.0	-2
Kero/Jet	63	(8.2)	5.5	131	(16.7)	-0.7	68	75	(7.9)	2.2	197	(15.5)	5.2	122	85	(7.9)	2.5	152	(12.0)	-5.0	67
Gas oil	70	(9.1)	4.9	236	(30.0)	2.6	166	85	(9.0)	2.5	375	(29.5)	6.0	289	95	(8.8)	2.3	445	(35.0)	3.5	349
Heavy Fuel	513	(66.2)	6.2	141	(17.9)	-1.8	-372	630	(66.1)	2.6	254	(20.0)	7.7	-376	705	(65.3)	2.3	254	(20.0)	0.0	-451
Fuel Oil Total	749	(96.6)	6.5	671	(85.4)	0.4	-78	913	(95.8)	2.5	1,105	(87.0)	6.4	192	1,033	(95.7)	2.5	1,130	(89.0)	0.5	97
LPG	17	(2.2)	5.0	32	(4.0)	10.3	14	30	(3.2)	7.4	76	(6.0)	11.6	46	36	(3.3)	3.3	51	(4.0)	-7.7	15
Other Products	9	(1.2)	1.6	83	(10.6)	5.9	74	10	(1.0)	1.2	89	(7.0)	0.8	79	10	(0.9)	0.4	89	(7.0)	0.0	79
CDU capacity	1,269	thou.b/d		Oper. Rate:	61.9 %			1,337	thou.b/d		Oper. Rate:	95.0 %			1,337	thou.b/d		Oper. Rate:	95.0 %		
Brunei																					
Products Total	12	(100.0)	5.0	11	(100.0)	22.9	-1	16	(100.0)	3.5	10	(100.0)	-1.2	-6	18	(100.0)	2.8	10	(100.0)	0.0	-8
Gasoline	4	(37.4)	5.4	4	(39.7)		0	6	(38.5)	3.9	4	(40.0)	-1.1	-2	7	(37.5)	2.3	4	(40.0)	0.0	-3
Naphtha	0	(1.1)	-0.7	0	(1.2)		0	0	(0.9)	0.8	0	(1.4)	0.8	0	0	(0.8)	0.0	0	(1.4)	0.0	0
Kero/Jet	2	(15.8)	6.0	2	(15.6)		0	3	(15.9)	3.6	1	(5.9)	-12.6	-2	3	(18.0)	5.5	1	(0.0)	0.0	-3
Gas oil	3	(26.7)	3.0	3	(29.0)		0	5	(30.3)	5.1	3	(25.0)	-3.1	-2	6	(30.5)	3.0	3	(25.0)	0.0	-3
Heavy Fuel	0	(0.2)	0.1	0	(0.2)		0	0	(0.1)	0.3	0	(1.0)	22.4	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.3)	4.4	10	(85.7)		0	14	(85.7)	4.2	7	(73.3)	-3.1	-6	16	(86.9)	3.1	7	(73.3)	0.0	-8
LPG	2	(17.2)	13.8	2	(14.3)	12.5	0	2	(12.8)	-0.2	2	(22.4)	4.5	0	2	(11.6)	0.8	2	(22.4)	0.0	0
Other Products	0	(1.5)	0.6	0	(0.0)		0	0	(1.5)	2.9	0	(4.3)	0.0	0	0	(1.5)	3.4	0	(4.3)	0.0	0
CDU capacity	9	thou.b/d		Oper. Rate:	130.6 %			9	thou.b/d		Oper. Rate:	118.3 %			9	thou.b/d		Oper. Rate:	118.3 %		
Indonesia																					
Products Total	1,227	(100.0)	5.1	1,042	(100.0)	4.9	-185	1,605	(100.0)	3.4	1,248	(100.0)	2.3	-357	1,890	(100.0)	3.3	1,542	(100.0)	4.3	-348
Gasoline	212	(17.3)	5.9	194	(18.7)	7.0	-18	285	(17.7)	3.7	333	(26.7)	6.9	48	354	(18.7)	4.5	453	(29.4)	6.4	99
Naphtha	14	(1.1)		43	(4.2)		29	21	(1.3)	5.2	13	(1.0)	-14.3	-8	26	(1.4)	4.4	26	(1.7)	15.7	0
Kero/Jet	294	(24.0)	3.3	187	(18.0)	4.6	-107	377	(23.5)	3.1	222	(17.8)	2.1	-155	438	(23.2)	3.0	252	(16.3)	2.6	-186
Gas oil	490	(39.9)	6.0	302	(28.9)	8.2	-188	649	(40.4)	3.6	314	(25.2)	0.5	-335	761	(40.3)	3.2	496	(32.1)	9.5	-265
Heavy Fuel	161	(13.1)	4.2	243	(23.3)	1.5	81	209	(13.0)	3.3	320	(25.7)	3.5	111	239	(12.7)	2.7	262	(17.0)	-3.9	23
Fuel Oil Total	1,171	(95.5)	4.9	969	(93.0)	4.9	-202	1,541	(96.0)	3.5	1,201	(96.3)	2.7	-339	1,818	(96.2)	3.4	1,489	(96.6)	4.4	-330
LPG	41	(3.3)	11.6	39	(3.7)	4.4	-2	50	(3.1)	2.5	21	(1.7)	-7.2	-28	57	(3.0)	2.7	22	(1.4)	0.6	-35
Other Products	15	(1.2)	5.0	34	(3.3)	9.0	19	15	(0.9)	-0.2	25	(2.0)	-3.8	10	15	(0.8)	0.0	31	(2.0)	4.3	16
CDU capacity	1,073	thou.b/d		Oper. Rate:	97.2 %			1,273	thou.b/d		Oper. Rate:	98.0 %			1,573	thou.b/d		Oper. Rate:	98.0 %		
Malaysia																					
Products Total	460	(100.0)	4.9	464	(100.0)	6.5	4	653	(100.0)	4.5	518	(100.0)	1.4	-135	811	(100.0)	4.4	643	(100.0)	4.4	-168
Gasoline	150	(32.5)	8.1	94	(20.3)	7.6	-55	217	(33.3)	4.8	94	(18.2)	0.0	-123	270	(33.3)	4.5	119	(18.5)	4.8	-152
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0
Kero/Jet	39	(8.4)	5.3	64	(13.7)	9.2	25	56	(8.6)	4.8	47	(9.0)	-3.8	-10	70	(8.7)	4.6	58	(9.0)	4.4	-12
Gas oil	181	(39.3)	5.6	180	(38.8)	7.6	-1	259	(39.6)	4.6	207	(40.0)	1.8	-52	321	(39.6)	4.4	257	(40.0)	4.4	-64
Heavy Fuel	48	(10.5)	-0.9	49	(10.6)	0.4	1	63	(9.6)	3.3	72	(13.8)	4.8	9	77	(9.5)	4.3	87	(13.5)	4.0	10
Fuel Oil Total	418	(90.8)	4.7	387	(83.5)	5.9	-30	595	(91.1)	4.5	419	(81.0)	1.0	-175	739	(91.1)	4.4	521	(81.0)	4.4	-218
LPG	27	(5.9)	9.3	25	(5.4)	9.4	-2	37	(5.7)	3.9	52	(10.0)	9.4	15	47	(5.8)	4.9	64	(10.0)	4.4	17
Other Products	15	(3.3)	4.8	51	(11.0)	14.3	36	21	(3.2)	4.3	47	(9.0)	-1.2	26	25	(3.1)	3.8	58	(9.0)	4.4	33
CDU capacity	515	thou.b/d		Oper. Rate:	90.0 %			545	thou.b/d		Oper. Rate:	95.0 %			677	thou.b/d		Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia
(Case of existing plans)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
Philippines																					
Products Total	340	(100.0)	1.8	266	(100.0)	1.6	-74	432	(100.0)	3.0	318	(100.0)	2.3	-114	530	(100.0)	4.2	318	(100.0)	0.0	-212
Gasoline	64	(18.8)	4.0	44	(16.7)	1.9	-19	103	(23.9)	6.2	54	(17.0)	2.5	-49	134	(25.3)	5.4	54	(17.0)	0.0	-80
Naphtha	1	(0.2)	-6.0	11	(4.2)	8.3	11	1	(0.1)	-0.2	16	(5.0)	4.6	15	1	(0.1)	0.0	39	(12.2)	19.5	38
Kero/Jet	29	(8.6)	3.7	24	(8.9)	1.7	-6	40	(9.2)	3.8	40	(12.5)	6.7	0	53	(10.1)	6.2	24	(7.5)	-9.6	-30
Gas oil	135	(39.6)	4.1	87	(32.8)	3.1	-47	177	(40.9)	3.5	65	(20.5)	-3.5	-111	216	(40.8)	4.1	86	(27.2)	5.8	-130
Heavy Fuel	76	(22.2)	-1.8	80	(29.9)	0.1	4	68	(15.8)	-1.3	102	(32.0)	3.1	34	75	(14.1)	1.8	102	(32.0)	0.0	27
Fuel Oil Total	304	(89.4)	1.7	246	(92.5)	1.7	-58	389	(89.9)	3.1	277	(87.0)	1.5	-112	479	(90.5)	4.3	305	(95.9)	2.0	-174
LPG	33	(9.8)	4.4	17	(6.5)	2.1	-16	39	(9.0)	2.1	38	(12.0)	10.4	-1	46	(8.6)	3.2	10	(3.1)	-23.7	-36
Other Products	3	(0.8)	-2.8	3	(1.0)	-1.8	0	4	(1.0)	5.7	3	(1.0)	2.3	-1	5	(0.9)	1.9	3	(1.0)	0.0	-2
CDU capacity	420	thou.b/d		Oper. Rate:	63.4 %			335	thou.b/d		Oper. Rate:	95.1 %			335	thou.b/d		Oper. Rate:	95.1 %		
Thailand																					
Products Total	773	(100.0)	5.7	815	(100.0)	8.0	42	1,036	(100.0)	3.7	1,021	(100.0)	2.9	-15	1,286	(100.0)	4.4	1,267	(100.0)	4.4	-19
Gasoline	120	(15.5)	5.9	135	(16.5)	7.6	15	176	(17.0)	4.9	176	(17.2)	3.4	0	228	(17.8)	5.3	228	(18.0)	5.3	0
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0
Kero/Jet	63	(8.1)	5.2	87	(10.6)	7.3	24	85	(8.2)	3.8	75	(7.3)	-1.8	-10	105	(8.1)	4.3	105	(8.3)	7.0	0
Gas oil	298	(38.6)	6.8	322	(39.5)	9.0	24	425	(41.0)	4.5	425	(41.6)	3.5	0	543	(42.2)	5.0	543	(42.8)	5.0	0
Heavy Fuel	145	(18.7)	2.1	168	(20.7)	5.7	24	170	(16.4)	2.0	170	(16.6)	0.1	0	192	(15.0)	2.5	192	(15.2)	2.5	0
Fuel Oil Total	626	(81.0)	4.9	712	(87.4)	7.6	86	856	(82.6)	4.0	846	(82.8)	2.2	-10	1,068	(83.1)	4.5	1,068	(84.3)	4.8	0
LPG	128	(16.5)	14.4	84	(10.3)	13.7	-44	155	(14.9)	2.4	155	(15.2)	8.0	0	185	(14.4)	3.6	174	(13.7)	2.3	-12
Other Products	19	(2.5)	8.6	19	(2.4)	10.2	0	25	(2.4)	3.3	20	(2.0)	0.7	-5	32	(2.5)	5.2	25	(2.0)	4.4	-7
CDU capacity	991	thou.b/d		Oper. Rate:	82.2 %			1,075	thou.b/d		Oper. Rate:	95.0 %			1,334	thou.b/d		Oper. Rate:	95.0 %		
Vietnam																					
Products Total	212	(100.0)	8.3	0	(0.0)		-212	342	(100.0)	6.2	124	(100.0)	0.0	-218	439	(100.0)	5.1	257	(100.0)	15.7	-183
Gasoline	45	(21.4)	8.4	0	(0.0)		-45	72	(21.1)	6.0	31	(25.0)		-41	95	(21.5)	5.6	64	(25.0)	15.7	-30
