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RIS Discussion Papers

**Asian Energy Outlook to 2020:
Trends, Patterns and Imperatives of
Regional Cooperation**

**Kokichi Ito, Li Zhidong
and
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RIS-DP # 93/2005



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Asian Energy Outlook to 2020: Trends, Patterns and Imperatives of Regional Cooperation

Kokichi Ito*, Li Zhidong**, Ryoichi Komiyama***

Abstract: With booming economic growth Asia will play increasingly important role in global economic and energy matters. World primary energy consumption is projected to expand at an average annual growth rate of 2.1 percent by 2020. About 70 percent of the increase would be accounted for by non-OECD member economies, two thirds of which are from the Asian region. The increase in demand for oil in Asia will most likely amplify the dependency on shipments from other regions (particularly the Middle East). Ensuring energy security would therefore turn out to be a vital task. In Asia (particularly East Asia), the achievement of the “three Es” (economic development, energy security, and environmental preservation) could no longer be viewed as a task to be addressed by each economy separately. Instead, it should be approached through region-wide cooperation - a goal of common interest.

Introduction

In the wake of the Cold War economies around the world have become increasingly globalized against the background of trends such as the transition to market economies and the spread of information technology (IT). The countries (and territories) of Asia have achieved an overall high rate of economic growth thanks to the fast-paced expansion of trade and foreign direct investment (FDI), close mutual economic ties, and industrialization. In the process, they

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have made the region into the growth center for the entire world economy. Due to its economic advances, the region has also become a market with tremendous impact on the global energy supply and demand. The medium-to-long-term outlook for the global energy supply and demand envisions continued strong economic growth in Asia and a rapid rise in its energy demand. If so, the promotion of efforts to assure energy supply and demand stability and address energy and environmental problems, from a perspective embracing all of Asia and in cooperation with the other countries in the region, will become of crucial importance for Japan in its future deployment of international energy policy.

The objective of this research lay in producing a quantified profile of the future configuration of energy supply and demand in the world as a whole and Asia in particular to 2020, by applying econometric means. The free trade agreements (FTAs) and other strong ties of interdependence among the economies in the region are expected to develop further and keep rates of economic growth on high levels. Focusing on this region, the research consisted of comprehensive investigation of its energy economics. Thus far, the Institute has executed programs of research on various topics with a focus on the region of Asia. The preparation of this outlook drew upon the findings of these programs. This was supplemented by an in-depth analysis of the situation in each country based on extensive information-sharing with counterpart institutions in other Asian countries through long-standing network links with them, in order to bring the resulting portrait of the supply and demand closer to reality.

1. Socioeconomic Outlook

With the continued drive provided by the Asian economy, the world economy is expected to exhibit moderate growth at an overall rate of 2.7 per cent over the forecast period (i.e., the years 2000 - 2020).

By region, North America and the European members of the Organization for Economic Cooperation and Development (OECD) are anticipated to exhibit stable economic growth at respective annual average rates of 2.6 per cent and 2.0 per cent. In the non-OECD countries of Europe such as the former Soviet Union, economies are getting on the path of sustained growth following the dismemberment of the Soviet Union in the 1990s, and are forecast to attain a corresponding rate of 3.3 per cent as a whole. As for Asia (outside Japan), in spite of some uncertainty associated with the prospects for economic growth in developed countries in other regions, the forecast is continued strong growth at

a rate of 5.4 per cent, owing to the presence of economies with enormous markets such as China, the Association of Southeast Asian Nations (ASEAN), and India, as well as the reinforcement of mutual interdependence in the region and swift technological progress.

With the support of its surging domestic demand, the Chinese economy in particular sustained high rates of growth throughout the 1990s, and has kept them in the range of 7-9 per cent with the start of the 2000s. It managed to record growth of 7.3 per cent in 2001 in spite of deceleration of the U.S. economy and slumping performance among Asian newly industrializing economies (NIEs) and the ASEAN countries. Furthermore, following its admission into the World Trade Organization (WTO) in 2002, China posted high rates of economic growth, at 8.0 per cent in that year and 9.1 per cent in 2003. Although it is saddled with an array of problems such as internal economic disparities, the need for reform of state enterprises, unemployment, and bad debt, China should be able to achieve high-order growth at rates averaging 7.2 per cent over the long term, provided that it continues to practice proper macroeconomic management. The forecast for Japan is comparatively low growth at a corresponding rate of 1.3 per cent owing to factors such as economic maturation and the decline in the labor population accompanying population decrease and aging.

