

Outlook of Supply and Demand Trends of Petroleum Products in Asia

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I. International Working Group* for Study of A Series of Framework for Petroleum Industry in 2002: Supply and Demand Trends of Petroleum Products Making Use of Econometric Model

1. The background and Purpose of Study

Before the economic crisis which attacked the Asian region in 1997 , the oil demand of East Asian region except Japan was an important problem since the rapid increase in an annual rate of no less than 7% has been accomplished, when considering the security of the oil supply to Japan. However, the oil demand in the East Asian region* decreased in 1998 immediately after the crisis, the supply of petroleum products became excess, and the market condition got worse quickly. It became a key point about what time the oil demand will recover from such a situation. Furthermore, the phenomena that have big influence on oil business, such as steep rise of a crude oil price, the simultaneous terrorist attacks, and the Iraq problem, have occurred frequently in recent years.

In the present condition of the above rapid changes, it is the purpose of this research to offer taking advantage of the basic information for making policy proposals by means of prediction analysis the newest energy and business information about the supply and demand conditions of petroleum products in the East Asian region which have a big impact especially on oil supply and demand of Japan.

This fiscal year, while having been anxious about the future of the energy and the economic situations, such as high crude oil price by the Iraq problem and global economical stagnation, we investigated the oil supply and demand in 2006 and 2010 from the viewpoint of reexamining the economic conditions and oil demand of each country of the East Asian region.

*Note: We abbreviate the East Asian region except Japan to the East Asian region from now on.

*This research is done by the Institute of Energy Economics, Japan in "Study of A

Series of Framework for Petroleum Industry: Supply and Demand Trends of Petroleum Products Making Use of Econometric Model” in response to consignment of the Ministry of Economy, Trade and Industry. In addition, on the occasion of enforcement, the International Working Group (following International WG) committee was constituted, and examination was advanced in the committee.

2. Focused Issues in FY2002

- (1) Although the oil demand of the East Asian region hung low under the influence of the Asian economic crisis in 1998, the oil demand also began to show a restorative tendency slowly according to the economical recovery keynote of Asian countries after the middle of 1999. After that the big phenomena have occurred such as high crude oil price, the simultaneous terrorist attacks and the Iraq problem, which have influenced the economy and oil demand of the East Asian region, then the prospect of future oil supply and demand is very uncertain.
- (2) Although, as for China which has huge energy demand, the economic growth of about 7% per year continues to be expected, it is thought that the trend of abolition of the oil product trade restrictions by joining in WTO and rapid increase of the oil demand corresponding to economic growth has big influence on the oil supply and demand of the East Asian region.

Based on the above fluctuation factor, the future trend of the demand-and-supply balance in the future East Asian region was examined.

II. Background of International Working Group Study

1. Progress of International Working Group in 2002

(1) Four meetings were held since September 2002 to analyze future supply and demand of international petroleum products focusing on those in the East Asian region*.

(*Note: In this report, the East Asian region refers to China, Republic of Korea, Chinese Taipei, Hong Kong, Singapore, Brunei, Indonesia, Malaysia, Philippines, Thailand, and Vietnam.)

(2) The investigation was done with the consciousness of issues as described in the previous page by integrating knowledge of the Working Group members with the help of combined a world energy demand estimation model (econometric model) and a world oil-refining trade flow model (linear programming model) developed by the Energy Data and Modeling Center, the Institute of Energy Economics, Japan.

The future supply and demand of energy and petroleum in the world being investigated, in particular, special interest was focused on that in the East Asian region.

2. Scenarios and Main Assumptions

(1) Scenarios

In 2002, we put on emphasis on two cases of "Base case" with relatively favorable economic growth and "low GDP growth case" where it was assumed to be that the economic growth of the East Asian region also would stagnate when stagnation of the world economy of these days prolongs. In addition, both crude oil price rise by 5\$/bbl case and China refining capacities reinforcement case were set to analyze as sensitivity analysis how they would influence decrease in demand and the oil supply and demand balance of the East Asian region respectively (Table 1).

Base case (Business As Usual)

In this case, economic growth rate as the premise of petroleum products demand was set basically taking account of economic outlooks of corresponding country's governments, international organizations and quasi-organizations as such.

The average economic growth rate of the East Asian region from 2000 to 2006 is set at 5.3%.

And the average annual economic growth rate of the East Asian region from 2006 to 2010 is set at 5.5%. Demand of petroleum products was calculated on the above premises. As for supply assumptions, realistic domestic plans for refining capacity expansion are adopted.

Low GDP growth case

The world economic stagnation is assumed to be continuing, so that annual economic growth rate is lower by 1.0% from 2003 to 2010 compared with that in the Base case.

The annual growth rate is assumed to be 4.6% from 2000 to 2006 and 4.5% from 2006 to 2010.

Supply side assumptions are set all the same with the Base case.

Table 1.Assumption

	Case	Object year	The changed part to a Base case
1	Base case	2006 2010	
2	Low GDP growth case	2006 2010	The annual economic growth rate is lower by 1.0% from 2003 compared with that in base case
3	Crude oil price rise case by 5\$/bbl	2006 2010	The crude oil price rise 5\$/bbl from 2003
4	China refining capability enhancement case (7.4 million b/d) *	2010	The Chinese CDU capability increase in +1 million b/d (from 6.4 million b/d of Base case to 7.4 million b/d.)
5	Middle East refining capability enhancement case (8.1million b/d) *	2010	The Middle East CDU capability increase in +1 million b/d (from 7.1 million b/d of Base case to 8.1 million b/d.)

*Enhanced refining capacities are Crude distillation unit (CDU).

(2) GDP Growth Rate Assumption

About the GDP growth rate, assumption as shown in Table 2 was placed based on the prediction value of Asian Development Bank's announcement, or the government plans announced by each country.

Table 2. Annual GDP Growth Rate Assumption of each Country in East Asia

Unit: Average annual growth rate(%)

	Actual	Base case		Low GDP growth case	
	2001/ 2000	2006/ 2000	2010/ 2006	2006/ 2000	2010/ 2006
China	7.3	7.3	6.5	6.6	5.5
Hong Kong	0.6	3.4	4.0	2.4	3.0
Chinese Taipei	-2.2	2.7	4.0	2.0	3.0
Korea	3.0	5.2	5.3	4.6	4.3
Singapore	-2.0	3.2	5.0	2.5	4.0
Brunei	3.0	2.6	2.8	1.6	1.8
Indonesia	3.2	3.8	5.0	3.0	4.0
Malaysia	0.4	4.3	5.5	3.7	4.5
Philippines	3.2	4.1	4.9	3.4	3.9
Thailand	1.8	3.8	4.6	3.1	3.6
Vietnam	5.8	6.3	7.2	5.3	6.2
Average East Asia	3.5	5.3	5.5	4.6	4.5

(Sources) Base case and low GDP growth case forecasted by International Working Group, the long-term economic plans and prospects from Asian Development Bank, the government of each country and related are regarded.

(3) Assumption of Crude Oil Prices

The prospect of “World Oil Price” of the Annual Energy Outlook 2003(DOE) is used for this crude oil price assumption.

Table 3. Assumption of a Crude Oil Price (\$/bbl)

	2001	2006	2010	2015	2020
Nominal price (\$/bbl)	27.7	25.4	33.6	35.0	39.8
FY2001 Real price(\$/bbl)	22.4	23.3	24.0	24.7	25.5

(Source) DOE, Annual Energy Outlook 2003.

(Note) Nominal price is calculated by International Working Group using the deflators of the Annual Energy Outlook 2003.

3. Present condition of the oil supply and demand of petroleum products in the East Asian region

(1) Actual petroleum products demand

Oil demand in the East Asian region, which was damaged by the economic crisis, began to recover in 1999. But for most countries, the ratio of demand increase slowed down from 1999 to 2000.

Despite the economic crisis in the region, oil demand in China increased. As a result, the increase of oil demand in China occupied about 2/3 of that of the East Asian region from 1999 to 2000. On the other hand, Thailand and Philippines have decreased in terms of absolute quantity over the same period (figure-1 and figure-2).