Naphtha	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0	0	(0.0)		0	(0.0)		0
Kero/Jet	15	(6.9)	4.9	0	(0.0)		-15	23	(6.6)	5.5	21	(16.8)		-2	29	(6.7)	5.4	29	(11.4)	7.2	0
Gas oil	87	(40.9)	8.0	0	(0.0)		-87	140	(40.9)	6.2	31	(24.7)		-109	185	(42.2)	5.8	97	(37.8)	26.0	-88
Heavy Fuel	51	(24.1)	9.3	0	(0.0)		-51	81	(23.7)	6.0	19	(15.2)		-62	100	(22.8)	4.3	40	(15.6)	16.4	-60
Fuel Oil Total	198	(93.4)	8.1	0	(0.0)		-198	315	(92.3)	6.0	101	(81.7)		-214	409	(93.2)	5.4	230	(89.8)	18.0	-179
LPG	10	(4.9)	23.5	0	(0.0)		-10	23	(6.6)	10.3	23	(18.3)	0.0	0	26	(6.0)	3.0	26	(10.2)	3.0	0
Other Products	4	(1.7)	6.8	0	(0.0)		-4	4	(1.1)	-0.2	0	(0.0)		-4	4	(0.8)	0.0	0	(0.0)		-4
CDU capacity	0	thou.b/d		Oper. Rate:	0.0 %			130	thou.b/d		Oper. Rate:	95.0 %			270	thou.b/d		Oper. Rate:	95.0 %		
East Asia (excluding Japan)																					
Products Total	12,157	(100.0)	5.4	11,392	(100.0)	5.0	-764	16,724	(100.0)	4.1	15,281	(100.0)	3.7	-1,443	19,859	(100.0)	3.5	17,796	(100.0)	3.1	-2,063
Gasoline	1,772	(14.6)	6.6	1,874	(16.5)	6.5	102	2,763	(16.5)	5.7	2,755	(18.0)	4.9	-8	3,392	(17.1)	4.2	3,352	(18.8)	4.0	-40
Naphtha	1,495	(12.3)	11.5	1,416	(12.4)	9.7	-79	2,186	(13.1)	4.9	1,711	(11.2)	2.4	-474	2,517	(12.7)	2.9	1,960	(11.0)	2.7	-557
Kero/Jet	1,072	(8.8)	5.2	1,113	(9.8)	4.7	40	1,399	(8.4)	3.4	1,269	(8.3)	1.7	-130	1,699	(8.6)	4.0	1,421	(8.0)	2.3	-278
Gas oil	3,551	(29.2)	6.5	3,588	(31.5)	6.6	37	5,215	(31.2)	4.9	5,108	(33.4)	4.5	-108	6,490	(32.7)	4.5	6,330	(35.6)	4.4	-159
Heavy Fuel	2,610	(21.5)	2.1	1,884	(16.5)	0.7	-726	3,087	(18.5)	2.1	2,497	(16.3)	3.6	-590	3,382	(17.0)	1.8	2,588	(14.5)	0.7	-794
Fuel Oil Total	10,501	(86.4)	5.2	9,875	(86.7)	4.8	-626	14,651	(87.6)	4.3	13,340	(87.3)	3.8	-1,311	17,480	(88.0)	3.6	15,651	(87.9)	3.2	-1,829
LPG	1,136	(9.3)	10.3	811	(7.1)	8.6	-325	1,472	(8.8)	3.3	1,234	(8.1)	5.4	-238	1,707	(8.6)	3.0	1,356	(7.6)	1.9	-351
Other Products	520	(4.3)	4.2	706	(6.2)	5.4	186	601	(3.6)	1.8	707	(4.6)	0.0	106	671	(3.4)	2.2	788	(4.4)	2.2	117
CDU capacity	13,865	thou.b/d		Oper. Rate:	82.2 %			16,663	thou.b/d		Oper. Rate:	91.7 %			19,260	thou.b/d		Oper. Rate:	92.4 %		

Petroleum Products Balances in East Asia
(Case of existing plans)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
India																					
Products Total	2,363	(100.0)	6.0	2,421	(100.0)	7.2	58	3,141	(100.0)	3.6	3,241	(100.0)	3.7	100	3,934	(100.0)	4.6	4,060	(100.0)	4.6	125
Gasoline	171	(7.2)	7.8	234	(9.7)	9.4	63	231	(7.4)	3.8	272	(8.4)	1.9	41	306	(7.8)	5.8	336	(8.3)	4.3	30
Naphtha	260	(11.0)	8.1	219	(9.1)	7.4	-41	336	(10.7)	3.2	336	(10.4)	5.5	0	418	(10.6)	4.5	427	(10.5)	4.9	8
Kero/Jet	281	(11.9)	4.2	290	(12.0)	6.6	10	389	(12.4)	4.2	389	(12.0)	3.7	0	468	(11.9)	3.7	468	(11.5)	3.7	0
Gas oil	836	(35.4)	5.9	923	(38.1)	7.8	88	1,052	(33.5)	2.9	1,264	(39.0)	4.0	212	1,317	(33.5)	4.6	1,583	(39.0)	4.6	266
Heavy Fuel	344	(14.6)	3.6	348	(14.4)	4.4	4	469	(14.9)	3.9	469	(14.5)	3.8	0	595	(15.1)	4.9	603	(14.9)	5.2	8
Fuel Oil Total	1,891	(80.0)	5.5	2,016	(83.3)	6.9	124	2,476	(78.8)	3.4	2,730	(84.2)	3.9	253	3,104	(78.9)	4.6	3,417	(84.2)	4.6	313
LPG	261	(11.0)	12.6	179	(7.4)	10.9	-82	371	(11.8)	4.5	292	(9.0)	6.3	-79	466	(11.8)	4.7	365	(9.0)	4.6	-101
Other Products	211	(8.9)	7.1	227	(9.4)	8.1	16	294	(9.4)	4.2	220	(6.8)	-0.4	-74	365	(9.3)	4.4	278	(6.8)	4.8	-87
CDU capacity	2,135	thou.b/d		Oper. Rate:	113.4 %			3,029	thou.b/d		Oper. Rate:	107.0 %			3,794	thou.b/d		Oper. Rate:	107.0 %		
Other Asia																					
Products Total	725	(100.0)	5.2	316	(100.0)	1.8	-409	1,075	(100.0)	5.1	713	(100.0)	10.7	-363	1,358	(100.0)	4.8	900	(100.0)	4.8	-458
Gasoline	63	(8.7)	2.6	43	(13.5)	1.4	-21	80	(7.4)	3.0	85	(11.9)	9.0	5	93	(6.9)	3.1	107	(11.9)	4.7	14
Naphtha	3	(0.4)		14	(4.4)	1.8	11	3	(0.2)	-0.2	3	(0.4)	-18.7	0	3	(0.2)	0.0	3	(0.3)	0.0	0
Kero/Jet	77	(10.6)	2.3	41	(12.9)	1.1	-37	113	(10.5)	4.9	113	(15.9)	13.7	0	152	(11.2)	6.0	152	(16.8)	6.0	0
Gas oil	325	(44.9)	6.0	102	(32.2)	2.6	-224	483	(45.0)	5.1	184	(25.8)	7.7	-299	607	(44.7)	4.7	276	(30.7)	8.4	-331
Heavy Fuel	215	(29.6)	6.9	86	(27.1)	1.3	-129	334	(31.1)	5.7	214	(30.0)	12.1	-120	425	(31.3)	4.9	270	(30.0)	4.8	-155
Fuel Oil Total	683	(94.2)	5.2	284	(90.1)	1.7	-399	1,014	(94.2)	5.1	599	(84.1)	9.8	-414	1,280	(94.2)	4.8	807	(89.7)	6.1	-472
LPG	22	(3.1)	7.3	12	(3.8)	4.3	-10	36	(3.4)	6.1	78	(10.9)	26.3	42	47	(3.5)	5.6	47	(5.3)	-9.4	0
Other Products	19	(2.7)	2.8	19	(6.1)	2.5	0	26	(2.4)	3.8	36	(5.0)	8.0	10	31	(2.3)	3.7	45	(5.0)	4.8	14
CDU capacity	442	thou.b/d		Oper. Rate:	71.4 %			720	thou.b/d		Oper. Rate:	99.0 %			909	thou.b/d		Oper. Rate:	99.0 %		
Asia (excluding Japan)																					
Products Total	15,244	(100.0)	5.5	14,129	(100.0)	5.2	-1,116	20,940	(100.0)	4.0	19,234	(100.0)	3.9	-1,706	25,151	(100.0)	3.7	22,755	(100.0)	3.4	-2,396
Gasoline	2,006	(13.2)	6.5	2,151	(15.2)	6.5	145	3,074	(14.7)	5.5	3,113	(16.2)	4.7	38	3,791	(15.1)	4.3	3,795	(16.7)	4.0	4
Naphtha	1,758	(11.5)	10.9	1,650	(11.7)	9.2	-108	2,524	(12.1)	4.6	2,050	(10.7)	2.8	-474	2,938	(11.7)	3.1	2,389	(10.5)	3.1	-549
Kero/Jet	1,430	(9.4)	4.8	1,443	(10.2)	4.9	13	1,902	(9.1)	3.6	1,771	(9.2)	2.6	-130	2,318	(9.2)	4.0	2,040	(9.0)	2.9	-278
Gas oil	4,712	(30.9)	6.3	4,613	(32.6)	6.7	-99	6,751	(32.2)	4.6	6,556	(34.1)	4.5	-195	8,414	(33.5)	4.5	8,190	(36.0)	4.6	-224
Heavy Fuel	3,169	(20.8)	2.4	2,318	(16.4)	1.1	-851	3,890	(18.6)	2.6	3,180	(16.5)	4.0	-710	4,402	(17.5)	2.5	3,461	(15.2)	1.7	-941
Fuel Oil Total	13,075	(85.8)	5.2	12,175	(86.2)	5.0	-900	18,141	(86.6)	4.2	16,669	(86.7)	4.0	-1,472	21,863	(86.9)	3.8	19,875	(87.3)	3.6	-1,988
LPG	1,419	(9.3)	10.5	1,002	(7.1)	8.9	-417	1,879	(9.0)	3.6	1,603	(8.3)	6.1	-275	2,221	(8.8)	3.4	1,769	(7.8)	2.0	-452
Other Products	750	(4.9)	4.8	952	(6.7)	5.8	202	921	(4.4)	2.6	962	(5.0)	0.1	41	1,067	(4.2)	3.0	1,111	(4.9)	2.9	44
CDU capacity	16,442	thou.b/d		Oper. Rate:	85.9 %			20,412	thou.b/d		Oper. Rate:	94.2 %			23,964	thou.b/d		Oper. Rate:	95.0 %		
Asia																					
Products Total	20,819	(100.0)	3.7	18,575	(100.0)	3.5	-2,244	26,295	(100.0)	3.0	23,734	(100.0)	3.1	-2,561	30,456	(100.0)	3.0	27,254	(100.0)	2.8	-3,202
Gasoline	17,681	(84.9)	3.5	16,077	(86.5)	3.3	-1,605	22,455	(85.4)	3.0	20,481	(86.3)	3.1	-1,974	26,116	(85.8)	3.1	23,677	(86.9)	2.9	-2,439
Naphtha	3,004	(14.4)	4.9	3,117	(16.8)	5.0	113	4,079	(15.5)	3.9	4,084	(17.2)	3.4	5	4,785	(15.7)	3.2	4,799	(17.6)	3.3	14
Kero/Jet	2,565	(12.3)	6.5	1,955	(10.5)	5.6	-610	3,213	(12.2)	2.9	2,297	(9.7)	2.0	-916	3,628	(11.9)	2.5	2,636	(9.7)	2.8	-991
Gas oil	2,215	(10.6)	3.7	2,133	(11.5)	3.6	-82	2,629	(10.0)	2.2	2,469	(10.4)	1.8	-160	3,039	(10.0)	2.9	2,740	(10.1)	2.1	-300