On the population front, although birthrates are tending to move downward in developing countries as they make economic progress, the world population is forecast to continue exhibiting a basic tone of expansion and reach some 7.7 billion in 2020 as compared to about 6.2 billion in 2000. Among the developed countries, a sustained increase is projected in the United States of America, but the tempo should slow to a gradual level. The U.S. share of the world population is therefore not expected to expand. Japan's population is forecast to go into gradual decline after peaking within the next few years. In Europe, too, the population is projected to peak out from 2010 to 2020. In Asia, on the other hand, it is anticipated to continue growing, albeit at lower rates. In 2020, it is estimated that the countries of China and India will have respective populations of 1.4 and 1.3 billion, and that Asia as a whole will account for 53 per cent of the world population increase.

The outlook for crude oil prices was prepared on the basis of the price estimates in documents such as the Annual Energy Outlook (AEO) released by

Table 1: Major Energy and Economic Indicators

	Asia			World		
	Average annual growth rate (AAGR)(%)			Average annual growth rate (AAGR)(%)		
	2000	2020	2000-2020	2000	2020	2000-2020
GDP (billions of US dollars at 1995 value)	9,361	17,805	3.3	34,251	58,570	2.7
GDP (developing Asia*)	3,673	10,432	5.4			
Population (millions)	3,322	4,095	1.1	6,179	7,710	1.1
Primary energy consumption (millions of tons of oil-equivalent; Mtoe)	2,423	4,570	3.2	9,057	13,593	2.1
Coal (Mtoe)	1,049	1,811	2.8	2,325	3,489	2.0
	(43%)	(40%)	(26%)	(26%)	(26%)	
Oil (Mtoe)	938	1,720	3.1	3,494	5,072	1.9
	(39%)	(38%)	(39%)	(39%)	(37%)	
Natural gas (Mtoe)	237	598	4.7	2,107	3,490	2.6
	(10%)	(13%)	(23%)	(23%)	(26%)	
Final energy consumption (Mtoe)	1,511	2,826	3.2	6,103	8,900	1.9
Transportation sector (Mtoe)	346	786	4.2	1,781	2,730	2.2
	(23%)	(28%)	(29%)	(29%)	(31%)	
Power sector (Mtoe)	276	619	4.1	1,088	1,935	2.9
	(18%)	(22%)	(18%)	(18%)	(22%)	

Table 1 continued

Table 1 continued

	Asia			World		
	Average annual growth rate (AAGR)(%)			Average annual growth rate (AAGR)(%)		
	2000	2020	2000-2020	2000	2020	2000-2020
CO ₂ emissions (millions of tons of carbon-equivalent; Mt-C)	1,975	3,627	3.1	6,507	9,852	2.1
GDP per capita of population (US dollars at 1995 value/person)	2,818	4,348	2.2	5,544	7,596	1.6
Primary Energy consumption per capita of population (toe/person)	0.73	1.12	2.1	1.47	1.76	0.9
Primary Energy consumption per unit of GDP**	259	257	-0.04	264	232	-0.65
CO ₂ emissions per unit of GDP***	211	204	-0.18	190	168	-0.61
CO ₂ emissions per unit of primary energy consumption****	0.815	0.794	-0.13	0.718	0.725	0.04
Automobile ownership volume (millions of vehicles)	140	336	4.5	757	1,222	2.4
Automobile ownership volume per thousand of population (vehicles per thousand of population)	42	82	3.4	123	159	1.3

* Asia excluding Japan ** toe/millions of US dollar at 1995 value *** t-C/millions of US dollar at 1995 value **** t-C/toe Note: Figures in parentheses indicate percentage shares of totals.

the Department of Energy (EIA/DOE) in the United States. It envisages a moderate rise over the long term as oil production costs increase, with the per-barrel price reaching 24 dollars in 2010 and 27 dollars in 2020 (at 2000 values; the nominal price figures are 29 and 40 dollars, respectively).

As for natural gas prices, the general view is that they are linked with crude oil prices. However, in this outlook, which took account of those of the International Energy Agency (IEA) and other institutions, it was assumed that they would not rise as fast as crude oil prices, in light of the ample supply capacity supported by new projects and more flexible price determination methods. The historical trend shows that coal prices do not have a very strong correlation with crude oil prices, and the forecast levels, which were based on the IEA outlook and other data, incorporate only a gradual increase in production costs.

2. World Energy Demand Outlook

2.1 Primary energy consumption outlook

World primary energy consumption is forecast to increase at an average annual rate of 2.1 per cent over the forecast period, much higher than the corresponding rate of 1.7 per cent over the preceding 20-year period (1980 - 2000). The volume in 2020 is expected to reach 13.6 billion oil-equivalent tons, a 1.5-fold increase from the 9.1 billion tons in 2000.