Fig-1 Oil Demand of the East Asian region

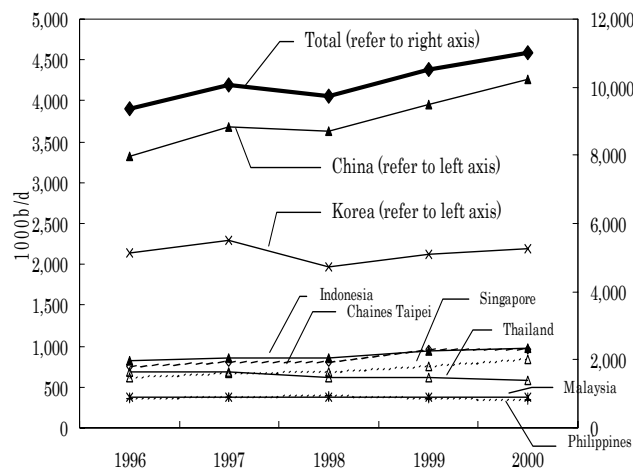
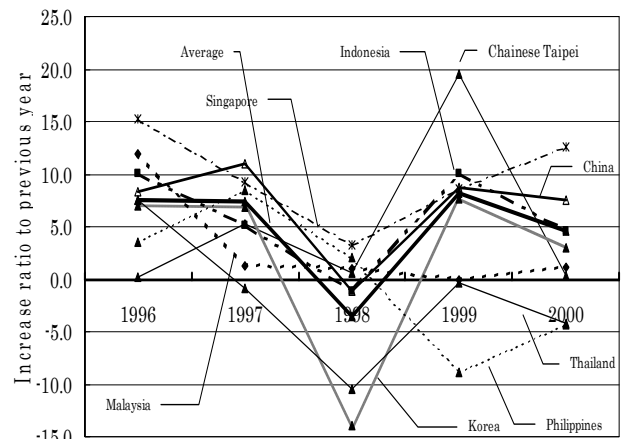


Fig-2 The Rate of Increase of Oil Products Demand in the East Asian region



(Source) Estimated by International Working Group, regarding to following information: IEA, Energy balances of OECD countries 1960-2000, Energy balances NON-OECD countries 1960-2000, Oil market report, Blackwell, Oil and energy trends annual statistics review 2001, and so on.

4. Forecasts of petroleum products demand in the East Asian region

(1) Forecasts of petroleum products demand in 2006 and 2010

—The oil demand of the East Asian region increases at about 3.5%. The increase of oil demand of whole Asian countries makes up 40 percent of that of the world.

① Base Case

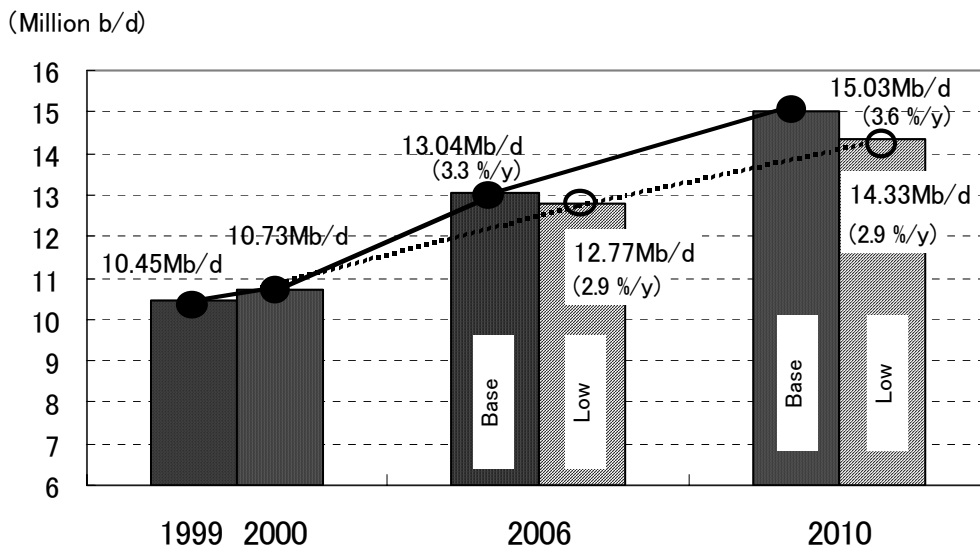
It is predicted that the demand for petroleum products in the East Asian region will slowly recover by 2006 (figure-3) whose average annual growth rate by 2006 is 3.3%. After that, till 2010, it will be supported by favorable economic growth and it is predicted that petroleum products' demand increases at an average annual rate of 3.6%.

Petroleum products' demand of China, Malaysia, the Philippines, and Vietnam are

shown comparatively high. On the other hands, it is predicted that that of Hong Kong, Taiwan, and South Korea increase by comparatively low growth.

The oil demand of the world is expected to increase by 6.4 million b/d from 2000 to 2006, of which whole Asian countries increase by 2.55 million b/d and occupy 40 percent of the world. This tendency will not change till 2010.

**Fig-3 Petroleum Products Demand in East Asia Region - Excluding Japan-
(Base Case and Low GDP Growth Case)**



Tabel-4 Petroleum Products Demand in the East Asian Region - Excluding Japan-

(Unit: 1,000 b/d)	2000	2006	2010	Increase 1,000 b/d		Annual average Growth rate%	
				00~06	06~10	06/00	10/06
China	4,210	5,446	6,495	1,235	1,050	4.4	4.5
Hong Kong	245	266	284	21	19	1.4	1.7
Chinese Taipei	821	862	932	40	70	0.8	2.0
Korea	2,161	2,432	2,603	270	172	2.0	1.7
Singapore	680	818	930	138	112	3.1	3.3
Brunei	10	13	14	2	1	3.5	2.1
Indonesia	1,048	1,297	1,451	249	155	3.6	2.9
Malaysia	420	519	622	99	104	3.6	4.7
Philippines	328	399	489	70	90	3.3	5.2
Thailand	637	721	841	84	120	2.1	3.9
Vietnam	169	269	372	100	103	8.1	8.5
East Asian Region Total (ex. Japan)	10,730	13,039	15,034	2,309	1,995	3.3	3.6
(Low GDP growth case)	10,730	12,767	14,325	2,037	1,559	2.9	2.9
Refining capacities	12,876	14,122	15,072	1,246	950	1.6	1.6
Asian Total (Base case)	18,621	21,255	23,754	2,633	2,500	2.2	2.8
World Total (Base case)	71,749	78,236	84,516	6,487	6,279	1.5	1.9
Share (%)							
East Asian Region	15.0	16.7	17.8	35.6	31.8		
Asia	26.0	27.2	28.1	40.6	39.8		

← The share of East Asian region and Asia to the increment in the world

② Low GDP Growth Case

In the Low GDP growth case where the annual economic growth rate from 2003 is 1% lower than Base case, petroleum product demand will decrease by 2.1% (270 thousand b/d reduction) in 2006, and the reduction rate will be expanded to 4.7% (710 thousand b/d reduction) in 2010 compared with the Base case ratio.

(2) Oil refining capacities in the East Asian region

- The reinforcement of oil refineries will be carried out in China, and also planned in Indonesia and in Vietnam -

Oil refining capacities in the East Asian region are expected to increase to 1,251 thousand b/d in 2006. The gap, what's called supply surplus*, between oil refining capacities and the demand without taking into account operation rates, was 2,141 thousand b/d in 2000, it will decrease to 1,080 thousand b/d in 2006, and further down to 40 thousand b/d in 2010.

Even as the assumption of oil refining capacities in 2010 might be severe in this time because many of the construction plans are unclear at present and also some projects that have stopped in a completion schedule by economic crisis or other reasons are excluded, we made that by taking into account construction plans which highly estimated to complete by 2010.

*Supply surplus: the difference between refining capacities and oil products demand without considering operation rates

Table-5 Differences between Refining Capacities and Petroleum Products Demand in the East Asian Region (Base Case)- Excluding Japan-

	Unit: 1,000 b/d			Increase	
	2000	2006	2010	00~06	06~10
① Refining capacities	10,730	13,039	15,034	2,309	1,995
② Petroleum products demand	12,871	14,122	15,072	1,251	950
Supply surplus(② - ①)	2,141	1,083	38	-1,058	-1,046

As seen in Table-6, refining capacities reinforcements from 2000 to 2010 are assumed as follows: China+1,400 thousand b/d, Vietnam+300 thousand b/d, and +200 thousand b/d of Indonesia. Although there are about 400 thousand b/d reinforcements plans in Indonesia, we assumed about 200 thousand b/d would be reinforced because of taking into account construction plans which are highly estimated to complete. In addition, FORUMOSA oil refinery in Taiwan, about 300 thousand b/d reinforcement was already completed in 2001.