Heavy Fuel	6,010	(28.9)	5.2	5,881	(31.7)	5.4	-130	8,000	(30.4)	3.6	7,805	(32.9)	3.6	-195	9,657	(31.7)	3.8	9,433	(34.6)	3.9	-224
Fuel Oil Total	20,819	(100.0)	3.7	18,575	(100.0)	3.5	-2,244	26,295	(100.0)	3.0	23,734	(100.0)	3.1	-2,561	30,456	(100.0)	3.0	27,254	(100.0)	2.8	-3,202
LPG	2,086	(10.0)	5.6	1,330	(7.2)	5.8	-757	2,611	(9.9)	2.8	1,982	(8.4)	5.1	-629	2,965	(9.7)	2.6	2,160	(7.9)	1.7	-805
Other Products	1,051	(5.0)	3.7	1,169	(6.3)	4.4	118	1,229	(4.7)	2.0	1,271	(5.4)	1.0	41	1,375	(4.5)	2.3	1,417	(5.2)	2.2	42
CDU capacity	21,209	thou.b/d	0	Oper. Rate:	81.6 %			25,148	thou.b/d	0	Oper. Rate:	94.4 %			28,700	thou.b/d	0	Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia
(Case of higher CDU capacity in China)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
China																					
Products Total	4,830	(100.0)	5.5	4,451	(100.0)	4.8	-379	7,685	(100.0)	6.0	6,915	(100.0)	5.7	-770	9,426	(100.0)	4.2	9,044	(100.0)	5.5	-382
Gasoline	819	(16.9)	6.3	939	(21.1)	6.6	120	1,433	(18.6)	7.3	1,433	(20.7)	5.4	0	1,755	(18.6)	4.1	1,755	(19.4)	4.1	0
Naphtha	517	(10.7)	11.8	517	(11.6)	10.5	0	923	(12.0)	7.5	761	(11.0)	4.9	-163	1,185	(12.6)	5.1	1,131	(12.5)	8.2	-55
Kero/Jet	192	(4.0)	4.3	180	(4.0)	3.6	-12	362	(4.7)	8.3	362	(5.2)	9.1	0	513	(5.4)	7.2	402	(4.4)	2.1	-110
Gas oil	1,632	(33.8)	7.3	1,656	(37.2)	6.9	24	2,739	(35.6)	6.7	2,705	(39.1)	6.3	-35	3,558	(37.7)	5.4	3,545	(39.2)	5.6	-13
Heavy Fuel	776	(16.1)	1.3	390	(8.8)	-2.0	-386	1,062	(13.8)	4.0	666	(9.6)	6.9	-397	1,052	(11.2)	-0.2	904	(10.0)	6.3	-148
Fuel Oil Total	3,935	(81.5)	5.3	3,682	(82.7)	4.7	-253	6,520	(84.8)	6.5	5,926	(85.7)	6.1	-594	8,063	(85.5)	4.3	7,738	(85.5)	5.5	-326
LPG	569	(11.8)	11.6	425	(9.5)	10.1	-144	798	(10.4)	4.3	622	(9.0)	4.9	-175	947	(10.1)	3.5	891	(9.9)	7.4	-57
Other Products	325	(6.7)	3.1	344	(7.7)	3.3	19	367	(4.8)	1.5	366	(5.3)	0.8	0	416	(4.4)	2.5	416	(4.6)	2.6	0
CDU capacity	5,619	thou.b/d		Oper. Rate:	79.2 %			7,900	thou.b/d		Oper. Rate:	85.0 %			10,400	thou.b/d		Oper. Rate:	86.0 %		
Hong Kong																					
Products Total	281	(100.0)	3.6	0	(0.0)	0.0	-281	320	(100.0)	1.7	0	(0.0)	0.0	-320	351	(100.0)	1.8	0	(0.0)	0.0	-351
Gasoline	8	(2.9)	3.2	0	(0.0)	0.0	-8	11	(3.6)	4.4	0	(0.0)	0.0	-11	13	(3.8)	2.8	0	(0.0)	0.0	-13
Naphtha	14	(5.0)	9.1	0	(0.0)	0.0	-14	14	(4.3)	-0.2	0	(0.0)	0.0	-14	14	(3.9)	0.0	0	(0.0)	0.0	-14
Kero/Jet	77	(27.5)	6.7	0	(0.0)	0.0	-77	81	(25.2)	0.5	0	(0.0)	0.0	-81	84	(23.9)	0.7	0	(0.0)	0.0	-84
Gas oil	110	(39.1)	7.7	0	(0.0)	0.0	-110	127	(39.6)	1.8	0	(0.0)	0.0	-127	140	(39.9)	2.0	0	(0.0)	0.0	-140
Heavy Fuel	60	(21.5)	-1.2	0	(0.0)	0.0	-60	75	(23.4)	2.8	0	(0.0)	0.0	-75	87	(24.7)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	269	(96.0)	3.6	0	(0.0)	0.0	-269	308	(96.1)	1.7	0	(0.0)	0.0	-308	338	(96.1)	1.9	0	(0.0)	0.0	-338
LPG	8	(2.9)	5.6	0	(0.0)	0.0	-8	9	(2.8)	1.2	0	(0.0)	0.0	-9	10	(2.7)	1.4	0	(0.0)	0.0	-10
Other Products	3	(1.1)	2.3	0	(0.0)	0.0	-3	4	(1.1)	1.7	0	(0.0)	0.0	-4	4	(1.1)	1.8	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 %		
Chinese Taipei																					
Products Total	932	(100.0)	4.0	1,131	(100.0)	5.4	199	1,110	(100.0)	2.2	1,245	(100.0)	1.2	135	1,166	(100.0)	1.0	1,307	(100.0)	1.0	142
Gasoline	165	(17.6)	7.7	177	(15.6)	7.9	12	221	(19.9)	3.7	269	(21.6)	5.4	48	248	(21.3)	2.4	306	(23.4)	2.6	57
Naphtha	205	(21.9)	9.0	326	(28.8)	12.1	121	363	(32.7)	7.4	325	(26.1)	0.0	-38	363	(31.1)	0.0	303	(23.2)	-1.4	-60
Kero/Jet	49	(5.3)	6.8	65	(5.8)	6.5	16	60	(5.4)	2.4	60	(4.8)	-1.1	0	69	(5.9)	2.7	71	(5.4)	3.4	2
Gas oil	114	(12.2)	3.6	178	(15.8)	4.9	64	124	(11.2)	1.0	252	(20.3)	4.4	128	133	(11.4)	1.5	275	(21.0)	1.7	141
Heavy Fuel	267	(28.6)	0.7	248	(22.0)	1.4	-18	200	(18.1)	-3.5	200	(16.1)	-2.6	0	205	(17.6)	0.4	196	(15.0)	-0.4	-9
Fuel Oil Total	799	(85.7)	3.7	994	(88.0)	5.3	195	968	(87.2)	2.4	1,106	(88.9)	1.3	138	1,017	(87.3)	1.0	1,150	(88.0)	0.8	133
LPG	65	(7.0)	3.8	54	(4.8)	3.4	-11	65	(5.9)	0.0	61	(4.9)	1.6	-4	66	(5.6)	0.1	65	(5.0)	1.3	0
Other Products	68	(7.3)	9.4	82	(7.3)	11.0	15	77	(6.9)	1.6	77	(6.2)	-0.8	0	82	(7.1)	1.5	92	(7.0)	3.5	9
CDU capacity	1,220	thou.b/d		Oper. Rate:	92.7 %			1,310	thou.b/d		Oper. Rate:	95.0 %			1,376	thou.b/d		Oper. Rate:	95.0 %		
Korea																					
Products Total	2,315	(100.0)	6.9	2,427	(100.0)	7.3	111	2,573	(100.0)	1.3	2,613	(100.0)	0.9	40	2,762	(100.0)	1.4	2,803	(100.0)	1.4	41
Gasoline	170	(7.3)	10.9	204	(8.4)	11.7	34	222	(8.6)	3.4	209	(8.0)	0.3	-13	269	(9.7)	4.0	224	(8.0)	1.4	-45
Naphtha	658	(28.4)	12.0	438	(18.1)	10.1	-220	759	(29.5)	1.8	470	(18.0)	0.9	-289	799	(28.9)	1.0	505	(18.0)	1.4	-294
Kero/Jet	249	(10.7)	9.7	373	(15.4)	11.1	125	238	(9.2)	-0.6	246	(9.4)	-5.1	8	250	(9.0)	1.0	308	(11.0)	4.6	59
Gas oil	431	(18.6)	6.3	623	(25.7)	8.0	192	486	(18.9)	1.5	732	(28.0)	2.0	245	531	(19.2)	1.8	785	(28.0)	1.4	254
Heavy Fuel	514	(22.2)	2.7	565	(23.3)	3.4	51	529	(20.6)	0.4	695	(26.6)	2.6	166	549	(19.9)	0.8	701	(25.0)	0.2	152
Fuel Oil Total	2,022	(87.3)	6.5	2,204	(90.8)	7.1	182	2,234	(86.8)	1.3	2,351	(90.0)	0.8	117	2,398	(86.8)	1.4	2,523	(90.0)	1.4	125
LPG	234	(10.1)	12.5	134	(5.5)	10.1	-100	264	(10.3)	1.5	183	(7.0)	4.0	-81	286	(10.3)	1.6	196	(7.0)	1.4	-90
Other Products	59	(2.6)	9.8	89	(3.7)	11.6	30	75	(2.9)	3.0	78	(3.0)	-1.6	4	78	(2.8)	0.9	84	(3.0)	1.4	6
CDU capacity	2,750	thou.b/d		Oper. Rate:	88.2 %			2,750	thou.b/d		Oper. Rate:	95.0 %			2,951	thou.b/d		Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia
(Case of higher CDU capacity in China)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
Singapore																					
Products Total	775	(100.0)	6.3	785	(100.0)	0.9	11	953	(100.0)	2.6	1,270	(100.0)	6.2	317	1,079	(100.0)	2.5	1,270	(100.0)	0.0	191
Gasoline	15	(2.0)	3.3	82	(10.5)	0.8	67	17	(1.8)	1.6	152	(12.0)	8.0	135	18	(1.7)	0.9	152	(12.0)	0.0	134
Naphtha	87	(11.2)	20.8	81	(10.3)	2.6	-6	105	(11.0)	2.3	127	(10.0)	5.8	22	129	(12.0)	4.3	104	(8.2)	-3.9	-25
Kero/Jet	63	(8.2)	5.5	131	(16.7)	-0.7	68	75	(7.9)	2.2	197	(15.5)	5.2	122	85	(7.9)	2.5	172	(13.5)	-2.7	86
Gas oil	70	(9.1)	4.9	236	(30.0)	2.6	166	85	(9.0)	2.5	375	(29.5)	6.0	289	95	(8.8)	2.3	445	(35.0)	3.5	349
Heavy Fuel	513	(66.2)	6.2	141	(17.9)	-1.8	-372	630	(66.1)	2.6	254	(20.0)	7.7	-376	705	(65.3)	2.3	254	(20.0)	0.0	-451
Fuel Oil Total	749	(96.6)	6.5	671	(85.4)	0.4	-78	913	(95.8)	2.5	1,105	(87.0)	6.4	192	1,033	(95.7)	2.5	1,127	(88.7)	0.4	93
LPG	17	(2.2)	5.0	32	(4.0)	10.3	14	30	(3.2)	7.4	76	(6.0)	11.6	46	36	(3.3)	3.3	54	(4.3)	-6.5	19
Other Products	9	(1.2)	1.6	83	(10.6)	5.9	74	10	(1.0)	1.2	89	(7.0)	0.8	79	10	(0.9)	0.4	89	(7.0)	0.0	79