About 70 per cent of the increase in energy consumption over the forecast period would derive from the non-OECD countries (mainly developing ones). The non-OECD Asian countries should account for about two-thirds of the total, and China, for about 30 per cent.

Along with population increase and economic growth, the share of the world primary energy consumption occupied by non-OECD countries is expected to increase from 41 per cent in 2000 to 51 per cent in 2020. Conversely, that occupied by OECD countries is forecast to shrink from 59 per cent to 49 per cent. The Asian share is forecast to rise from 27 per cent in 2000 to 34 per cent in 2020, and the Chinese share, from a corresponding 10 to 15 per cent. China is now the world's biggest energy consumer after the United States, and it should near the U.S. consumption level by 2020. As such, its presence in the global energy market should become even larger.

2.2 Outlook for fossil fuel consumption

Fossil fuels (coal, oil, and natural gas) are expected to contribute about 90 per cent of the increase in primary energy consumption over the years 2000 - 2020, and therefore should continue to play a major role as energy sources. Consumption of oil is predicted to show the largest increase of all fossil fuels and account for 35 per cent of the increase in primary energy consumption, followed by natural gas at 30 per cent and coal at 26 per cent.

World oil consumption is forecast to rise from the order of 70 million barrels per day in 2000 to that of 102 million barrels per day in 2020, for an increase rate of 1.9 per cent. By region, Asia should account for about 50 per cent of this increase. By sector, it is estimated that about 60 per cent will come from the transportation sector. The share occupied by oil in primary energy consumption is forecast to decline slightly, from 39 per cent in 2000 to 37 per cent in 2020, but oil would nevertheless remain the single-largest energy source.

Consumption of natural gas, which came to 2,341 billion cubic meters in 2000, is forecast to hit 3,877 billion cubic meters in 2020, for an average annual increase rate of 2.6 per cent, the highest among the fossil fuels. Installation of combined-cycle power generation systems fueled with natural gas is steadily spreading due to advances in utilization technology and considerations of environmental compatibility. About 60 per cent of the increase in natural gas consumption should come from fuel input into the power sector. Expanded utilization led by this sector is expected to drive an increase in the natural gas share of primary consumption, from 23 per cent in 2000 to 26 per cent in 2020.

In oil-equivalent terms, world coal consumption is forecast to rise from 2.325 billion tons in 2000 to 3.489 billion tons in 2020, for an average annual increase rate of 2.0 per cent. By region, Asia should account for about 70 per cent of this increase, and China, about 40 per cent. By sector, about 90 per cent should come from the power sector as the trend toward input as fuel for generation deepens. The coal share of primary energy consumption should remain more or less unchanged at around 26 per cent over the years 2000-2020.

Table 2: World Primary Energy Consumption

Primary energy consumption	Millions of toe						Share (%)			AAGR (%)	
	1980	2000	2020	1980	2000	2020	1980-2000	2000-2020	1980-2000	2000-2020	
	Total	6,481	9,057	13,593	100	100	100	1.7	2.1	1.7	2.1
Coal	1,782	2,325	3,489	27	26	26	1.3	2	1.3	2	
Oil	3,008	3,494	5,072	46	39	37	0.8	1.9	0.8	1.9	
Natural gas	1,239	2,107	3,490	19	23	26	2.7	2.6	2.7	2.6	
Nuclear	186	676	781	2.9	7.5	5.7	6.6	0.7	6.6	0.7	
Hydro	148	223	339	2.3	2.5	2.5	2.1	2.1	2.1	2.1	
Geothermal	12	45	123	0.2	0.5	0.9	6.6	5.2	6.6	5.2	
Other renewables	106	187	299	1.6	2.1	2.2	2.9	2.4	2.9	2.4	

2.3 Outlook for other fuel consumption

In oil-equivalent terms, consumption of power generated by nuclear power plants is forecast to rise from 676 million tons in 2000 to 781 million tons in 2020, for an average annual increase rate of 0.7 per cent. The nuclear share of primary energy consumption is expected to decline from 8 per cent in 2000 to 6 per cent in 2020 owing to the fast-paced expansion of natural gas utilization in the power sectors of developed countries in North America and Europe and their virtual lack of prospects for construction of additional nuclear power plants. The increase in the generated output of nuclear power plants should be confined almost exclusively to a few countries in Asia. In East Asia, nevertheless, nuclear power will continue to play a vital role in Japan, South Korea, and Taiwan, which have few domestic energy resource reserves, and China, with its rapidly growing demand for electricity.