Table-6 Capacities of Oil Refineries in the East Asian Region - Excluding Japan-

Unit: 1000 b/d	CDU Capacities			Increase	
	2000	2006	2010	00~06	06~10
China	5,000	5,800	6,400	800	600
Chinese Taipei	925	1,220	1,220	295	0
Korea	2,750	2,750	2,750	0	0
Singapore	1,269	1,269	1,269	0	0
Brunei	9	9	9	0	0
Indonesia	1,065	1,073	1,273	8	200
Malaysia	515	515	515	0	0
Philippines	420	420	420	0	0
Thailand	918	918	918	0	0
Vietnam	0	150	300	150	150
East Asian region total	12,871	14,122	15,072	1,253	950

(3) Supply and demand balance of petroleum products in the East Asian region

① Base Case

—Supply and demand balance of petroleum products in the East Asian region will keep import position by 860 thousand b/d in 2006, and the gap will become wider 1,290 thousand b/d in 2010. —

In 2006, even as petroleum products demand increases by 2,310 thousand b/d from 2000 to 2006, refining capacities are expected to increase by 1,420 thousand b/d about 60 percent of the increase in demand. Although the operating ratio of equipments goes up by 4% and becomes 86% in order to compensate the increase of demand that exceeds that of supply, a supply-demand gap becomes an import position of 860 thousand b/d.

In 2010, petroleum products demand becomes almost equal to refining capacities, and the operating ratio of refining equipments goes up further to 91.2%. While refining capacities of the East Asian region reach to an assuming upper limit of operation rate, the supply cannot cover the whole demand and the supply-demand gap is expanded up to import position of 1,290 thousand b/d as a result.

**Table-7 Petroleum Products Supply and Demand
in the East Asian region (Base Case)- Excluding Japan-**

Unit: 1,000 b/d				Increase	
	2000	2006	2010	2000~2006	2006~2010
Petroleum products demand	10,730	13,039	15,034	2,309	1,995
Petroleum products production	10,504	12,182	13,746	1,678	1,564
Demand-supply gap in East Asia	-226	-857	-1,288	-631	-431
Demand-supply gap in China*	-216	-806	-1,055	-590	-250
Refining equipment capability	12,871	14,122	15,072	1,251	950
Refinery utilization in East Asia	81.6%	86.3%	91.2%	4.7	4.9

(Notes) Because of rounding off, demand-supply gaps are not equal to differences between petroleum products demand and production in this table.

*Demand-supply gap in china is included in the East Asia's.

**Fig-4 Capacities of Oil Refineries and Petroleum Products Demand
in the East Asian Region - Excluding Japan-**

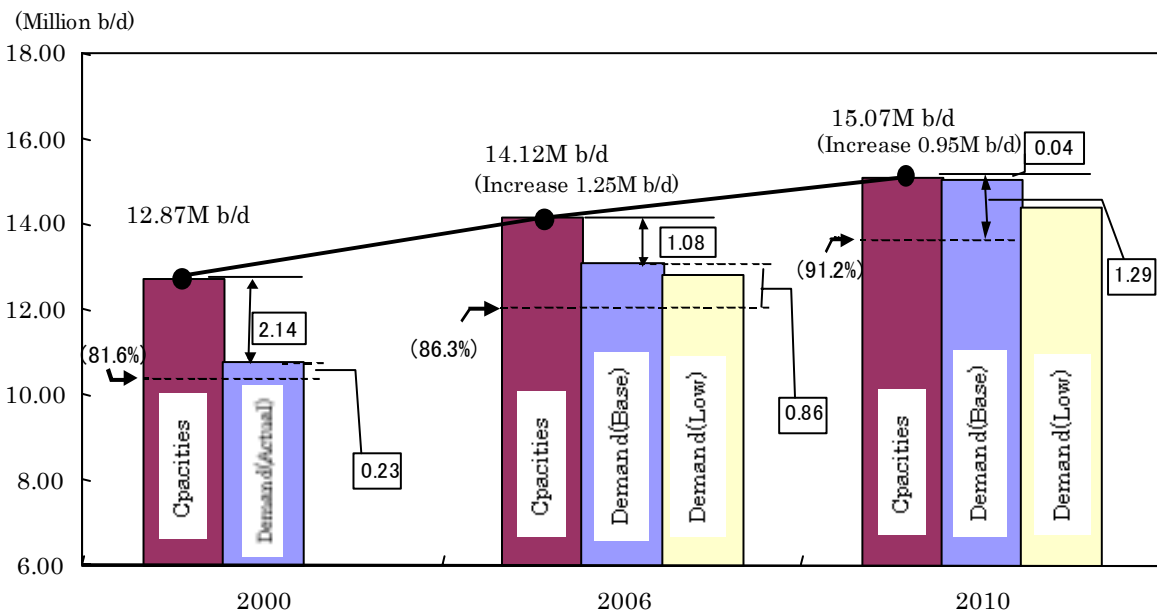
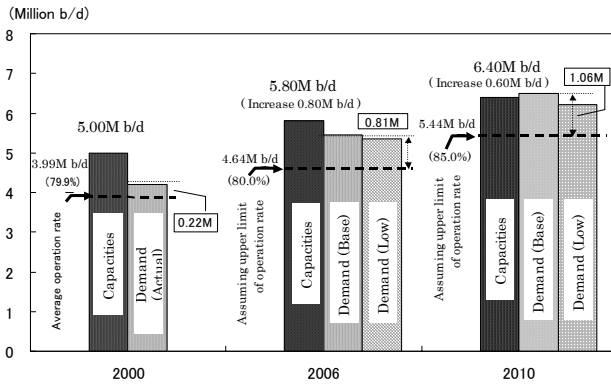
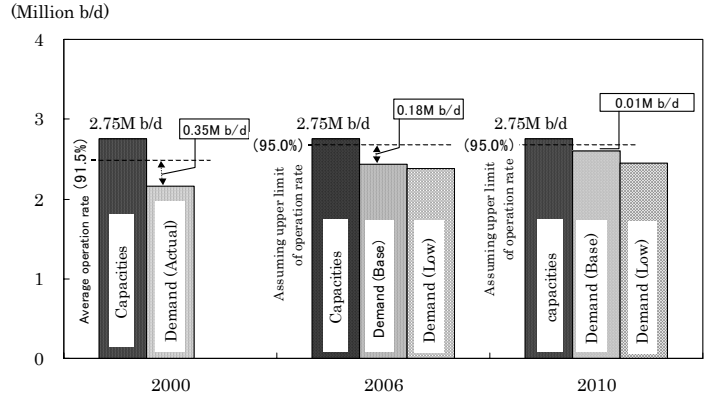


Fig-5 Capacities of Oil Refineries and Petroleum Products Demand in China



It is predicted that petroleum products demand of China exceeds Capacities of Oil Refineries in 2010.

Fig-6 Capacities of Oil Refineries and Petroleum Products Demand in Korea



While South Korea is export position at present, it is predicted that supply and demand will balance in 2010.

② Low GDP Growth Case

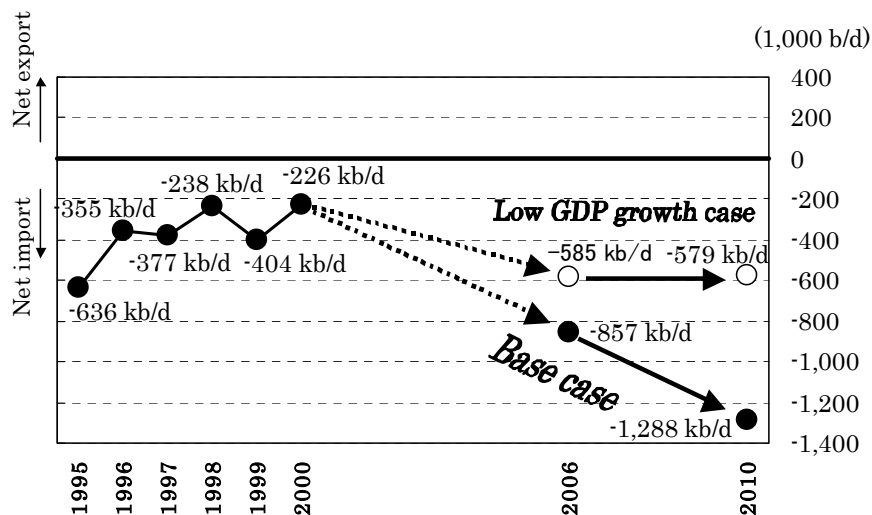
— In this case annual economic growth rate of the East Asian region is low about 1%, supply and demand balance of petroleum products is in import position of 580 thousand b/d in 2006 and 2010. —

In the low GDP growth case where the annual GDP growth rate of the East Asian region is lower 1% than base case from 2003, as compared with the base case, the demand will decrease 270 thousand b/d in 2006, and the supply and demand balance becomes import position of 585 thousand b/d.