CDU capacity	1,269	thou.b/d		Oper. Rate:	61.9 %			1,337	thou.b/d		Oper. Rate:	95.0 %			1,337	thou.b/d		Oper. Rate:	95.0 %		
Brunei																					
Products Total	12	(100.0)	5.0	11	(100.0)	22.9	-1	16	(100.0)	3.5	10	(100.0)	-1.2	-6	18	(100.0)	2.8	10	(100.0)	0.0	-8
Gasoline	4	(37.4)	5.4	4	(39.7)	0.0	0	6	(38.5)	3.9	4	(40.0)	-1.1	-2	7	(37.5)	2.3	4	(40.0)	0.0	-3
Naphtha	0	(1.1)	-0.7	0	(1.2)	0.0	0	0	(0.9)	0.8	0	(1.4)	0.8	0	0	(0.8)	0.0	0	(1.4)	0.0	0
Kero/Jet	2	(15.8)	6.0	2	(15.6)	0.0	0	3	(15.9)	3.6	1	(5.9)	-12.6	-2	3	(18.0)	5.5	1	(5.9)	0.0	-3
Gas oil	3	(26.7)	3.0	3	(29.0)	0.0	0	5	(30.3)	5.1	3	(25.0)	-3.1	-2	6	(30.5)	3.0	3	(25.0)	0.0	-3
Heavy Fuel	0	(0.2)	0.1	0	(0.2)	0.0	0	0	(0.1)	0.3	0	(1.0)	22.4	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.3)	4.4	10	(85.7)	0.0	0	14	(85.7)	4.2	7	(73.3)	-3.1	-6	16	(86.9)	3.1	7	(73.3)	0.0	-8
LPG	2	(17.2)	13.8	2	(14.3)	12.5	0	2	(12.8)	-0.2	2	(22.4)	4.5	0	2	(11.6)	0.8	2	(22.4)	0.0	0
Other Products	0	(1.5)	0.6	0	(0.0)	0.0	0	0	(1.5)	2.9	0	(4.3)	0.0	0	0	(1.5)	3.4	0	(4.3)	0.0	0
CDU capacity	9	thou.b/d		Oper. Rate:	130.6 %			9	thou.b/d		Oper. Rate:	118.3 %			9	thou.b/d		Oper. Rate:	118.3 %		
Indonesia																					
Products Total	1,227	(100.0)	5.1	1,042	(100.0)	4.9	-185	1,605	(100.0)	3.4	1,248	(100.0)	2.3	-357	1,890	(100.0)	3.3	1,542	(100.0)	4.3	-348
Gasoline	212	(17.3)	5.9	194	(18.7)	7.0	-18	285	(17.7)	3.7	333	(26.7)	6.9	48	354	(18.7)	4.5	404	(26.2)	4.0	50
Naphtha	14	(1.1)	0.0	43	(4.2)	0.0	29	21	(1.3)	5.2	13	(1.0)	-14.3	-8	26	(1.4)	4.4	0	(0.0)	-100.0	-26
Kero/Jet	294	(24.0)	3.3	187	(18.0)	4.6	-107	377	(23.5)	3.1	222	(17.8)	2.1	-155	438	(23.2)	3.0	259	(16.8)	3.1	-179
Gas oil	490	(39.9)	6.0	302	(28.9)	8.2	-188	649	(40.4)	3.6	314	(25.2)	0.5	-335	761	(40.3)	3.2	490	(31.8)	9.3	-271
Heavy Fuel	161	(13.1)	4.2	243	(23.3)	1.5	81	209	(13.0)	3.3	320	(25.7)	3.5	111	239	(12.7)	2.7	319	(20.7)	-0.1	79
Fuel Oil Total	1,171	(95.5)	4.9	969	(93.0)	4.9	-202	1,541	(96.0)	3.5	1,201	(96.3)	2.7	-339	1,818	(96.2)	3.4	1,471	(95.4)	4.1	-347
LPG	41	(3.3)	11.6	39	(3.7)	4.4	-2	50	(3.1)	2.5	21	(1.7)	-7.2	-28	57	(3.0)	2.7	40	(2.6)	13.1	-17
Other Products	15	(1.2)	5.0	34	(3.3)	9.0	19	15	(0.9)	-0.2	25	(2.0)	-3.8	10	15	(0.8)	0.0	31	(2.0)	4.3	16
CDU capacity	1,073	thou.b/d		Oper. Rate:	97.2 %			1,273	thou.b/d		Oper. Rate:	98.0 %			1,573	thou.b/d		Oper. Rate:	98.0 %		
Malaysia																					
Products Total	460	(100.0)	4.9	464	(100.0)	6.5	4	653	(100.0)	4.5	518	(100.0)	1.4	-135	811	(100.0)	4.4	643	(100.0)	4.4	-168
Gasoline	150	(32.5)	8.1	94	(20.3)	7.6	-55	217	(33.3)	4.8	94	(18.2)	0.0	-123	270	(33.3)	4.5	128	(20.0)	6.4	-142
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	39	(8.4)	5.3	64	(13.7)	9.2	25	56	(8.6)	4.8	47	(9.0)	-3.8	-10	70	(8.7)	4.6	58	(9.0)	4.4	-12
Gas oil	181	(39.3)	5.6	180	(38.8)	7.6	-1	259	(39.6)	4.6	207	(40.0)	1.8	-52	321	(39.6)	4.4	257	(40.0)	4.4	-64
Heavy Fuel	48	(10.5)	-0.9	49	(10.6)	0.4	1	63	(9.6)	3.3	72	(13.8)	4.8	9	77	(9.5)	4.3	77	(12.0)	1.6	0
Fuel Oil Total	418	(90.8)	4.7	387	(83.5)	5.9	-30	595	(91.1)	4.5	419	(81.0)	1.0	-175	739	(91.1)	4.4	521	(81.0)	4.4	-218
LPG	27	(5.9)	9.3	25	(5.4)	9.4	-2	37	(5.7)	3.9	52	(10.0)	9.4	15	47	(5.8)	4.9	64	(10.0)	4.4	17
Other Products	15	(3.3)	4.8	51	(11.0)	14.3	36	21	(3.2)	4.3	47	(9.0)	-1.2	26	25	(3.1)	3.8	58	(9.0)	4.4	33
CDU capacity	515	thou.b/d		Oper. Rate:	90.0 %			545	thou.b/d		Oper. Rate:	95.0 %			677	thou.b/d		Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia
(Case of higher CDU capacity in China)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
Philippines																					
Products Total	340	(100.0)	1.8	266	(100.0)	1.6	-74	432	(100.0)	3.0	318	(100.0)	2.3	-114	530	(100.0)	4.2	318	(100.0)	0.0	-212
Gasoline	64	(18.8)	4.0	44	(16.7)	1.9	-19	103	(23.9)	6.2	54	(17.0)	2.5	-49	134	(25.3)	5.4	54	(17.0)	0.0	-80
Naphtha	1	(0.2)	-6.0	11	(4.2)	8.3	11	1	(0.1)	-0.2	16	(5.0)	4.6	15	1	(0.1)	0.0	13	(4.0)	-4.4	12
Kero/Jet	29	(8.6)	3.7	24	(8.9)	1.7	-6	40	(9.2)	3.8	40	(12.5)	6.7	0	53	(10.1)	6.2	33	(10.5)	-3.4	-20
Gas oil	135	(39.6)	4.1	87	(32.8)	3.1	-47	177	(40.9)	3.5	65	(20.5)	-3.5	-111	216	(40.8)	4.1	75	(23.5)	2.7	-141
Heavy Fuel	76	(22.2)	-1.8	80	(29.9)	0.1	4	68	(15.8)	-1.3	102	(32.0)	3.1	34	75	(14.1)	1.8	102	(32.0)	0.0	27
Fuel Oil Total	304	(89.4)	1.7	246	(92.5)	1.7	-58	389	(89.9)	3.1	277	(87.0)	1.5	-112	479	(90.5)	4.3	277	(87.0)	0.0	-202
LPG	33	(9.8)	4.4	17	(6.5)	2.1	-16	39	(9.0)	2.1	38	(12.0)	10.4	-1	46	(8.6)	3.2	38	(12.0)	0.0	-8
Other Products	3	(0.8)	-2.8	3	(1.0)	-1.8	0	4	(1.0)	5.7	3	(1.0)	2.3	-1	5	(0.9)	1.9	3	(1.0)	0.0	-2
CDU capacity	420	thou.b/d		Oper. Rate:	63.4 %			335	thou.b/d		Oper. Rate:	95.1 %			335	thou.b/d		Oper. Rate:	95.1 %		
Thailand																					
Products Total	773	(100.0)	5.7	815	(100.0)	8.0	42	1,036	(100.0)	3.7	1,021	(100.0)	2.9	-15	1,286	(100.0)	4.4	1,267	(100.0)	4.4	-19
Gasoline	120	(15.5)	5.9	135	(16.5)	7.6	15	176	(17.0)	4.9	176	(17.2)	3.4	0	228	(17.8)	5.3	228	(18.0)	5.3	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	63	(8.1)	5.2	87	(10.6)	7.3	24	85	(8.2)	3.8	75	(7.3)	-1.8	-10	105	(8.1)	4.3	104	(8.2)	6.7	-1
Gas oil	298	(38.6)	6.8	322	(39.5)	9.0	24	425	(41.0)	4.5	425	(41.6)	3.5	0	543	(42.2)	5.0	539	(42.5)	4.9	-4
Heavy Fuel	145	(18.7)	2.1	168	(20.7)	5.7	24	170	(16.4)	2.0	170	(16.6)	0.1	0	192	(15.0)	2.5	192	(15.2)	2.5	0
Fuel Oil Total	626	(81.0)	4.9	712	(87.4)	7.6	86	856	(82.6)	4.0	846	(82.8)	2.2	-10	1,068	(83.1)	4.5	1,063	(83.9)	4.7	-5
LPG	128	(16.5)	14.4	84	(10.3)	13.7	-44	155	(14.9)	2.4	155	(15.2)	8.0	0	185	(14.4)	3.6	179	(14.1)	2.9	-6
Other Products	19	(2.5)	8.6	19	(2.4)	10.2	0	25	(2.4)	3.3	20	(2.0)	0.7	-5	32	(2.5)	5.2	25	(2.0)	4.4	-7
CDU capacity	991	thou.b/d		Oper. Rate:	82.2 %			1,075	thou.b/d		Oper. Rate:	95.0 %			1,334	thou.b/d		Oper. Rate:	95.0 %		
Vietnam																					
Products Total	212	(100.0)	8.3	0	(0.0)	0.0	-212	342	(100.0)	6.2	124	(100.0)	0.0	-218	439	(100.0)	5.1	257	(100.0)	15.7	-183
Gasoline	45	(21.4)	8.4	0	(0.0)	0.0	-45	72	(21.1)	6.0	31	(25.0)	0.0	-41	95	(21.5)	5.6	64	(25.0)	15.7	-30
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	15	(6.9)	4.9	0	(0.0)	0.0	-15	23	(6.6)	5.5	21	(16.8)	0.0	-2	29	(6.7)	5.4	7	(2.8)	-19.2	-22
Gas oil	87	(40.9)	8.0	0	(0.0)	0.0	-87	140	(40.9)	6.2	31	(24.7)	0.0	-109	185	(42.2)	5.8	119	(46.4)	31.3	-66
Heavy Fuel	51	(24.1)	9.3	0	(0.0)	0.0	-51	81	(23.7)	6.0	19	(15.2)	0.0	-62	100	(22.8)	4.3	40	(15.6)	16.4	-60
Fuel Oil Total	198	(93.4)	8.1	0	(0.0)	0.0	-198	315	(92.3)	6.0	101	(81.7)	0.0	-214	409	(93.2)	5.4	230	(89.8)	18.0	-179
LPG	10	(4.9)	23.5	0	(0.0)	0.0	-10	23	(6.6)	10.3	23	(18.3)	0.0	0	26	(6.0)	3.0	26	(10.2)	3.0	0