There are high hopes for the diffusion of renewable energy sources with little environmental burden, such as hydropower, geothermal energy, and new energy. Their share of primary energy consumption is forecast to increase from 5 per cent in 2000 to 6 per cent in 2020. However, they are not going to rank on a par with fossil resources as pillars of the base energy supply, due to their high supply cost and supply instability deriving from natural influences, such as the intermittent nature of photovoltaics and wind power.

2.4 Outlook for final energy consumption

Consumption of electrical power, a sophisticated form of energy utilization, grew at a swift rate averaging 3.1 per cent annually over the years 1980 - 2000. Over the forecast period, it is expected to grow at a corresponding one of 2.9 per cent and undergo a 1.8-fold increase relative to 2000. By sector, the swiftest increase is anticipated in the residential and commercial sector at 3.2 per cent. By region, consumption is forecast to grow at a 2.0 per cent pace in the OECD countries as opposed to 4.1 per cent in Asia as income levels rise in the latter. The share of final energy consumption occupied by petroleum products was 49 per cent in 2000 and is anticipated to remain in that area. Such products therefore should continue to account for almost half of the total. Energy consumption in the transportation sector, which has a massive demand for petroleum products, is forecast to increase at an average annual rate of 2.2 per cent as a reflection of motorization in developing countries.

2.5 Outlook for the power generation structure

In 2000, coal-fired power accounted for the single-largest share of the world generated output at 39 per cent. The remainder was taken up by natural-gas-

fired power, nuclear power, and hydropower. The outlook for the forecast period contains a shift to natural-gas-fired power along with the spread of new technology such as combined-cycle systems fueled with natural gas and efforts to alleviate environmental load. The share of the total generated output occupied by natural-gas-fired power is forecast to jump from 17 per cent in 2000 to 27 per cent in 2020. That occupied by coal-fired power, which was 39 per cent in 2000, is anticipated to stay on that level even as of 2020. Coal-fired power should remain the single-largest power supply source. In China and India in particular, it is anticipated to be the key source for supply of the rapidly expanding demand for power. Meanwhile, the share occupied by oil-fired power is likely to continue in a basic trend of decline, especially in the developed countries. It is estimated that the nuclear power share will shrink from 17 per cent in 2000 to 11 per cent in 2020, because of the almost complete lack of additional plant construction in developed countries, which are also leaning toward the decommissioning of aging facilities without replacement.

3. Energy Supply-Demand Outlook in Asia

3.1 Outlook for primary energy consumption

Primary energy consumption in Asia is forecast to grow at an average annual rate of 3.2 per cent and reach 4.6 billion oil-equivalent tons in 2020, for a 1.9-fold increase from the corresponding total of 2.4 billion tons in 2000. Stronger growth is anticipated in countries achieving fast-paced economic growth, such as China, India, Vietnam, Thailand, Malaysia, and Indonesia. About 50 per cent of the consumption increase over the period in question should derive from expanded consumption in China, followed by India at about 20 per cent, Indonesia and South Korea at about 5 per cent each, and Thailand, Malaysia, and the Philippines at about 3 per cent each. Japan's share of the increase is expected to be held to about 2 per cent, or around the same level as that of Vietnam, which is anticipated to achieve rapid economic growth. The share of the primary energy consumption in Asia occupied by China is forecast to expand from 38 per cent in 2000 to 45 per cent in 2020. The outlook also envisions a corresponding expansion from 13 to 15 per cent for India, 4 to 5 per cent for Indonesia, and 2 to 3 per cent for Thailand. In contrast, the share occupied by Japan is predicted to decline from 22 per cent in 2000 to 12 per cent in 2020 owing to factors such as economic maturation and population decrease, thereby ranking the country third in this connection, behind China and India.

Table 3 World Final Energy Consumption

Primary energy consumption	Millions of toe			Share (%)		AAGR (%)	
	1980	2000	2020	1980	2000	1980-2000	2000-2020
Total	4,684	6,103	8,900	100	100	1.3	1.9
Industry	1,896	2,154	2,944	40	35	0.6	1.6
Transportation	1,146	1,781	2,730	24	29	2.2	2.2
Residential/Commercial	1,466	1,987	2,974	31	33	1.5	2
Non-energy, etc.	176	180	251	3.8	3	0.1	1.7
Energy source							
Total	4,684	6,103	8,900	100	100	1.3	1.9
Coal	699	524	618	15	8.6	-1.4	0.8
Oil	2,347	2,970	4,379	50	49	1.2	2
Natural gas	832	1,151	1,578	18	19	1.6	1.6
Electricity	585	1,088	1,935	12	18	3.1	2.9
Heat	120	237	262	2.6	3.9	3.4	0.5
Renewables	100	133	128	2.1	2.2	1.4	-0.2