In order that the demand will decrease 700 thousand b/d in 2010 compared with the base case, the supply and demand balance becomes import position of 579 thousand b/d, almost same level as in 2006.

Fig-7 Demand-Supply Gap of Petroleum Products in East Asia (Excluding Japan)

$$(\text{Demand-Supply Gap}) = (\text{Petroleum Products Production}) - (\text{Demand})$$



(4) Sensitivity analysis

① Change of the balance of the East Asian region by the difference degree of the amount of refining capacities (CDU) reinforcement in China

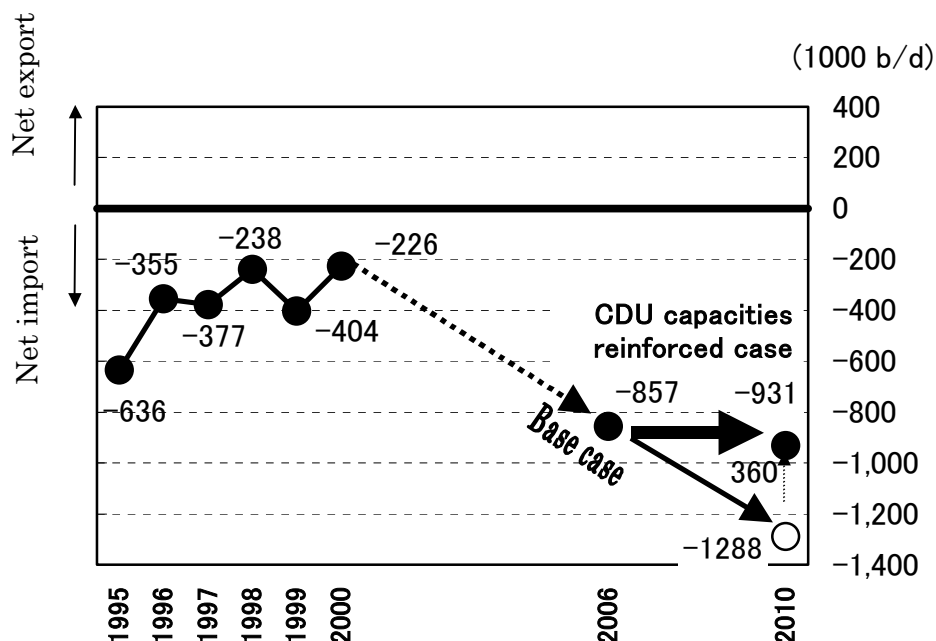
—In the case where CDU capacities reinforcement of 1 million b/d is performed in 2010, the supply and demand balance of petroleum product in the East Asian region will become import position of 931 thousand b/d , almost same level as in 2006. —

When refining capacities in China rise to 7,400 thousand b/d (Base case ratio+1 million b/d) in 2010, it is predicted that the supply-demand gap of the East Asian region become import position of 931 thousand b/d from that of 1,290 thousand b/d in base case, and become almost same level as in 2006.

According to the above-mentioned sensitivity analysis, it is predicted as follows. Even if China extends refining capacities by 1 million b/d, the operating ratio will not reach to the assumed upper limit (85%) because of the compound factor of oil products balance and cost, but became a little more than 80%, then the increase of production will reach at not more than 500 thousand b/d. On the other hand, there is decrease of 140 thousand b/d by decline of operation in Thailand because of higher operation cost within the region, and the net import of the East Asian region will decrease by 360 thousand b/d compared with the Base case, resulting in 931 thousand b/d.

Fig-8 Case of Chinese refining capacities rise to 7 million b/d (Base case ratio+1 million b/d) in 2010

Demand-Supply Gap of Petroleum Products in the East Asia (Excluding Japan)



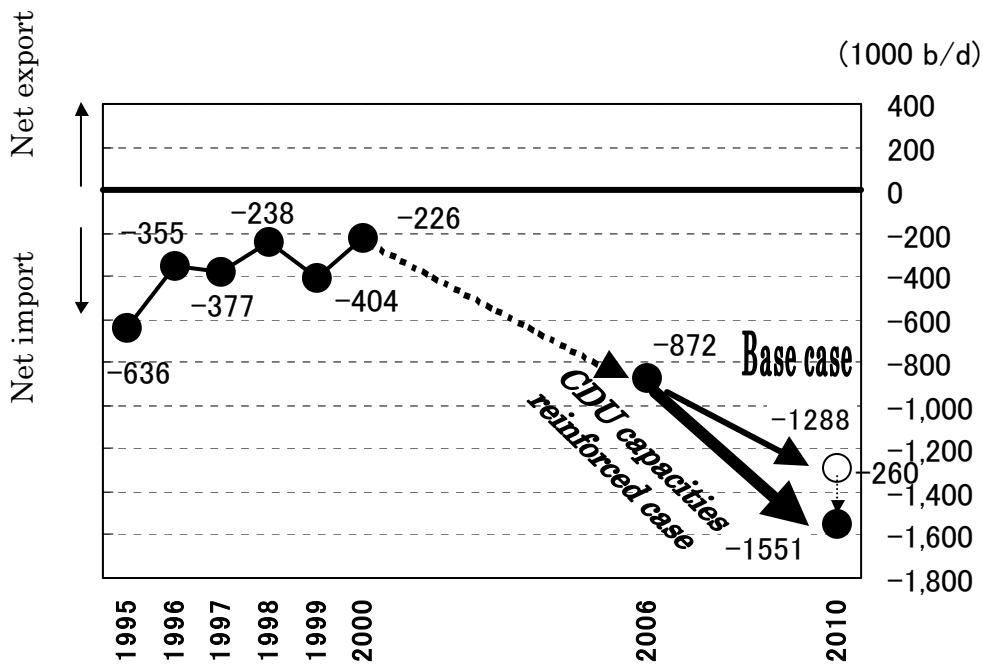
②Change of the balance of the East Asian region by the difference degree of the amount of refining capacities (CDU) reinforcement in Middle East

—In the case where CDU capacities reinforcement of 1 million b/d is performed in 2010, the supply and demand balance of petroleum products in the East Asian region will become import position of 1,551 thousand b/d, the net import will increase by 260 thousand b/d compared with the Base case. —

When refining capacities in the Middle East rise to 8.1 million b/d (the Base case ratio+1 million b/d) in 2010, it is predicted that the supply and demand gap of the East Asian region will become import position of 1,551 thousand b/d from that of 1,288 thousand b/d of the Base case.

According to the above-mentioned sensitivity analysis, if the Middle East extends CDU capacities by 1 million b/d, the export of increased petroleum products from the Middle East will mainly replace that from Taiwan and Thailand within the region. As a result, the quantity of production totally decreases by 261 thousand b/d because of decline of CDU operation rate in Taiwan and Thailand, the demand and supply balance spreads in net import about 1,551 thousand b/d.

Fig-9 Case of the Middle East refining capacities rise to 8.1 million b/d (Base case ratio+1 million b/d) in 2010
Demand-Supply Gap of Petroleum Products in the East Asian region



③Change of the demand of the East Asian region in the case of rising crude oil price
—When the crude oil price rises by \$5, petroleum products demand decreases 2% (250 thousand b/d) compared with the Base case.—

The working group has done the sensitivity analysis of petroleum products when the crude oil price rises up to \$5 from 2003 as compared with the Base case. Usually, the income moves to oil producing countries if crude oil price rises. Although the fall of GDP could be considered in the East Asian region because of many countries import crude oil in the region, GDP was fixed on this case and the influence was seen by means of crude oil price fluctuations.

When the crude oil price rises by \$5, petroleum products demand in the East Asian region decreases 230 thousand b/d (about 1.8%) in 2006 compared with the Base case. Among them petroleum products demand in China decreases 110 thousand b/d. Then almost the same result is seen in 2010, when the crude oil price rises by \$5 as same assumption, petroleum products demand decreases 270 thousand b/d (about 1.8%) compared with the Base case.