Other Products	4	(1.7)	6.8	0	(0.0)	0.0	-4	4	(1.1)	-0.2	0	(0.0)	0.0	-4	4	(0.8)	0.0	0	(0.0)	0.0	-4
CDU capacity	0	thou.b/d		Oper. Rate:	0.0 %			130	thou.b/d		Oper. Rate:	95.0 %			270	thou.b/d		Oper. Rate:	95.0 %		
East Asia (excluding Japan)																					
Products Total	12,157	(100.0)	5.4	11,392	(100.0)	5.0	-764	16,724	(100.0)	4.1	15,281	(100.0)	3.7	-1,443	19,759	(100.0)	3.4	18,462	(100.0)	3.9	-1,296
Gasoline	1,772	(14.6)	6.6	1,874	(16.5)	6.5	102	2,763	(16.5)	5.7	2,755	(18.0)	4.9	-8	3,392	(17.2)	4.2	3,320	(18.0)	3.8	-72
Naphtha	1,495	(12.3)	11.5	1,416	(12.4)	9.7	-79	2,186	(13.1)	4.9	1,711	(11.2)	2.4	-474	2,517	(12.7)	2.9	2,055	(11.1)	3.7	-462
Kero/Jet	1,072	(8.8)	5.2	1,113	(9.8)	4.7	40	1,399	(8.4)	3.4	1,269	(8.3)	1.7	-130	1,699	(8.6)	4.0	1,414	(7.7)	2.2	-284
Gas oil	3,551	(29.2)	6.5	3,588	(31.5)	6.6	37	5,215	(31.2)	4.9	5,108	(33.4)	4.5	-108	6,490	(32.8)	4.5	6,532	(35.4)	5.0	42
Heavy Fuel	2,610	(21.5)	2.1	1,884	(16.5)	0.7	-726	3,087	(18.5)	2.1	2,497	(16.3)	3.6	-590	3,282	(16.6)	1.2	2,786	(15.1)	2.2	-497
Fuel Oil Total	10,501	(86.4)	5.2	9,875	(86.7)	4.8	-626	14,651	(87.6)	4.3	13,340	(87.3)	3.8	-1,311	17,380	(88.0)	3.5	16,108	(87.2)	3.8	-1,272
LPG	1,136	(9.3)	10.3	811	(7.1)	8.6	-325	1,472	(8.8)	3.3	1,234	(8.1)	5.4	-238	1,707	(8.6)	3.0	1,556	(8.4)	4.8	-151
Other Products	520	(4.3)	4.2	706	(6.2)	5.4	186	601	(3.6)	1.8	707	(4.6)	0.0	106	671	(3.4)	2.2	798	(4.3)	2.5	127
CDU capacity	13,865	thou.b/d		Oper. Rate:	82.2 %			16,663	thou.b/d		Oper. Rate:	91.7 %			20,260	thou.b/d		Oper. Rate:	91.1 %		

Petroleum Products Balances in East Asia
(Case of higher CDU capacity in China)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
India																					
Products Total	2,363	(100.0)	6.0	2,421	(100.0)	7.2	58	3,141	(100.0)	3.6	3,241	(100.0)	3.7	100	3,934	(100.0)	4.6	4,060	(100.0)	4.6	125
Gasoline	171	(7.2)	7.8	234	(9.7)	9.4	63	231	(7.4)	3.8	272	(8.4)	1.9	41	306	(7.8)	5.8	336	(8.3)	4.3	30
Naphtha	260	(11.0)	8.1	219	(9.1)	7.4	-41	336	(10.7)	3.2	336	(10.4)	5.5	0	418	(10.6)	4.5	418	(10.3)	4.5	0
Kero/Jet	281	(11.9)	4.2	290	(12.0)	6.6	10	389	(12.4)	4.2	389	(12.0)	3.7	0	468	(11.9)	3.7	468	(11.5)	3.7	0
Gas oil	836	(35.4)	5.9	923	(38.1)	7.8	88	1,052	(33.5)	2.9	1,264	(39.0)	4.0	212	1,317	(33.5)	4.6	1,583	(39.0)	4.6	266
Heavy Fuel	344	(14.6)	3.6	348	(14.4)	4.4	4	469	(14.9)	3.9	469	(14.5)	3.8	0	595	(15.1)	4.9	615	(15.1)	5.6	20
Fuel Oil Total	1,891	(80.0)	5.5	2,016	(83.3)	6.9	124	2,476	(78.8)	3.4	2,730	(84.2)	3.9	253	3,104	(78.9)	4.6	3,420	(84.2)	4.6	317
LPG	261	(11.0)	12.6	179	(7.4)	10.9	-82	371	(11.8)	4.5	292	(9.0)	6.3	-79	466	(11.8)	4.7	365	(9.0)	4.6	-101
Other Products	211	(8.9)	7.1	227	(9.4)	8.1	16	294	(9.4)	4.2	220	(6.8)	-0.4	-74	365	(9.3)	4.4	274	(6.8)	4.5	-91
CDU capacity	2,135	thou.b/d		Oper. Rate:	113.4 %			3,029	thou.b/d		Oper. Rate:	107.0 %			3,794	thou.b/d		Oper. Rate:	107.0 %		
Other Asia																					
Products Total	725	(100.0)	5.2	316	(100.0)	1.8	-409	1,075	(100.0)	5.1	713	(100.0)	10.7	-363	1,358	(100.0)	4.8	900	(100.0)	4.8	-458
Gasoline	63	(8.7)	2.6	43	(13.5)	1.4	-21	80	(7.4)	3.0	85	(11.9)	9.0	5	93	(6.9)	3.1	96	(10.7)	2.4	3
Naphtha	3	(0.4)	0.0	14	(4.4)	1.8	11	3	(0.2)	-0.2	3	(0.4)	-18.7	0	3	(0.2)	0.0	0	(0.0)	-100.0	-3
Kero/Jet	77	(10.6)	2.3	41	(12.9)	1.1	-37	113	(10.5)	4.9	113	(15.9)	13.7	0	152	(11.2)	6.0	152	(16.8)	6.0	0
Gas oil	325	(44.9)	6.0	102	(32.2)	2.6	-224	483	(45.0)	5.1	184	(25.8)	7.7	-299	607	(44.7)	4.7	276	(30.6)	8.4	-332
Heavy Fuel	215	(29.6)	6.9	86	(27.1)	1.3	-129	334	(31.1)	5.7	214	(30.0)	12.1	-120	425	(31.3)	4.9	270	(30.0)	4.8	-155
Fuel Oil Total	683	(94.2)	5.2	284	(90.1)	1.7	-399	1,014	(94.2)	5.1	599	(84.1)	9.8	-414	1,280	(94.2)	4.8	793	(88.1)	5.8	-487
LPG	22	(3.1)	7.3	12	(3.8)	4.3	-10	36	(3.4)	6.1	78	(10.9)	26.3	42	47	(3.5)	5.6	62	(6.9)	-4.5	14
Other Products	19	(2.7)	2.8	19	(6.1)	2.5	0	26	(2.4)	3.8	36	(5.0)	8.0	10	31	(2.3)	3.7	45	(5.0)	4.8	14
CDU capacity	442	thou.b/d		Oper. Rate:	71.4 %			720	thou.b/d		Oper. Rate:	99.0 %			909	thou.b/d		Oper. Rate:	99.0 %		
Asia (excluding Japan)																					
Products Total	15,244	(100.0)	5.5	14,129	(100.0)	5.2	-1,116	20,940	(100.0)	4.0	19,234	(100.0)	3.9	-1,706	25,051	(100.0)	3.7	23,422	(100.0)	4.0	-1,630
Gasoline	2,006	(13.2)	6.5	2,151	(15.2)	6.5	145	3,074	(14.7)	5.5	3,113	(16.2)	4.7	38	3,791	(15.1)	4.3	3,752	(16.0)	3.8	-39
Naphtha	1,758	(11.5)	10.9	1,650	(11.7)	9.2	-108	2,524	(12.1)	4.6	2,050	(10.7)	2.8	-474	2,938	(11.7)	3.1	2,474	(10.6)	3.8	-464
Kero/Jet	1,430	(9.4)	4.8	1,443	(10.2)	4.9	13	1,902	(9.1)	3.6	1,771	(9.2)	2.6	-130	2,318	(9.3)	4.0	2,034	(8.7)	2.8	-284
Gas oil	4,712	(30.9)	6.3	4,613	(32.6)	6.7	-99	6,751	(32.2)	4.6	6,556	(34.1)	4.5	-195	8,414	(33.6)	4.5	8,391	(35.8)	5.1	-23
Heavy Fuel	3,169	(20.8)	2.4	2,318	(16.4)	1.1	-851	3,890	(18.6)	2.6	3,180	(16.5)	4.0	-710	4,302	(17.2)	2.0	3,670	(15.7)	2.9	-632
Fuel Oil Total	13,075	(85.8)	5.2	12,175	(86.2)	5.0	-900	18,141	(86.6)	4.2	16,669	(86.7)	4.0	-1,472	21,763	(86.9)	3.7	20,321	(86.8)	4.0	-1,443
LPG	1,419	(9.3)	10.5	1,002	(7.1)	8.9	-417	1,879	(9.0)	3.6	1,603	(8.3)	6.1	-275	2,221	(8.9)	3.4	1,984	(8.5)	4.3	-237
Other Products	750	(4.9)	4.8	952	(6.7)	5.8	202	921	(4.4)	2.6	962	(5.0)	0.1	41	1,067	(4.3)	3.0	1,117	(4.8)	3.0	50
CDU capacity	16,442	thou.b/d		Oper. Rate:	85.9 %			20,412	thou.b/d		Oper. Rate:	94.2 %			24,964	thou.b/d		Oper. Rate:	93.8 %		
Asia																					
Products Total	20,819	(100.0)	3.7	18,575	(100.0)	3.5	-2,244	26,295	(100.0)	3.0	23,734	(100.0)	3.1	-2,561	30,356	(100.0)	2.9	27,921	(100.0)	3.3	-2,435
Gasoline	3,004	(14.4)	4.9	3,117	(16.8)	5.0	113	4,079	(15.5)	3.9	4,084	(17.2)	3.4	5	4,785	(15.8)	3.2	4,787	(17.1)	3.2	3
Naphtha	2,565	(12.3)	6.5	1,955	(10.5)	5.6	-610	3,213	(12.2)	2.9	2,297	(9.7)	2.0	-916	3,628	(11.9)	2.5	2,721	(9.7)	3.4	-906
Kero/Jet	2,215	(10.6)	3.7	2,133	(11.5)	3.6	-82	2,629	(10.0)	2.2	2,469	(10.4)	1.8	-160	3,039	(10.0)	2.9	2,731	(9.8)	2.0	-308
Gas oil	6,010	(28.9)	5.2	5,881	(31.7)	5.4	-130	8,000	(30.4)	3.6	7,805	(32.9)	3.6	-195	9,657	(31.8)	3.8	9,612	(34.4)	4.3	-45
Heavy Fuel	3,887	(18.7)	0.4	2,990	(16.1)	-0.5	-896	4,534	(17.2)	1.9	3,826	(16.1)	3.1	-708	4,908	(16.2)	1.6	4,267	(15.3)	2.2	-642
Fuel Oil Total	17,681	(84.9)	3.5	16,077	(86.5)	3.3	-1,605	22,455	(85.4)	3.0	20,481	(86.3)	3.1	-1,974	26,016	(85.7)	3.0	24,118	(86.4)	3.3	-1,898
LPG	2,086	(10.0)	5.6	1,330	(7.2)	5.8	-757	2,611	(9.9)	2.8	1,982	(8.4)	5.1	-629	2,965	(9.8)	2.6	2,375	(8.5)	3.7	-591
Other Products	1,051	(5.0)	3.7	1,169	(6.3)	4.4	118	1,229	(4.7)	2.0	1,271	(5.4)	1.0	41	1,375	(4.5)	2.3	1,428	(5.1)	2.4	53
CDU capacity	21,209	thou.b/d	0	Oper. Rate:	81.6 %			25,148	thou.b/d	0	Oper. Rate:	94.4 %			29,700	thou.b/d	0	Oper. Rate:	94.0 %		