Table 4: World Power Generation

Electricity generation	(TWh)				Share (%)			AAGR(%)	
	1980	2000	2020	1980	2000	2020	1980-2000	2000-2020	
	Total 8,246	15,375	27,518	100	100	100	3.2	3.0	3.0
Coal	3,139	6,014	10,842	38	39	39	3.3	3.0	
Oil	1,655	1,225	1,689	20	8.0	6.1	-1.5	1.6	
Natural gas	991	2,679	7,318	12	17	27	5.1	5.2	
Nuclear	713	2,591	2,998	8.7	17	11	6.7	0.7	
Hydro	1,719	2,632	3,941	21	17	14	2.2	2.0	
Geothermal	14	50	140	0.2	0.3	0.5	6.7	5.3	
Other renewables	14	185	589	0.2	1.2	2.1	13.7	6.0	

3.2 Outlook for fossil fuel consumption

In Asia, fossil fuels (coal, oil, and natural gas) are expected to continue to have a vital place as sources of energy, and to account for about 90 per cent of the increase in primary energy consumption over the forecast period, as in the world as a whole. Among the fossil fuels, oil is anticipated to have the largest share of the increase at 36 per cent, followed by coal at 35 per cent and natural gas at 17 per cent.

Consumption of oil, which was on the order of 19 million barrels per day in 2000, is anticipated to increase by an average annual rate of 3.1 per cent and hit that of 35 million barrels per day in 2020. By region, it is estimated that China will account for about 50 per cent of the increase, and India, about 20 per cent. By sector, about 60 per cent should derive from transportation, with the residential/commercial and industrial sectors accounting for about 20 per cent respectively. The oil share of primary energy consumption should stay on roughly the same level; it is expected to dip from 39 per cent in 2000 to 38 per cent in 2020.

Consumption of natural gas is forecast to undergo a 2.5-fold increase, from 263 billion cubic meters in 2000 to 664 billion cubic meters in 2020, for growth at the highest rate of all fossil fuels (an annual average of 4.7 per cent). It is estimated that about 50 per cent of the consumption increase will derive from input as fuel in the power sector, and about 20 per cent, from the expanded demand in the residential/commercial sector along with the spread of urbanization accompanying economic growth. The natural gas share of Asian primary energy consumption is predicted to rise from 10 per cent in 2000 to 13 per cent in 2020, but the natural gas shift should be slower than in North America and Europe.

Consumption of coal is forecast to rise from the order of 1.049 billion oil-equivalent tons in 2000 to 1.811 billion tons in 2020, for an average annual increase rate of 2.8 per cent. It is estimated that China will account for about 70 per cent of the increase, and India, about 20 per cent. By sector, about 90 per cent of the increase should derive from power generation, and the remaining 10 per cent, from industry. While its share of primary energy consumption is forecast to slip from 43 per cent in 2000 to 40 per cent in 2020, coal should retain the single-largest share of the primary energy supply in Asia.

3.3 Outlook for other fuel consumption

In Asia, consumption of power generated by nuclear power plants is forecast to increase at an annual average rate of 3.2 per cent, from 132 million oil-equivalent tons in 2000 to 247 million tons in 2020. Almost all of the corresponding global increase should come from Asia. There are good prospects for expansion in China and in countries with few domestic reserves of energy resources, such as Japan, Korea, and India. China is predicted to account for about 50 per cent of the nuclear power increase in Asia. The nuclear share of the primary energy consumption should stay on the order of 5 per cent over the period in question. The share occupied by renewable energies (e.g., hydropower, geothermal energy, and new energy) is expected to increase from 3 per cent in 2000 to 4 per cent in 2020. It should be noted, however, that energy consumption is forecast to expand rapidly in the region, and this will make quick response to assure a stable supply of energy a matter of the highest priority. These circumstances would act to limit utilization of renewable energies, whose supply can be unstabilized by natural conditions (except for hydropower and geothermal energy). Nevertheless, installation of new energy systems with low environmental loads will continue to be a key agenda item.