**Table-8 The Sensitivity Analysis of Petroleum Products Demand
in the East Asian Region (Excluding Japan)**

Unit:1000b/d

	2006			2010		
	Base	Low	\$5 up	Base	Low	\$5 up
①Demand	13,039	12,767	12,804	15,034	14,325	14,761
②Difference*		-272	-235		-709	-273
Rate of change(②/①)		-2.1%	-1.8%		-4.7%	-1.8%

(Note) *(Difference) = (Each case) – (Base case)

—<<Reference >> When the crude oil price rises by \$5, GDP of the East Asian region will fall about 0.4%.—

As in the former sensitivity analysis, GDP was fixed, here is the reference of the change of GDP of the East Asian region estimated in 2000 when a crude oil price rises by \$5. Consequently, it is expected that GDP of the East Asian region fall about 0.4% only by the effect of income transfer to the oil exporting countries. Since the ripple effect by income transfer is actually expected, it is predicted that the decreasing rate of GDP becomes larger than 0.4%.

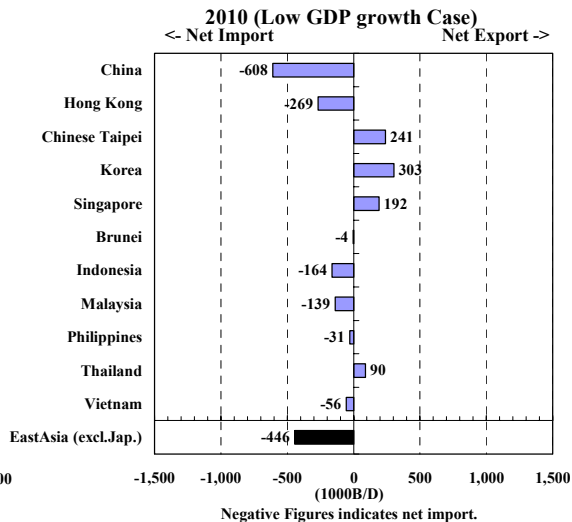
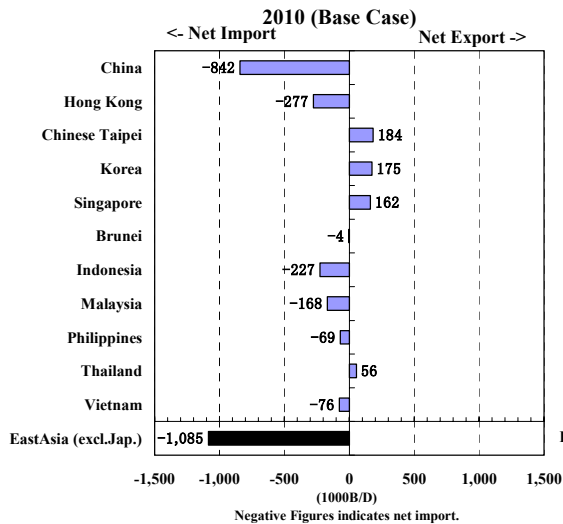
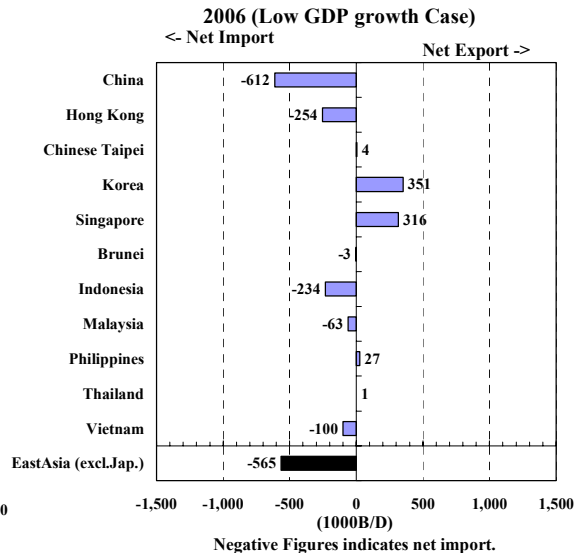
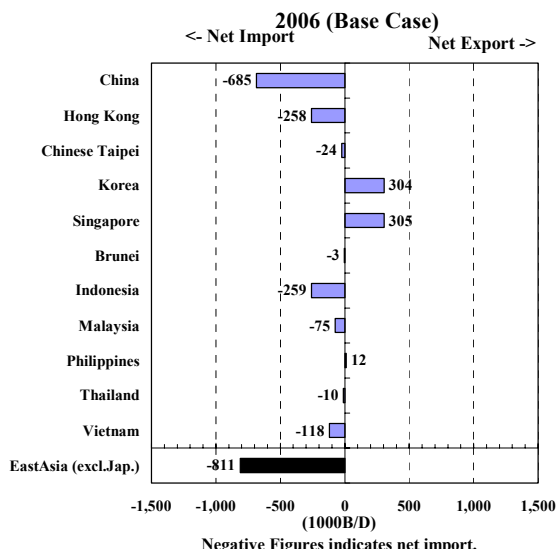
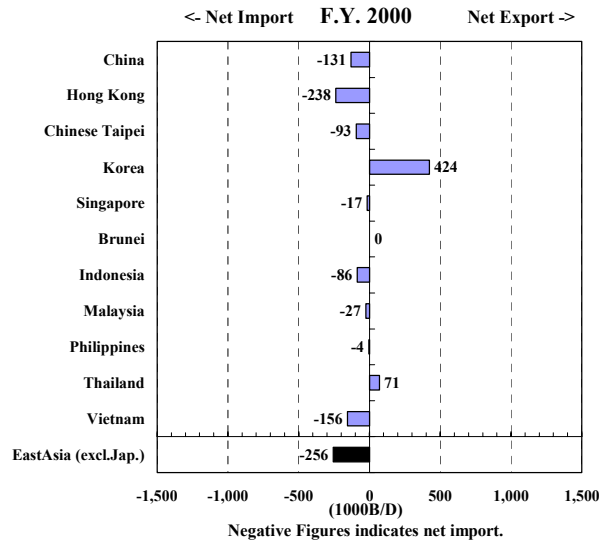
Table-9 The change of GDP in the East Asian Countries when the crude oil price rises by \$5

(Rough value in 2000)

(Unit: Billion \$, Million bbl)		China	Chinese Taipei	Korea	Singapore	Indonesia	Malaysia	Philippines	Thailand	Total
①	Net import of petroleum products	518	324	782	284	-129	-72	121	218	2,045
②	GDP(nominal price)	1,080	309	462	93	152	90	75	122	2,382
Influence of the crude price rises by \$5	③ The increase amount of money in net import	2.6	1.6	3.9	1.4	-0.6	-0.4	0.6	1.1	10.2
	④ GDP ratio% (③/②*100)	-0.24	-0.52	-0.85	-1.53	0.42	0.40	-0.81	-0.89	-0.43

Analysis by assumption that an oil import CIF price also carries out a 5\$/bbl rise when a crude oil price carries out a 5\$/bbl rise.