Petroleum Products Balances in East Asia

(Case of lower economic growth in Asia)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	Production thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	Demand thou.b/d	(share) %	10/02 %/Y	Production thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	Demand thou.b/d	(share) %	15/02 %/Y	Production thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
China																					
Products Total	4,830	(100.0)	5.5	4,451	(100.0)	4.8	-379	7,685	(100.0)	6.0	6,915	(100.0)	5.7	-770	9,295	(100.0)	3.9	8,378	(100.0)	3.9	-917
Gasoline	819	(16.9)	6.3	939	(21.1)	6.6	120	1,433	(18.6)	7.3	1,433	(20.7)	5.4	0	1,682	(18.1)	3.3	1,682	(20.1)	3.3	0
Naphtha	517	(10.7)	11.8	517	(11.6)	10.5	0	923	(12.0)	7.5	761	(11.0)	4.9	-163	1,178	(12.7)	5.0	922	(11.0)	3.9	-256
Kero/Jet	192	(4.0)	4.3	180	(4.0)	3.6	-12	362	(4.7)	8.3	362	(5.2)	9.1	0	496	(5.3)	6.5	435	(5.2)	3.7	-61
Gas oil	1,632	(33.8)	7.3	1,656	(37.2)	6.9	24	2,739	(35.6)	6.7	2,705	(39.1)	6.3	-35	3,456	(37.2)	4.8	3,421	(40.8)	4.8	-35
Heavy Fuel	776	(16.1)	1.3	390	(8.8)	-2.0	-386	1,062	(13.8)	4.0	666	(9.6)	6.9	-397	1,142	(12.3)	1.5	754	(9.0)	2.5	-388
Fuel Oil Total	3,935	(81.5)	5.3	3,682	(82.7)	4.7	-253	6,520	(84.8)	6.5	5,926	(85.7)	6.1	-594	7,953	(85.6)	4.1	7,213	(86.1)	4.0	-740
LPG	569	(11.8)	11.6	425	(9.5)	10.1	-144	798	(10.4)	4.3	622	(9.0)	4.9	-175	933	(10.0)	3.2	754	(9.0)	3.9	-179
Other Products	325	(6.7)	3.1	344	(7.7)	3.3	19	367	(4.8)	1.5	366	(5.3)	0.8	0	409	(4.4)	2.2	411	(4.9)	2.3	2
CDU capacity	5,619	thou.b/d		Oper. Rate:	79.2 %			7,900	thou.b/d		Oper. Rate:	85.0 %			9,400	thou.b/d		Oper. Rate:	87.0 %		
Hong Kong																					
Products Total	281	(100.0)	3.6	0	(0.0)	0.0	-281	320	(100.0)	1.7	0	(0.0)	0.0	-320	347	(100.0)	1.6	0	(0.0)	0.0	-347
Gasoline	8	(2.9)	3.2	0	(0.0)	0.0	-8	11	(3.6)	4.4	0	(0.0)	0.0	-11	13	(3.7)	2.0	0	(0.0)	0.0	-13
Naphtha	14	(5.0)	9.1	0	(0.0)	0.0	-14	14	(4.3)	-0.2	0	(0.0)	0.0	-14	14	(4.0)	0.0	0	(0.0)	0.0	-14
Kero/Jet	77	(27.5)	6.7	0	(0.0)	0.0	-77	81	(25.2)	0.5	0	(0.0)	0.0	-81	83	(24.0)	0.6	0	(0.0)	0.0	-83
Gas oil	110	(39.1)	7.7	0	(0.0)	0.0	-110	127	(39.6)	1.8	0	(0.0)	0.0	-127	138	(39.6)	1.6	0	(0.0)	0.0	-138
Heavy Fuel	60	(21.5)	-1.2	0	(0.0)	0.0	-60	75	(23.4)	2.8	0	(0.0)	0.0	-75	87	(25.0)	3.0	0	(0.0)	0.0	-87
Fuel Oil Total	269	(96.0)	3.6	0	(0.0)	0.0	-269	308	(96.1)	1.7	0	(0.0)	0.0	-308	334	(96.2)	1.6	0	(0.0)	0.0	-334
LPG	8	(2.9)	5.6	0	(0.0)	0.0	-8	9	(2.8)	1.2	0	(0.0)	0.0	-9	9	(2.7)	1.0	0	(0.0)	0.0	-9
Other Products	3	(1.1)	2.3	0	(0.0)	0.0	-3	4	(1.1)	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 %		
Chinese Taipei																					
Products Total	932	(100.0)	4.0	1,131	(100.0)	5.4	199	1,110	(100.0)	2.2	1,245	(100.0)	1.2	135	1,151	(100.0)	0.7	1,307	(100.0)	1.0	156
Gasoline	165	(17.6)	7.7	177	(15.6)	7.9	12	221	(19.9)	3.7	269	(21.6)	5.4	48	241	(20.9)	1.8	298	(22.8)	2.1	57
Naphtha	205	(21.9)	9.0	326	(28.8)	12.1	121	363	(32.7)	7.4	325	(26.1)	0.0	-38	363	(31.5)	0.0	327	(25.0)	0.1	-36
Kero/Jet	49	(5.3)	6.8	65	(5.8)	6.5	16	60	(5.4)	2.4	60	(4.8)	-1.1	0	66	(5.8)	2.0	66	(5.1)	2.0	0
Gas oil	114	(12.2)	3.6	178	(15.8)	4.9	64	124	(11.2)	1.0	252	(20.3)	4.4	128	132	(11.5)	1.3	274	(21.0)	1.7	142
Heavy Fuel	267	(28.6)	0.7	248	(22.0)	1.4	-18	200	(18.1)	-3.5	200	(16.1)	-2.6	0	202	(17.6)	0.2	196	(15.0)	-0.4	-6
Fuel Oil Total	799	(85.7)	3.7	994	(88.0)	5.3	195	968	(87.2)	2.4	1,106	(88.9)	1.3	138	1,004	(87.2)	0.7	1,161	(88.8)	1.0	157
LPG	65	(7.0)	3.8	54	(4.8)	3.4	-11	65	(5.9)	0.0	61	(4.9)	1.6	-4	66	(5.7)	0.1	65	(5.0)	1.3	0
Other Products	68	(7.3)	9.4	82	(7.3)	11.0	15	77	(6.9)	1.6	77	(6.2)	-0.8	0	81	(7.1)	1.2	81	(6.2)	1.0	0
CDU capacity	1,220	thou.b/d		Oper. Rate:	92.7 %			1,310	thou.b/d		Oper. Rate:	95.0 %			1,376	thou.b/d		Oper. Rate:	95.0 %		
Korea																					
Products Total	2,315	(100.0)	6.9	2,427	(100.0)	7.3	111	2,573	(100.0)	1.3	2,613	(100.0)	0.9	40	2,709	(100.0)	1.0	2,747	(100.0)	1.0	38
Gasoline	170	(7.3)	10.9	204	(8.4)	11.7	34	222	(8.6)	3.4	209	(8.0)	0.3	-13	261	(9.6)	3.4	220	(8.0)	1.0	-42
Naphtha	658	(28.4)	12.0	438	(18.1)	10.1	-220	759	(29.5)	1.8	470	(18.0)	0.9	-289	786	(29.0)	0.7	495	(18.0)	1.0	-291
Kero/Jet	249	(10.7)	9.7	373	(15.4)	11.1	125	238	(9.2)	-0.6	246	(9.4)	-5.1	8	247	(9.1)	0.8	302	(11.0)	4.2	55
Gas oil	431	(18.6)	6.3	623	(25.7)	8.0	192	486	(18.9)	1.5	732	(28.0)	2.0	245	524	(19.4)	1.5	769	(28.0)	1.0	245
Heavy Fuel	514	(22.2)	2.7	565	(23.3)	3.4	51	529	(20.6)	0.4	695	(26.6)	2.6	166	540	(19.9)	0.4	687	(25.0)	-0.2	147
Fuel Oil Total	2,022	(87.3)	6.5	2,204	(90.8)	7.1	182	2,234	(86.8)	1.3	2,351	(90.0)	0.8	117	2,358	(87.0)	1.1	2,473	(90.0)	1.0	114
LPG	234	(10.1)	12.5	134	(5.5)	10.1	-100	264	(10.3)	1.5	183	(7.0)	4.0	-81	277	(10.2)	1.0	192	(7.0)	1.0	-85
Other Products	59	(2.6)	9.8	89	(3.7)	11.6	30	75	(2.9)	3.0	78	(3.0)	-1.6	4	74	(2.7)	-0.2	82	(3.0)	1.0	9
CDU capacity	2,750	thou.b/d		Oper. Rate:	88.2 %			2,750	thou.b/d		Oper. Rate:	95.0 %			2,892	thou.b/d		Oper. Rate:	95.0 %		

Petroleum Products Balances in East Asia

(Case of lower economic growth in Asia)

	2002 (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
Singapore																					
Products Total	775	(100.0)	6.3	785	(100.0)	0.9	11	953	(100.0)	2.6	1,270	(100.0)	6.2	317	1,057	(100.0)	2.1	1,270	(100.0)	0.0	213
Gasoline	15	(2.0)	3.3	82	(10.5)	0.8	67	17	(1.8)	1.6	152	(12.0)	8.0	135	16	(1.5)	-1.5	152	(12.0)	0.0	136
Naphtha	87	(11.2)	20.8	81	(10.3)	2.6	-6	105	(11.0)	2.3	127	(10.0)	5.8	22	123	(11.6)	3.2	127	(10.0)	0.0	4
Kero/Jet	63	(8.2)	5.5	131	(16.7)	-0.7	68	75	(7.9)	2.2	197	(15.5)	5.2	122	83	(7.8)	1.8	167	(13.2)	-3.2	85
Gas oil	70	(9.1)	4.9	236	(30.0)	2.6	166	85	(9.0)	2.5	375	(29.5)	6.0	289	92	(8.7)	1.5	445	(35.0)	3.5	353
Heavy Fuel	513	(66.2)	6.2	141	(17.9)	-1.8	-372	630	(66.1)	2.6	254	(20.0)	7.7	-376	698	(66.0)	2.1	254	(20.0)	0.0	-444
Fuel Oil Total	749	(96.6)	6.5	671	(85.4)	0.4	-78	913	(95.8)	2.5	1,105	(87.0)	6.4	192	1,011	(95.6)	2.1	1,145	(90.2)	0.7	134
LPG	17	(2.2)	5.0	32	(4.0)	10.3	14	30	(3.2)	7.4	76	(6.0)	11.6	46	36	(3.4)	3.3	36	(2.8)	-14.0	0
Other Products	9	(1.2)	1.6	83	(10.6)	5.9	74	10	(1.0)	1.2	89	(7.0)	0.8	79	10	(1.0)	0.3	89	(7.0)	0.0	79
CDU capacity	1,269	thou.b/d		Oper. Rate:	61.9 %			1,337	thou.b/d		Oper. Rate:	95.0 %			1,337	thou.b/d		Oper. Rate:	95.0 %		
Brunei																					
Products Total	12	(100.0)	5.0	11	(100.0)	22.9	-1	16	(100.0)	3.5	10	(100.0)	-1.2	-6	17	(100.0)	2.1	10	(100.0)	0.0	-7
Gasoline	4	(37.4)	5.4	4	(39.7)	0.0	0	6	(38.5)	3.9	4	(40.0)	-1.1	-2	7	(37.5)	1.6	4	(40.0)	0.0	-2
Naphtha	0	(1.1)	-0.7	0	(1.2)	0.0	0	0	(0.9)	0.8	0	(1.4)	0.8	0	0	(0.8)	0.0	0	(1.4)	0.0	0