3.4 Outlook for final energy consumption

In Asia, fast-paced economic growth is being linked to an upgrading of the industrial structure, rise in the standard of living, and rapid increase in consumption of electrical power. Power consumption increased at an average annual rate of 5.9 per cent from 1980 to 2000, and is forecast to increase at one of 4.1 per cent over the forecast period. By sector, the rate of increase is expected to be the highest in the residential/commercial sector at 4.8 per cent. By region, China has the highest corresponding rate at 5.5 per cent, followed by India at 5.2 per cent. Against the backdrop of steady motorization, the share of the final energy demand occupied by petroleum products is forecast to expand from 50 per cent in 2000 to 52 per cent in 2020. Like that of home electrical products, the diffusion of the automobile is one of the most symbolic indicators of a tangible rise in the standard of living, and the general trend of motorization is bound to deepen.

3.5 Outlook for the generation structure

In Asia, many countries have abundant reserves of coal, and coal-fired power plants accounted for about 50 per cent of the region's generated output in 2000, the remainder being taken up by natural-gas-fired plants, nuclear power, and hydropower. Oil-fired power plants also generated about 10 per cent of the

Table 5: Primary Energy Consumption in Asia

Primary energy consumption	Millions of toe			Share (%)		AAGR (%)	
	1980	2000	2020	1980	2000	1980-2000	2000-2020
Total 1,054	2,423	4,570	100	100	100	3.2	3.2
Coal	469	1,049	1,811	44	43	4.1	2.8
Oil	485	938	1,720	46	39	3.3	3.1
Natural gas	52	237	598	4.9	10	7.9	4.7
Nuclear	25	132	247	2.4	5.4	8.6	3.2
Hydro	20	38	91	1.9	1.6	3.3	4.4
Geothermal	2.6	16	52	0.2	0.6	9.4	6.2
Other renewables	0.4	13	52	0.03	0.6	19.8	7.0

Table 6: Final Energy Consumption in Asia

Final energy consumption Sector	Millions of toe				Share (%)			AAGR (%)	
	1980	2000	2020	1980	2000	2020	1980-2000	2000-2020	
Total	755	1,511	2,826	100	100	100	3.5	3.2	
Industry	393	708	1,118	52	47	40	3	2.3	
Transportation	133	346	786	18	23	28	4.9	4.2	
Residential/Commercial	208	416	863	27	28	31	3.5	3.7	
Non-energy, etc.	21	41	60	2.8	2.7	2.1	3.3	1.9	
Energy source									
Total	1,511	2,826	100	100	100	3.5	3.2		
Coal	302	346	427	40	23	15	0.7	1.1	
Oil	333	763	1,471	44	50	52	4.2	3.3	
Natural gas	25	94	240	3.3	6.2	8.5	6.9	4.8	
Electricity	88	276	619	12	18	22	5.9	4.1	
Heat	7.5	28	64	1	1.9	2.3	6.9	4.2	
Other renewables	0	3.7	4.4	0	0.2	0.2	-	0.9	

supply. Over the forecast period, the structure should shift to natural gas along with increased installation of combined-cycle generation systems fueled with it, but coal-fired power generation should also continue to increase in line with policy for effective use of domestic resources. With expanded utilization in China, India, and Indonesia, the coal-fired share is predicted to expand from 51 per cent in 2000 to 54 per cent in 2020 as such plants acquire even more weight as the majority source. Meanwhile, the natural-gas-fired share is anticipated to experience a corresponding expansion from 13 to 17 per cent. The installed capacity of nuclear power is projected to increase in countries including China, South Korea, and India, but its share of the generated output in the region as a whole is forecast to fall from 13 per cent in 2000 to 11 per cent in 2020.

4. Outlook for CO₂ Emissions

As fossil fuels should be the source for about 90 per cent of the primary energy consumption in the world as a whole over the forecast period, CO₂ emissions, which came to about 6.5 billion (carbon-equivalent) tons in 2000, are forecast to reach about 9.9 billion tons in 2020. They would consequently expand at an average annual rate of 2.1 per cent, about the same as for primary energy consumption, and multiply by a factor of about 1.5. About 70 per cent of this increase would come from non-OECD countries, and about 30 per cent, from China alone.

5. Outlook for Motorization

In Asia and other largely developing regions, consumption of gasoline, gas oil, and other transportation fuel is rapidly expanding. Among the developed countries, motorization has already run its course and the demand is more or less saturated. The developing countries of Asia, in contrast, are now at the threshold of motorization, which is anticipated to gather momentum over the coming years as standards of living rise. The expanded consumption of oil associated with motorization in Asia should be a major factor characterizing the structure of energy supply and demand in the region over the medium and long terms. In 2020, the ownership volume in China is forecast to reach about 120 million vehicles (about 1.5 times as many as in Japan today), but this would amount to a diffusion rate of only about 8 per cent, which would still be low as compared to the average in developed countries (53 per cent in 2000). In other words, China would still have margin for further motorization after 2020, and the diffusion of ownership there may be expected to have a tremendous impact on the international oil market.