Supply and Demand Balance of Fuel Oil in East Asia (excluding Japan) by Country

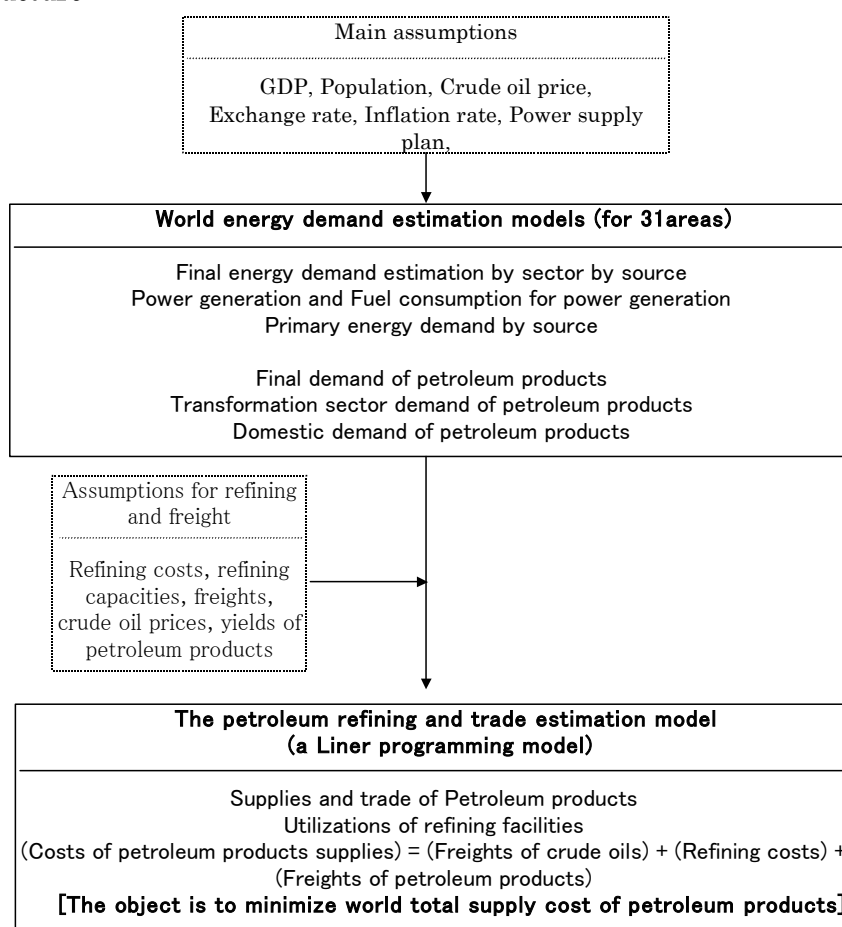


III. Supply and Demand Analysis of Petroleum Products in the East Asian Region and the World

1. Method and Feature of the Outlook

The supply and demand outlook was done by combining an econometric model (Energy demand estimation model) and a linear programming model (trade flow model of petroleum products) developed by the Energy Data and Modeling Center, the Institute of Energy Economics, Japan. Conceptual model structure is as follows. This outlook deals with the demand and supply of world energy and petroleum, and focus on that in the East Asian region. Main assumptions refer to pages 31 and 32.

Model Structure



2. Scenarios

Base Case (Business As Usual Case)

In this case, the average annual growth rate of the East Asian region except Japan (the East Asian region) from 2000 to 2006 is set at 5.3%. And the average annual growth rate of the East Asian region from 2006 to 2010 is set at 5.5%. Demand of petroleum products was calculated on these premises.

Low GDP Growth Case

In this case, the annual economic growth rate is lower by 1.0% after the year 2003 up to the year 2010 compared with that in the base case. The growth rate is assumed to be 4.6% from 2000 to 2006 and 4.5% from 2006 to 2010.

As for the supply assumption, realistic domestic plans for refineries capacities expansion are adopted in both cases.

3. Simulation Results

(1) Primary energy supply

Base Case

• Primary energy demand in the East Asian region is estimated to grow at an annual rate of 3.3% from 2000 to 2010, and also of the whole Asia is estimated to grow at an annual rate of 2.7% during the same period. On the other hand, since the primary energy demand of the Asian region is estimated to grow at an annual rate of 1.9 % during the same period, it is estimated that the share of the East Asian region and the whole Asia in the world is expected to grow by 2.3 point, and by 2.0 point respectively, therefore, finally it will reach at 18.9% and at 28.8% respectively.

Transition of Primary Energy Demand (Base and Low GDP Growth Case)

	Primary energy demand (Million TOE)							Annual average growth rate(%)					
	2000	2006		2010		2020		2006/2000		2010/2006		2020/2010	
		Base	Low	Base	Low	Base	Low	Base	Low	Base	Low	Base	Low
World Total	9,043	10,108	10,069	10,937	10,831	13,290	12,920	1.87	1.81	1.99	1.84	1.97	1.78
Asia Total	2,428	2,820	2,782	3,148	3,041	4,181	3,810	2.53	2.29	2.79	2.26	2.88	2.28
India	300	353	342	401	374	591	493	2.71	2.21	3.24	2.22	3.97	2.81
Other Asia	104	125	122	138	131	176	165	2.99	2.56	2.61	1.84	2.45	2.36
East Asia	2,023	2,343	2,318	2,609	2,537	3,413	3,152	2.48	2.29	2.73	2.29	2.72	2.19
East Asia (Ex.Japa)	1,498	1,805	1,780	2,068	1,996	2,858	2,597	3.15	2.91	3.46	2.91	3.29	2.67
China	928	1,089	1,082	1,248	1,219	1,740	1,610	2.70	2.59	3.46	3.04	3.38	2.82
Hong Kong	15	17	17	18	18	20	19	1.99	1.77	1.18	0.86	1.14	0.74
Chinese Taipei	83	99	98	110	105	132	125	3.07	2.73	2.46	1.82	1.90	1.75
Korea	194	236	229	263	245	314	257	3.35	2.83	2.75	1.69	1.80	0.48
Singapore	25	31	31	36	34	48	45	4.17	3.70	3.74	2.94	2.89	2.79
Brunei	2	3	3	3	3	5	5	5.33	5.29	4.22	4.18	4.28	4.25
Indonesia	98	125	123	144	138	209	186	4.13	3.80	3.61	2.96	3.78	3.03
Malaysia	47	61	60	74	71	110	101	4.50	4.21	4.76	4.31	4.05	3.55
Philippine	33	45	44	57	54	96	86	5.29	4.86	6.02	5.28	5.46	4.81
Thailand	59	74	73	84	80	130	114	3.74	3.41	3.12	2.34	4.49	3.61
Vietnam	14	24	22	32	29	53	50	8.99	7.16	7.37	7.47	5.25	5.55
(Share to World Total %)													
World Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
Asia Total	26.8	27.9	27.6	28.8	28.1	31.5	29.5						
India	3.3	3.5	3.4	3.7	3.5	4.4	3.8						
Other Asia	1.2	1.2	1.2	1.3	1.2	1.3	1.3						
East Asia	22.4	23.2	23.0	23.9	23.4	25.7	24.4						
East Asia (Ex.Japa)	16.6	17.9	17.7	18.9	18.4	21.5	20.1						
China	10.3	10.8	10.7	11.4	11.3	13.1	12.5						
Hong Kong	0.2	0.2	0.2	0.2	0.2	0.2	0.1						
Chinese Taipei	0.9	1.0	1.0	1.0	1.0	1.0	1.0						
Korea	2.1	2.3	2.3	2.4	2.3	2.4	2.0						
Singapore	0.3	0.3	0.3	0.3	0.3	0.4	0.4						
Brunei	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Indonesia	1.1	1.2	1.2	1.3	1.3	1.6	1.4						
Malaysia	0.5	0.6	0.6	0.7	0.7	0.8	0.8						
Philippine	0.4	0.4	0.4	0.5	0.5	0.7	0.7						
Thailand	0.7	0.7	0.7	0.8	0.7	1.0	0.9						
Vietnam	0.2	0.2	0.2	0.3	0.3	0.4	0.4						

(Note) The combustible renewable energy demands are included in the primary energy demands of OECD countries, China, Indonesia, Malaysia, Philippines, and Thailand.

Low GDP Growth Case

• In this case which is expected slowdown of the economic growth in the East Asian region, the growth rate of primary energy demand is lower by 0.4 % compared with that of the Base case from 2000 to 2010, and the primary energy demand is expected to grow at a annual rate of 2.9%.

Although it is predicted that the share of the East Asian region in the world will fall by 0.5 point in 2010 as compared with the Base case, the share of the East Asian region in the world will increase as compared with that in 2000, even if Low GDP growth case. The share of the whole Asia in the world will also increase, showing the same tendency.

(2) Petroleum products demand

Base Case

• While the demand of world petroleum products will grow by 1.7% per year from 2000 to 2006, by 2.1% from 2006 to 2010, the East Asian region's demand for petroleum products will expect to grow by 3.4% per year from 2000 to 2006, by 3.8% from 2006 to 2010, including China which grows by 4.2%, by 4.4% respectively during the same period. Therefore, the share of the East Asian region in the world is expected to grow by 1.6 point in 2006, by 2.8 point in 2010 as compared with that in 2000. Then the share of the whole Asia in the world is expected to grow by 1.2 point in 2006, by 2.1 point in 2010 as compared with that in 2000.