Kero/Jet	2	(15.8)	6.0	2	(15.6)	0.0	0	3	(15.9)	3.6	1	(5.9)	-12.6	-2	3	(18.0)	4.7	1	(5.9)	0.0	-3
Gas oil	3	(26.7)	3.0	3	(29.0)	0.0	0	5	(30.3)	5.1	3	(25.0)	-3.1	-2	5	(30.3)	2.1	3	(25.0)	0.0	-3
Heavy Fuel	0	(0.2)	0.1	0	(0.2)	0.0	0	0	(0.1)	0.3	0	(1.0)	22.4	0	0	(0.1)	0.0	0	(1.0)	0.0	0
Fuel Oil Total	10	(81.3)	4.4	10	(85.7)	0.0	0	14	(85.7)	4.2	7	(73.3)	-3.1	-6	15	(86.8)	2.4	7	(73.3)	0.0	-8
LPG	2	(17.2)	13.8	2	(14.3)	12.5	0	2	(12.8)	-0.2	2	(22.4)	4.5	0	2	(11.8)	0.4	2	(22.4)	0.0	0
Other Products	0	(1.5)	0.6	0	(0.0)	0.0	0	0	(1.5)	2.9	0	(4.3)	0.0	0	0	(1.4)	1.8	0	(4.3)	0.0	0
CDU capacity	9	thou.b/d		Oper. Rate:	130.6 %			9	thou.b/d		Oper. Rate:	118.3 %			9	thou.b/d		Oper. Rate:	118.3 %		
Indonesia																					
Products Total	1,227	(100.0)	5.1	1,042	(100.0)	4.9	-185	1,605	(100.0)	3.4	1,248	(100.0)	2.3	-357	1,761	(100.0)	1.9	1,419	(100.0)	2.6	-342
Gasoline	212	(17.3)	5.9	194	(18.7)	7.0	-18	285	(17.7)	3.7	333	(26.7)	6.9	48	299	(17.0)	1.0	338	(23.8)	0.3	39
Naphtha	14	(1.1)	0.0	43	(4.2)	0.0	29	21	(1.3)	5.2	13	(1.0)	-14.3	-8	26	(1.5)	4.4	0	(0.0)	-100.0	-26
Kero/Jet	294	(24.0)	3.3	187	(18.0)	4.6	-107	377	(23.5)	3.1	222	(17.8)	2.1	-155	426	(24.2)	2.5	278	(19.6)	4.7	-148
Gas oil	490	(39.9)	6.0	302	(28.9)	8.2	-188	649	(40.4)	3.6	314	(25.2)	0.5	-335	703	(39.9)	1.6	427	(30.1)	6.3	-276
Heavy Fuel	161	(13.1)	4.2	243	(23.3)	1.5	81	209	(13.0)	3.3	320	(25.7)	3.5	111	236	(13.4)	2.5	301	(21.2)	-1.2	65
Fuel Oil Total	1,171	(95.5)	4.9	969	(93.0)	4.9	-202	1,541	(96.0)	3.5	1,201	(96.3)	2.7	-339	1,690	(96.0)	1.9	1,344	(94.7)	2.3	-346
LPG	41	(3.3)	11.6	39	(3.7)	4.4	-2	50	(3.1)	2.5	21	(1.7)	-7.2	-28	56	(3.2)	2.4	47	(3.3)	16.8	-10
Other Products	15	(1.2)	5.0	34	(3.3)	9.0	19	15	(0.9)	-0.2	25	(2.0)	-3.8	10	15	(0.8)	0.0	28	(2.0)	2.6	14
CDU capacity	1,073	thou.b/d		Oper. Rate:	97.2 %			1,273	thou.b/d		Oper. Rate:	98.0 %			1,448	thou.b/d		Oper. Rate:	98.0 %		
Malaysia																					
Products Total	460	(100.0)	4.9	464	(100.0)	6.5	4	653	(100.0)	4.5	518	(100.0)	1.4	-135	804	(100.0)	4.3	637	(100.0)	4.2	-168
Gasoline	150	(32.5)	8.1	94	(20.3)	7.6	-55	217	(33.3)	4.8	94	(18.2)	0.0	-123	266	(33.1)	4.2	116	(18.2)	4.2	-151
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	39	(8.4)	5.3	64	(13.7)	9.2	25	56	(8.6)	4.8	47	(9.0)	-3.8	-10	69	(8.6)	4.3	57	(9.0)	4.2	-12
Gas oil	181	(39.3)	5.6	180	(38.8)	7.6	-1	259	(39.6)	4.6	207	(40.0)	1.8	-52	318	(39.6)	4.2	255	(40.0)	4.2	-64
Heavy Fuel	48	(10.5)	-0.9	49	(10.6)	0.4	1	63	(9.6)	3.3	72	(13.8)	4.8	9	77	(9.6)	4.3	88	(13.8)	4.2	11
Fuel Oil Total	418	(90.8)	4.7	387	(83.5)	5.9	-30	595	(91.1)	4.5	419	(81.0)	1.0	-175	732	(91.0)	4.2	516	(81.0)	4.2	-216
LPG	27	(5.9)	9.3	25	(5.4)	9.4	-2	37	(5.7)	3.9	52	(10.0)	9.4	15	47	(5.9)	4.9	64	(10.0)	4.2	17
Other Products	15	(3.3)	4.8	51	(11.0)	14.3	36	21	(3.2)	4.3	47	(9.0)	-1.2	26	25	(3.2)	3.8	57	(9.0)	4.2	32
CDU capacity	515	thou.b/d		Oper. Rate:	90.0 %			545	thou.b/d		Oper. Rate:	95.0 %			670	thou.b/d		Oper. Rate:	94.9 %		

Petroleum Products Balances in East Asia

(Case of lower economic growth in Asia)

	2002 (Actual)							2010							2015						
	Demand thou.b/d	(share) %	2002/80 %/Y	**Production** thou.b/d	(share) %	2002/80 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	10/02 %/Y	**Production** thou.b/d	(share) %	10/02 %/Y	Net Export thou.b/d	**Demand** thou.b/d	(share) %	15/02 %/Y	**Production** thou.b/d	(share) %	15/02 %/Y	Net Export thou.b/d
Philippines																					
Products Total	340	(100.0)	1.8	266	(100.0)	1.6	-74	432	(100.0)	3.0	318	(100.0)	2.3	-114	511	(100.0)	3.4	318	(100.0)	0.0	-193
Gasoline	64	(18.8)	4.0	44	(16.7)	1.9	-19	103	(23.9)	6.2	54	(17.0)	2.5	-49	129	(25.3)	4.6	54	(17.0)	0.0	-75
Naphtha	1	(0.2)	-6.0	11	(4.2)	8.3	11	1	(0.1)	-0.2	16	(5.0)	4.6	15	1	(0.1)	0.0	13	(4.0)	-4.4	12
Kero/Jet	29	(8.6)	3.7	24	(8.9)	1.7	-6	40	(9.2)	3.8	40	(12.5)	6.7	0	51	(10.0)	5.2	24	(7.5)	-9.6	-27
Gas oil	135	(39.6)	4.1	87	(32.8)	3.1	-47	177	(40.9)	3.5	65	(20.5)	-3.5	-111	210	(41.1)	3.5	84	(26.5)	5.2	-126
Heavy Fuel	76	(22.2)	-1.8	80	(29.9)	0.1	4	68	(15.8)	-1.3	102	(32.0)	3.1	34	71	(13.9)	0.8	102	(32.0)	0.0	31
Fuel Oil Total	304	(89.4)	1.7	246	(92.5)	1.7	-58	389	(89.9)	3.1	277	(87.0)	1.5	-112	462	(90.4)	3.5	277	(87.0)	0.0	-185
LPG	33	(9.8)	4.4	17	(6.5)	2.1	-16	39	(9.0)	2.1	38	(12.0)	10.4	-1	45	(8.7)	2.6	38	(12.0)	0.0	-6
Other Products	3	(0.8)	-2.8	3	(1.0)	-1.8	0	4	(1.0)	5.7	3	(1.0)	2.3	-1	5	(0.9)	1.6	3	(1.0)	0.0	-2
CDU capacity	420	thou.b/d		Oper. Rate:	63.4 %			335	thou.b/d		Oper. Rate:	95.1 %			335	thou.b/d		Oper. Rate:	95.1 %		
Thailand																					
Products Total	773	(100.0)	5.7	815	(100.0)	8.0	42	1,036	(100.0)	3.7	1,021	(100.0)	2.9	-15	1,244	(100.0)	3.7	1,229	(100.0)	3.8	-15
Gasoline	120	(15.5)	5.9	135	(16.5)	7.6	15	176	(17.0)	4.9	176	(17.2)	3.4	0	221	(17.8)	4.7	221	(18.0)	4.7	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	63	(8.1)	5.2	87	(10.6)	7.3	24	85	(8.2)	3.8	75	(7.3)	-1.8	-10	101	(8.2)	3.6	101	(8.3)	6.3	0
Gas oil	298	(38.6)	6.8	322	(39.5)	9.0	24	425	(41.0)	4.5	425	(41.6)	3.5	0	526	(42.3)	4.4	526	(42.8)	4.4	0
Heavy Fuel	145	(18.7)	2.1	168	(20.7)	5.7	24	170	(16.4)	2.0	170	(16.6)	0.1	0	183	(14.7)	1.5	183	(14.9)	1.5	0
Fuel Oil Total	626	(81.0)	4.9	712	(87.4)	7.6	86	856	(82.6)	4.0	846	(82.8)	2.2	-10	1,032	(83.0)	3.8	1,032	(84.0)	4.1	0
LPG	128	(16.5)	14.4	84	(10.3)	13.7	-44	155	(14.9)	2.4	155	(15.2)	8.0	0	180	(14.4)	3.0	173	(14.0)	2.2	-7
Other Products	19	(2.5)	8.6	19	(2.4)	10.2	0	25	(2.4)	3.3	20	(2.0)	0.7	-5	32	(2.6)	5.1	25	(2.0)	3.8	-8
CDU capacity	991	thou.b/d		Oper. Rate:	82.2 %			1,075	thou.b/d		Oper. Rate:	95.0 %			1,294	thou.b/d		Oper. Rate:	95.0 %		
Vietnam																					
Products Total	212	(100.0)	8.3	0	(0.0)	0.0	-212	342	(100.0)	6.2	124	(100.0)	0.0	-218	426	(100.0)	4.5	257	(100.0)	15.7	-169
Gasoline	45	(21.4)	8.4	0	(0.0)	0.0	-45	72	(21.1)	6.0	31	(25.0)	0.0	-41	92	(21.6)	5.0	64	(25.0)	15.7	-28
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	15	(6.9)	4.9	0	(0.0)	0.0	-15	23	(6.6)	5.5	21	(16.8)	0.0	-2	29	(6.7)	4.9	29	(11.2)	6.6	0
Gas oil	87	(40.9)	8.0	0	(0.0)	0.0	-87	140	(40.9)	6.2	31	(24.7)	0.0	-109	180	(42.2)	5.1	100	(38.8)	26.7	-80
Heavy Fuel	51	(24.1)	9.3	0	(0.0)	0.0	-51	81	(23.7)	6.0	19	(15.2)	0.0	-62	96	(22.6)	3.5	38	(15.0)	15.5	-58
Fuel Oil Total	198	(93.4)	8.1	0	(0.0)	0.0	-198	315	(92.3)	6.0	101	(81.7)	0.0	-214	396	(93.1)	4.7	231	(90.0)	18.0	-166
LPG	10	(4.9)	23.5	0	(0.0)	0.0	-10	23	(6.6)	10.3	23	(18.3)	0.0	0	26	(6.1)	2.7	26	(10.0)	2.7	0
Other Products	4	(1.7)	6.8	0	(0.0)	0.0	-4	4	(1.1)	-0.2	0	(0.0)	0.0	-4	4	(0.9)	0.0	0	(0.0)	0.0	-4