Table 7: Power generation in Asia

Electricity generation	(TWh)			Share (%)			AAGR (%)	
	1980	2000	2020	1980	2000	2020	1980-2000	2000-2020
Total	3,966	8,985	100	100	100	6.2	4.2	4.2
Coal	2,037	4,896	25	51	54	10.0	4.5	4.5
Oil	384	420	39	10	5	-1.0	0.5	0.5
Natural gas	91	519	1,486	7.6	13	17	9.1	5.4
Nuclear	97	505	949	8.2	13	11	8.6	3.2
Hydro	231	480	1,057	19	12	12	3.7	4.0
Geothermal	3.0	18	60	0.2	0.4	0.7	9.4	6.3
Other renewables	0	22	116	0	0.6	1.3	-	8.6

6. Crude Oil and LNG Supply and Demand in Asia

In the three countries in Northeast Asia (Japan, China, and South Korea), the rate of oil dependence on the Middle East should steadily deepen. Specifically, in 2020, it is forecast to reach about 90 per cent in Japan and 80 per cent in South Korea. In China, too, it is forecast to jump from 15 per cent in 2000 to about 50 per cent in 2020 due to the sharp increase in the oil demand and the leveling off of domestic production. In the process, the corresponding rate of dependence on the Middle East in Northeast Asia as a whole may be expected to rise from 58 per cent in 2000 to approximately 70 per cent in 2020 along with the quantitative expansion of consumption in China. If the three countries begin to import crude oil produced in Siberia (in quantities totaling about 100 million tons per year), the corresponding rate could possibly be lowered by about 11 per cent.

In North Asia (consisting of Japan, China, South Korea, and Taiwan), import of liquefied natural gas (LNG) should total in the range of 120 - 150 million tons in 2020, considering the commencement of natural gas import from Irkutsk and Sakhalin. At present, plans extending to 2010 would increase the LNG supply capacity to the Asia-Pacific market in that year to about 110 million tons, and this could be increased further to about 180 million tons with the execution of additional projects now under study. Assuming that LNG development moves steadily ahead in the second half of the forecast period from 2010, potential for supply to the region should be sufficiently high in 2020.

7. Implications

While the long term holds the prospect of a deepening dependence on the Middle East for the supply of oil in Asia, the region should have an ample supply capacity for natural gas and coal. The simultaneous attainment of energy security, market rationalization, and environmental preservation in Asia demands the construction of the “best mix” of energy sources in each country, considering its situation as regards its amount of energy reserves, geographical conditions, and stage of economic development. Furthermore, formation of an analogous “best mix” in the region as a whole would require extensive utilization of coal and nuclear power alongside natural gas while assuring the stability of the oil supply.

7.1. Ensuring energy security in Asia

- Strong economic growth and progressive motorization are going to expand the demand for energy in Asia. As noted above, the dependency on the

Middle East for supply of oil should deepen, because the regional oil supply would not be able to keep pace with the swift demand expansion. While it is naturally important for the individual countries to make efforts to secure their own energy supplies, there is also a possibility that excessive pursuit of the national interest by any single country could damage the energy security of the rest of the region. It is consequently becoming increasingly important for the issue to be treated as one in which all countries in the region have a common stake.

- To this end, it is imperative for the Asian countries that are net consumers of energy to collaborate with each other in pursuit of the following four major tasks: 1) fuller exercise of bargaining power given their collective position as a massive regional consumer of oil, and strengthening of ties of dialogue and cooperation as equal partners with net oil producers; 2) construction of a shared reserve scheme for response to emergencies and effective use of the existing infrastructure to deal with short-term crises such as supply suspensions; 3) promotion of cooperative resource development and procurement inside and outside the region; and 4) conditioning of international oil markets to give the supply and demand structure more flexibility.

7.2. Pursuit of energy diversification

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

- Coal has an excellent economic merit but also entails a high environmental load, and its utilization in developed countries could stop expanding as a result. In Asia, there are abundant reserves of coal in countries including China, India, and Indonesia, and the region's utilization of coal is expected to expand, especially in the power sector. This would further heighten the importance of environment-friendly utilization harnessing high-efficiency technology. As viewed from the perspective of energy security and economic merit, it is crucial for Asia to make better use of its abundant coal deposits, and Japan can play a pivotal role in this connection as a technologically advanced country.
- Utilization of natural gas is also projected to expand in Asia, especially in the power and civil sectors. This points to a need for improvement of its

economic feasibility. The Asia-Oceania region has a fully sufficient supply potential for natural gas into the long term, and the net consumer countries must collaborate in efforts to heighten the economic merit by exercise of stronger bargaining power, for example. Gas prices have thus far been set through linkage to crude oil prices because of the competition with oil, but competition with coal is going to carry increasing weight in the future.