Transition of Petroleum Products Demand (Base and low GDP Growth Case)

	Petroleum Products demand (Million TOE)							Annual average growth rate(%)					
	2000	2006		2010		2020		2006/2000		2010/2006		2020/2010	
		Base	Low	Base	Low	Base	Low	Base	Low	Base	Low	Base	Low
World Total	3,468	3,840	3,821	4,164	4,116	5,013	4,841	1.71	1.63	2.05	1.88	1.87	1.63
Asia Total	930	1,077	1,058	1,203	1,155	1,591	1,418	2.47	2.17	2.82	2.23	2.83	2.07
India	102	125	122	152	144	244	214	3.45	3.00	4.89	4.12	4.86	4.08
Other Asia	32	39	38	43	41	54	50	3.11	2.67	2.65	1.83	2.26	2.13
East Asia	795	912	898	1,008	971	1,293	1,154	2.31	2.04	2.54	1.98	2.52	1.74
East Asia (Ex.Japan)	530	648	634	752	714	1,047	908	3.40	3.01	3.78	3.04	3.37	2.43
China	222	284	279	337	323	494	421	4.22	3.95	4.37	3.70	3.91	2.68
Hong Kong	9	9	9	9	9	9	9	-0.01	-0.01	0.00	0.00	0.00	0.00
Chinese Taipei	37	39	38	43	40	51	48	0.88	0.22	2.16	1.29	1.79	1.85
Korea	104	119	116	130	121	147	122	2.31	1.87	2.13	1.13	1.26	0.03
Singapore	23	30	29	34	32	44	41	3.98	3.49	3.59	2.73	2.64	2.52
Brunei	0.3	0.4	0.4	0.5	0.5	0.6	0.5	8.90	8.70	1.71	1.43	1.63	1.28
Indonesia	53	67	66	76	72	109	96	4.00	3.62	3.15	2.46	3.68	2.91
Malaysia	23	30	29	37	35	60	53	4.55	4.05	5.49	4.78	4.85	4.17
Philippine	17	21	20	25	23	40	33	3.16	2.44	5.20	3.91	4.68	3.53
Thailand	34	36	35	42	41	60	53	1.09	0.84	4.33	3.68	3.44	2.66
Vietnam	8	13	12	18	17	33	32	8.02	6.74	8.26	8.69	6.22	6.46
【Share to World Total %】													
World Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00						
Asia Total	26.82	28.04	27.69	28.90	28.07	31.74	29.30						
India	2.95	3.27	3.20	3.64	3.49	4.87	4.42						
Other Asia	0.93	1.01	0.99	1.04	0.99	1.08	1.04						
East Asia	22.93	23.76	23.50	24.21	23.59	25.79	23.83						
East Asia (Ex.Japan)	15.29	16.87	16.58	18.05	17.35	20.89	18.76						
China	6.39	7.39	7.31	8.09	7.85	9.86	8.70						
Hong Kong	0.26	0.23	0.23	0.21	0.22	0.18	0.18						
Chinese Taipei	1.08	1.02	0.99	1.03	0.97	1.02	0.99						
Korea	2.99	3.10	3.03	3.11	2.95	2.93	2.51						
Singapore	0.67	0.77	0.75	0.82	0.78	0.88	0.85						
Brunei	0.01	0.01	0.01	0.01	0.01	0.01	0.01						
Indonesia	1.53	1.75	1.72	1.82	1.76	2.18	1.99						
Malaysia	0.66	0.78	0.76	0.89	0.85	1.19	1.09						
Philippine	0.49	0.54	0.52	0.61	0.56	0.80	0.68						
Thailand	0.97	0.93	0.92	1.02	0.99	1.19	1.10						
Vietnam	0.24	0.34	0.32	0.43	0.41	0.66	0.66						

(Note) * World total excludes "Other Africa", "Other Latin America", and "Other Asia and Oceania" which are defined by IEA.

Low GDP Growth Case

• In this case, the growth rate of petroleum products demand in the East Asian region is lower than that in the Base case by about 0.4 point per year from 2000 to 2006, by about 0.7% from 2006 to 2010. The share of the East Asian region in the world is expected to grow by 1.3 point in 2006, by 2.1 point in 2010 as compared with 2000, and the share of the whole Asia in the world is expected to grow by 0.9 point in 2006, by 1.3 point in 2010 as compared with that in 2000.

(3) Petroleum Products Supply and CDU (Crude Distillation Unit) Operation Rate

- CDU capacities in the East Asian region will be reinforced by 1,250 thousand b/d from 2000 to 2006, by 1,450 thousand b/d in the whole Asia, so that the share of production is estimated to grow by about 1 point in each area. On the other hand, since the future refining expansion plan will be severe because of uncertain economic conditions, it is expected that the CDU capacities expansion from 2006 to 2010 will be reduced to 950 thousand b/d in the East Asian region, and reduced to 1,560 thousand b/d in the whole Asia, respectively.
- Therefore, CDU operation rate is expected to rise by 10% on the level of 90%, as compared with that in 2000. Then the share of The East Asian region and the whole Asia in the world is expected to grow respectively by about 2 point, and by 3 point in 2010 compared with that in 2000.

CDU Capacities (Both in Base Case and Low GDP Growth Case)

(1,000b/d)	2000	Share(%)	2006	share(%)	2010	share(%)	2006/00	2010/06
World	83,060	100%	86,550	100%	90,470	100%	0.7 %/y	1.1 %/y
Asia	20,430	25%	21,880	25%	23,440	26%	1.1	1.7
East Asia*	12,870	15%	14,120	16%	15,070	17%	1.6	1.6

CDU Operation Rate (Both in Base Case and Low GDP Growth Case)

(%)	2000	2006	2010	2006/00	2010/06
World	88.4	90.4	93.4	0.4 %/y	0.8 %/y
Asia	84.5	88.1	92.4	0.7	1.2
East Asia*	81.6	86.3	91.2	0.9	1.4

Petroleum Products Production (Base case)

(1,000b/d)	2000	Share(%)	2006	share(%)	2010	share(%)	2006/00	2010/06
World	73,430	100%	78,240	100%	84,520	100%	1.1 %/y	1.9 %/y
Asia	17,250	23%	19,290	25%	21,670	26%	1.9	3.0
East Asia*	10,500	14%	12,180	16%	13,750	16%	2.5	3.1

(4) Demand-Supply Gap of Fuel oil (Base Case)

Demand-supply gap of fuel oil (gasoline, naphtha, kerosene, jet, gas oil, heavy fuel oil) was in import position of 256 thousand b/d in 2000 in the East Asian region, it will be increased to 811 thousand b/d in 2006. Moreover it is estimated that the gap will be in extreme import position of about 1,085 thousand b/d in 2010.

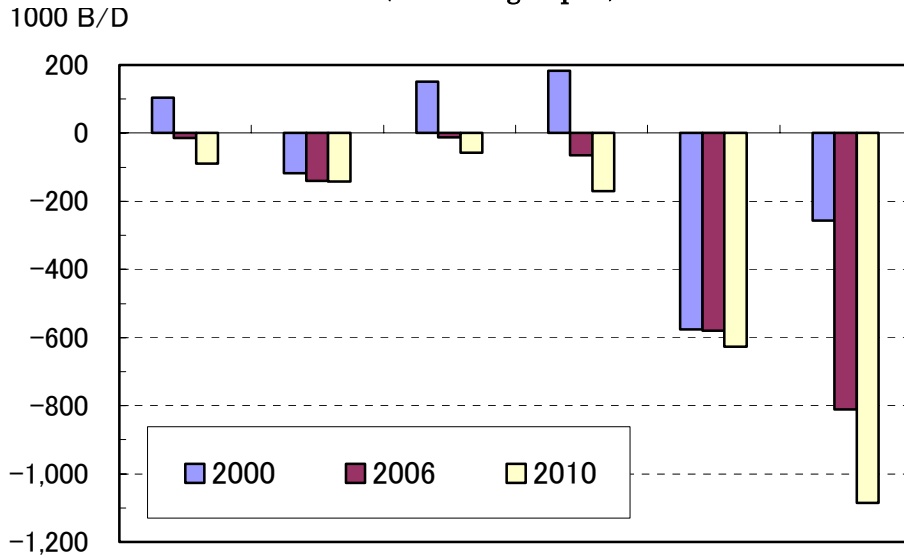
For each product, gasoline, kerosene, jet and gas oil will change from export position to import position in 2010, reflecting the increase of demand in traffic sector.

Especially as for gas oil's demand-and-supply balance change of about 350,000 b/d from 2000 to 2010, demand-and-supply balance change of about 370,000 b/d of China and Hong Kong serves as a key factor.