CDU capacity	0	thou.b/d		Oper. Rate:	0.0 %			130	thou.b/d		Oper. Rate:	95.0 %			270	thou.b/d		Oper. Rate:	95.0 %		
East Asia (excluding Japan)																					
Products Total	12,157	(100.0)	5.4	11,392	(100.0)	5.0	-764	16,724	(100.0)	4.1	15,281	(100.0)	3.7	-1,443	19,323	(100.0)	2.9	17,572	(100.0)	2.8	-1,751
Gasoline	1,772	(14.6)	6.6	1,874	(16.5)	6.5	102	2,763	(16.5)	5.7	2,755	(18.0)	4.9	-8	3,228	(16.7)	3.2	3,149	(17.9)	2.7	-79
Naphtha	1,495	(12.3)	11.5	1,416	(12.4)	9.7	-79	2,186	(13.1)	4.9	1,711	(11.2)	2.4	-474	2,489	(12.9)	2.6	1,883	(10.7)	1.9	-606
Kero/Jet	1,072	(8.8)	5.2	1,113	(9.8)	4.7	40	1,399	(8.4)	3.4	1,269	(8.3)	1.7	-130	1,655	(8.6)	3.4	1,460	(8.3)	2.9	-194
Gas oil	3,551	(29.2)	6.5	3,588	(31.5)	6.6	37	5,215	(31.2)	4.9	5,108	(33.4)	4.5	-108	6,284	(32.5)	3.8	6,303	(35.9)	4.3	20
Heavy Fuel	2,610	(21.5)	2.1	1,884	(16.5)	0.7	-726	3,087	(18.5)	2.1	2,497	(16.3)	3.6	-590	3,333	(17.2)	1.5	2,603	(14.8)	0.8	-729
Fuel Oil Total	10,501	(86.4)	5.2	9,875	(86.7)	4.8	-626	14,651	(87.6)	4.3	13,340	(87.3)	3.8	-1,311	16,988	(87.9)	3.0	15,399	(87.6)	2.9	-1,589
LPG	1,136	(9.3)	10.3	811	(7.1)	8.6	-325	1,472	(8.8)	3.3	1,234	(8.1)	5.4	-238	1,677	(8.7)	2.6	1,397	(7.9)	2.5	-280
Other Products	520	(4.3)	4.2	706	(6.2)	5.4	186	601	(3.6)	1.8	707	(4.6)	0.0	106	659	(3.4)	1.9	777	(4.4)	1.9	118
CDU capacity	13,865	thou.b/d		Oper. Rate:	82.2 %			16,663	thou.b/d		Oper. Rate:	91.7 %			19,030	thou.b/d		Oper. Rate:	92.3 %		

Petroleum Products Balances in East Asia

(Case of lower economic growth in Asia)

	2002 (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
India																					
Products Total	2,363	(100.0)	6.0	2,421	(100.0)	7.2	58	3,141	(100.0)	3.6	3,241	(100.0)	3.7	100	3,788	(100.0)	3.8	3,883	(100.0)	3.7	95
Gasoline	171	(7.2)	7.8	234	(9.7)	9.4	63	231	(7.4)	3.8	272	(8.4)	1.9	41	290	(7.6)	4.6	295	(7.6)	1.6	6
Naphtha	260	(11.0)	8.1	219	(9.1)	7.4	-41	336	(10.7)	3.2	336	(10.4)	5.5	0	418	(11.0)	4.5	418	(10.8)	4.5	0
Kero/Jet	281	(11.9)	4.2	290	(12.0)	6.6	10	389	(12.4)	4.2	389	(12.0)	3.7	0	449	(11.9)	2.9	449	(11.6)	2.9	0
Gas oil	836	(35.4)	5.9	923	(38.1)	7.8	88	1,052	(33.5)	2.9	1,264	(39.0)	4.0	212	1,254	(33.1)	3.6	1,514	(39.0)	3.7	260
Heavy Fuel	344	(14.6)	3.6	348	(14.4)	4.4	4	469	(14.9)	3.9	469	(14.5)	3.8	0	579	(15.3)	4.3	590	(15.2)	4.7	11
Fuel Oil Total	1,891	(80.0)	5.5	2,016	(83.3)	6.9	124	2,476	(78.8)	3.4	2,730	(84.2)	3.9	253	2,990	(78.9)	3.8	3,267	(84.1)	3.7	277
LPG	261	(11.0)	12.6	179	(7.4)	10.9	-82	371	(11.8)	4.5	292	(9.0)	6.3	-79	448	(11.8)	3.8	349	(9.0)	3.7	-98
Other Products	211	(8.9)	7.1	227	(9.4)	8.1	16	294	(9.4)	4.2	220	(6.8)	-0.4	-74	350	(9.2)	3.6	267	(6.9)	4.0	-84
CDU capacity	2,135	thou.b/d		Oper. Rate:	113.4 %			3,029	thou.b/d		Oper. Rate:	107.0 %			3,629	thou.b/d		Oper. Rate:	107.0 %		
Other Asia																					
Products Total	725	(100.0)	5.2	316	(100.0)	1.8	-409	1,075	(100.0)	5.1	713	(100.0)	10.7	-363	1,287	(100.0)	3.7	855	(100.0)	3.7	-432
Gasoline	63	(8.7)	2.6	43	(13.5)	1.4	-21	80	(7.4)	3.0	85	(11.9)	9.0	5	91	(7.1)	2.7	91	(10.7)	1.4	0
Naphtha	3	(0.4)	0.0	14	(4.4)	1.8	11	3	(0.2)	-0.2	3	(0.4)	-18.7	0	3	(0.2)	0.0	0	(0.0)	-100.0	-3
Kero/Jet	77	(10.6)	2.3	41	(12.9)	1.1	-37	113	(10.5)	4.9	113	(15.9)	13.7	0	145	(11.3)	5.1	145	(17.0)	5.1	0
Gas oil	325	(44.9)	6.0	102	(32.2)	2.6	-224	483	(45.0)	5.1	184	(25.8)	7.7	-299	583	(45.3)	3.8	199	(23.3)	1.6	-384
Heavy Fuel	215	(29.6)	6.9	86	(27.1)	1.3	-129	334	(31.1)	5.7	214	(30.0)	12.1	-120	394	(30.6)	3.4	257	(30.0)	3.7	-137
Fuel Oil Total	683	(94.2)	5.2	284	(90.1)	1.7	-399	1,014	(94.2)	5.1	599	(84.1)	9.8	-414	1,216	(94.5)	3.7	692	(80.9)	2.9	-524
LPG	22	(3.1)	7.3	12	(3.8)	4.3	-10	36	(3.4)	6.1	78	(10.9)	26.3	42	41	(3.2)	2.4	121	(14.1)	9.1	80
Other Products	19	(2.7)	2.8	19	(6.1)	2.5	0	26	(2.4)	3.8	36	(5.0)	8.0	10	30	(2.3)	3.1	43	(5.0)	3.7	13
CDU capacity	442	thou.b/d		Oper. Rate:	71.4 %			720	thou.b/d		Oper. Rate:	99.0 %			864	thou.b/d		Oper. Rate:	99.0 %		
Asia (excluding Japan)																					
Products Total	15,244	(100.0)	5.5	14,129	(100.0)	5.2	-1,116	20,940	(100.0)	4.0	19,234	(100.0)	3.9	-1,706	24,398	(100.0)	3.1	22,311	(100.0)	3.0	-2,087
Gasoline	2,006	(13.2)	6.5	2,151	(15.2)	6.5	145	3,074	(14.7)	5.5	3,113	(16.2)	4.7	38	3,609	(14.8)	3.3	3,536	(15.8)	2.6	-73
Naphtha	1,758	(11.5)	10.9	1,650	(11.7)	9.2	-108	2,524	(12.1)	4.6	2,050	(10.7)	2.8	-474	2,910	(11.9)	2.9	2,301	(10.3)	2.3	-609
Kero/Jet	1,430	(9.4)	4.8	1,443	(10.2)	4.9	13	1,902	(9.1)	3.6	1,771	(9.2)	2.6	-130	2,249	(9.2)	3.4	2,054	(9.2)	3.0	-194
Gas oil	4,712	(30.9)	6.3	4,613	(32.6)	6.7	-99	6,751	(32.2)	4.6	6,556	(34.1)	4.5	-195	8,121	(33.3)	3.8	8,017	(35.9)	4.1	-104
Heavy Fuel	3,169	(20.8)	2.4	2,318	(16.4)	1.1	-851	3,890	(18.6)	2.6	3,180	(16.5)	4.0	-710	4,306	(17.6)	2.0	3,450	(15.5)	1.6	-856
Fuel Oil Total	13,075	(85.8)	5.2	12,175	(86.2)	5.0	-900	18,141	(86.6)	4.2	16,669	(86.7)	4.0	-1,472	21,194	(86.9)	3.2	19,358	(86.8)	3.0	-1,836
LPG	1,419	(9.3)	10.5	1,002	(7.1)	8.9	-417	1,879	(9.0)	3.6	1,603	(8.3)	6.1	-275	2,165	(8.9)	2.9	1,867	(8.4)	3.1	-298
Other Products	750	(4.9)	4.8	952	(6.7)	5.8	202	921	(4.4)	2.6	962	(5.0)	0.1	41	1,039	(4.3)	2.5	1,086	(4.9)	2.5	47
CDU capacity	16,442	thou.b/d		Oper. Rate:	85.9 %			20,412	thou.b/d		Oper. Rate:	94.2 %			23,523	thou.b/d		Oper. Rate:	94.8 %		
Asia																					
Products Total	20,819	(100.0)	3.7	18,575	(100.0)	3.5	-2,244	26,295	(100.0)	3.0	23,734	(100.0)	3.1	-2,561	29,544	(100.0)	2.4	26,810	(100.0)	2.5	-2,734
Gasoline	3,004	(14.4)	4.9	3,117	(16.8)	5.0	113	4,079	(15.5)	3.9	4,084	(17.2)	3.4	5	4,534	(15.3)	2.1	4,534	(16.9)	2.1	0
Naphtha	2,565	(12.3)	6.5	1,955	(10.5)	5.6	-610	3,213	(12.2)	2.9	2,297	(9.7)	2.0	-916	3,577	(12.1)	2.2	2,549	(9.5)	2.1	-1,028
Kero/Jet	2,215	(10.6)	3.7	2,133	(11.5)	3.6	-82	2,629	(10.0)	2.2	2,469	(10.4)	1.8	-160	2,963	(10.0)	2.4	2,770	(10.3)	2.3	-194
Gas oil	6,010	(28.9)	5.2	5,881	(31.7)	5.4	-130	8,000	(30.4)	3.6	7,805	(32.9)	3.6	-195	9,324	(31.6)	3.1	9,219	(34.4)	3.4	-104
Heavy Fuel	3,887	(18.7)	0.4	2,990	(16.1)	-0.5	-896	4,534	(17.2)	1.9	3,826	(16.1)	3.1	-708	4,887	(16.5)	1.5	4,084	(15.2)	1.3	-802
Fuel Oil Total	20,819	(100.0)	3.7	18,575	(100.0)	3.5	-2,244	26,295	(100.0)	3.0	23,734	(100.0)	3.1	-2,561	29,544	(100.0)	2.4	26,810	(100.0)	2.5	-2,734
LPG	2,086	(10.0)	5.6	1,330	(7.2)	5.8	-757	2,611	(9.9)	2.8	1,982	(8.4)	5.1	-629	2,914	(9.9)	2.2	2,263	(8.4)	2.7	-651
Other Products	1,051	(5.0)	3.7	1,169	(6.3)	4.4	118	1,229	(4.7)	2.0	1,271	(5.4)	1.0	41	1,346	(4.6)	1.8	1,392	(5.2)	1.8	46
CDU capacity	21,209	thou.b/d		Oper. Rate:	81.6 %			25,148	thou.b/d		Oper. Rate:	94.4 %			28,259	thou.b/d	0	Oper. Rate:	94.9 %		

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