Although it was assumed that the naphtha yield was increased according to the standup of the petrochemical plant in China, Taiwan, and Singapore, and the production of naphtha also increased considerably, it is predicted that the production of naphtha can not exceed the demand ,so that the import position will be continued.

It is expected that a large import position will continue in heavy fuel oil because of absolute shortage of the refining equipment capacity in the East Asian region and heavy fuel oil yield falls a little in order to provide the above-mentioned products demand which increases rapidly.

**Demand-Supply Balance of Fuel Oil in the East Asian Region
(Excluding Japan)**



	Gasoline	Naphtha	Kore/Jet	Gas oil	Heavy Fuel	Fuel Oil Total
2000	104	-118	151	183	-576	-256
2006	-15	-141	-12	-65	-579	-811
2010	-90	-142	-57	-170	-627	-1085

(5) Clean Oil Share in Products Demand

- Clean oil (gasoline, naphtha, kerosene, jet, and gas oil) share in fuel oil demand in the East Asian region is estimated to increase by 5.3 point in 2010, by 3.8 point in the whole Asia as compared with that in 2000.
- In the Low GDP growth case, the share is almost the same compared with the Base case.

Clean Oil Share in Total Fuel Oil (Base Case)

(%)	2000	2006	2010	2006/00	2010/06
World	81.2%	83.5%	84.3%	0.5 %/y	0.2 %/y
Asia	76.8%	79.6%	80.6%	0.6	0.3
East Asia	73.1%	77.0%	78.4%	0.9	0.5

Clean Oil Share in Total Fuel Oil (Low GDP Growth Case)

(%)	2000	2006	2010	2006/00	2010/06
World	81.2%	83.5%	84.3%	0.5 %/y	0.2 %/y
Asia	76.8%	79.7%	80.7%	0.6	0.3
East Asia	73.1%	77.0%	78.5%	0.9	0.5

Note: (Clean oil share) = ((Gasoline + Naphtha + Kerosene/Jet + Diesel oil)/(Fuel oil total))*100

Main Assumptions (1)

Crude Oil Price

	2001	2006	2010	2015	2020
Nominal Price (\$/bbl)	27.7	25.4	33.6	35	39.8
FY2001 Real Price(\$/bbl)	22.4	23.3	24	24.7	25.5

(Source) DOE, Annual energy outlook 2003.

(Note) Nominal price is calculated by the International working group using the deflators of the Annual energy outlook 2003.

GDP Growth Rate toward 2006 and 2010 (Base Case)

	Actual			Forecast (Base Case)			
	97/98	98/99	99/00	00/06	06/10	10/20	00/20
U.S.A.	4.40	4.26	4.20	2.52	2.70	2.65	2.62
Canada	3.30	4.59	4.50	3.49	2.50	2.00	2.54
Mexico	5.03	3.75	6.86	3.35	4.80	4.00	3.96
Chile	3.92	-1.14	5.38	4.04	4.60	4.60	4.43
Other Latin America	1.33	-0.62	3.06	2.37	3.50	3.50	3.16
U.K.	2.64	2.29	3.07	2.22	2.30	2.30	2.28
Germany	2.05	1.56	2.95	1.61	1.80	1.62	1.65
France	3.40	2.92	3.10	2.18	2.60	1.80	2.07
Italy	1.81	1.61	2.91	2.09	2.20	1.70	1.92
Other OECD Europe	3.55	2.85	4.06	2.34	2.60	2.00	2.22
F.S.U.	-3.27	4.60	7.94	3.97	3.00	2.90	3.24
Other Non OECD Europe	1.33	0.59	3.94	3.91	4.00	3.00	3.47
Africa	3.15	2.57	3.21	3.73	3.80	3.70	3.73
Middle East	2.02	1.25	4.84	3.21	3.30	3.20	3.22
China	7.80	7.05	7.94	7.30	6.50	6.00	6.49
Hong Kong	-5.31	3.04	10.47	3.41	4.00	3.30	3.47
Chinese Taipei	4.57	5.42	5.98	2.71	4.00	3.45	3.34
Korea	-6.69	10.89	8.81	5.25	5.30	3.70	4.48
Singapore	0.06	5.86	9.89	3.19	5.00	3.75	3.83
Brunei	1.00	2.56	2.83	2.63	2.80	2.80	2.75
Indonesia	-13.13	0.85	4.77	3.80	5.00	4.50	4.39
Malaysia	-7.36	6.08	8.30	4.33	5.50	5.00	4.90
Philippines	-0.58	3.40	4.01	4.10	4.90	4.25	4.34
Thailand	-10.77	4.22	4.31	3.80	4.60	4.50	4.31
Vietnam	5.99	7.10	3.92	5.08	5.50	5.50	5.37
India	5.80	4.80	5.50	6.32	7.20	6.00	6.33
Other Asia	0.00	0.00	0.00	3.63	3.30	3.30	3.40
Australia	5.36	4.29	1.94	2.90	2.20	2.00	2.31
New Zealand	0.03	4.40	2.50	2.68	2.30	2.30	2.41

(Source) Actual from Handbook of Energy&Economic Statistics 2003 , and Forecast was made by International Working Group.

GDP Growth rate of Asian Countries (Base Case and Low GDP Growth Case)

	Actual	Base case		Low GDP growth case	
	2001/00	2006/00	2010/06	2006/00	2010/06
China	7.3	7.3	6.5	6.6	5.5
Hong Kong	0.6	3.4	4.0	2.4	3.0
Chinese Taipei	-2.2	2.7	4.0	2.0	3.0
Korea	3.0	5.2	5.3	4.6	4.3
Singapore	-2.0	3.2	5.0	2.5	4.0
Brunei	3.0	2.6	2.8	1.6	1.8
Indonesia	3.2	3.8	5.0	3.0	4.0
Malaysia	0.4	4.3	5.5	3.7	4.5
Philippines	3.2	4.1	4.9	3.4	3.9
Thailand	1.8	3.8	4.6	3.1	3.6
Vietnam	5.8	6.3	7.2	5.3	6.2
Aaverage East Asia	3.5	5.3	5.5	4.6	4.5

(Source) Base case and low GDP growth case forecasted by International Working Group, the long-term economic plans and prospects from Asian Development Bank, the government of each country and related are regarded

Main Assumptions (2)

Outlook of World Crude Distillation Units Capacities

(Unit: 1,000 b/cd)

	2000	2001 Ref.	2006 Outlook	2010 Outlook	2000~2006 Increase	2006~2010 Increase
China	5,000	5,217	5,800	6,400	800	600
Hong Kong	0	0	0	0	0	0
Chinese Taipei	925	1,220	1,220	1,220	295	0
Korea	2,750	2,750	2,750	2,750	0	0
Singapore	1,269	1,269	1,269	1,269	0	0
Brunei	9	9	9	9	0	0
Indonesia	1,065	1,073	1,073	1,273	8	200
Malaysia	515	515	515	515	0	0
Philippines	420	420	420	420	0	0
Thailand	918	918	918	918	0	0
Vietnam	0	0	150	300	150	150
Easet Asia	12,871	13,391	14,122	15,072	1,252	950
India	1,857	2,185	2,445	3,050	588	605
Other Asia	345	425	546	546	201	0
Asia (Including Japan)	20,427	20,998	21,881	23,436	1,454	1,555
Australia	848	848	848	848	0	0
New Zealand	98	106	106	106	8	0
Papua New Guinea	0	0	0	0	0	0
U.S.A.	16,541	16,564	17,600	18,700	1,059	1,100
Canada	1,912	1,944	1,968	1,968	56	0
Mexico	1,525	1,525	1,525	1,640	0	115
Chile	205	205	205	205	0	0
Other Latin America	6,025	6,490	6,774	6,774	749	0
U.K.	1,785	1,785	1,964	1,964	179	0
Germany	2,275	2,275	2,259	2,259	-16	0
France	1,902	1,902	1,896	1,896	-6	0
Italy	2,341	2,341	2,295	2,295	-46	0
Other OECD Europe	6,131	7,056	7,151	7,151	1,020	0
F.S.U.	9,762	7,728	8,040	8,040	-1,722	0
Other NO-OECD Europe	2,287	2,124	2,158	2,158	-129	0
Africa	3,044	3,202	3,450	3,940	406	490
Middle East	5,953	6,046	6,426	7,090	473	664
Total	83,061	83,138	86,547	90,471	3,486	3,923