- In the developed countries of Europe and North America, construction of additional nuclear power plants has essentially been halted, and the installed capacity is expected to decline. As a result, Asia should be the site of almost all additional nuclear power plants. Many Asian countries have a relatively low level of domestic natural resources, and nuclear power has a major role to play for assurance of supply stability and conquest of environmental problems. There is also a need for intraregional cooperation encompassing the aspects of operation and management in this area.
- At any rate, it is vital to have various options for energy supply sources. This would be linked not only to higher levels of energy security but also a stronger position in price negotiations for competing fuels.

7.3. Responding to global environmental problems

- The trend of rapid increase in CO₂ emissions in China and other developing Asian countries underscores the limited effectiveness of Japan's emission countermeasures within its borders. As such, a far larger overall benefit would be delivered by mitigation of environmental load through transfer of technology to other countries in Asia and other regions with a burgeoning energy demand.
- Japan should regard this role not merely as a variety of assistance to fulfill its obligations as a developed country but also as a precious opportunity for development of promising business deriving from the environment. China and other developing Asian countries have immense potential for energy conservation, and offer enormous margin for technical assistance through the Clean Development Mechanism (CDM) and other schemes. Japan ranks at the vanguard worldwide in respect of energy-conservation and environmental technology. With its dearth of natural resources, it is crucial for Japan to support the advancement of its economy through extensive use of its undepletable resource - its technology.

**Annex Table 1: World Primary Energy Consumption
(by Region)**

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/	2010/	2020/	2020/
					1990	2000	2010	2000
North America	2,137 (27.4)	2,555 (28.2)	2,863 (25.9)	3,196 (23.5)	1.8	1.1	1.1	1.1
Central and South America	382 (4.9)	526 (5.8)	710 (6.4)	980 (7.2)	3.2	3.0	3.3	3.2
OECD Europe	1,624 (20.8)	1,764 (19.5)	1,953 (17.7)	2,116 (15.6)	0.8	1.0	0.8	0.9
Non-OECD Europe	1,468 (18.8)	1,001 (11.1)	1,197 (10.8)	1,385 (10.2)	-3.8	1.8	1.5	1.6
Africa	201 (2.6)	259 (2.9)	336 (3.0)	455 (3.4)	2.5	2.7	3.1	2.9
Middle East	224 (2.9)	385 (4.3)	492 (4.5)	703 (5.2)	5.6	2.5	3.6	3.0
Asia	60 (21.2)	2,423 (26.8)	3,335 (30.2)	4,570 (33.6)	3.9	3.2	3.2	3.2
China	673 (8.6)	932 (10.3)	1,406 (12.7)	2,063 (15.2)	3.3	4.2	3.9	4.1
Japan	439 (5.6)	525 (5.8)	543 (4.9)	561 (4.1)	1.8	0.3	0.3	0.3
India	187 (2.4)	322 (3.6)	452 (4.1)	684 (5.0)	5.6	3.4	4.2	3.8
Other Asian countries	361 (4.6)	644 (7.1)	934 (8.4)	1,263 (9.3)	6.0	3.8	3.1	3.4
Oceania	102 (1.3)	129 (1.4)	149 (1.3)	166 (1.2)	2.4	1.4	1.1	1.3
Other regions	14 (0.2)	15 (0.2)	18 (0.2)	22 (0.2)	0.9	1.7	1.9	1.8
OECD country total	4,517 (57.8)	5,317 (58.7)	5,981 (54.1)	6,633 (48.8)	1.6	1.2	1.0	1.1
Non-OECD country total	3,293 (42.2)	3,740 (41.3)	5,073 (45.9)	6,961 (51.2)	1.3	3.1	3.2	3.2
World total	7,811 (100.0)	9,057 (100.0)	11,053 (100.0)	13,593 (100.0)	1.5	2.0	2.1	2.1

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.
Note: Figures in parentheses indicate percentage shares of totals.

**Annex Table 2 Primary Energy Consumption in Asia
(by Region)**

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/	2010/	2020/	2020/
					1990	2000	2010	2000
China	673 (40.5)	932 (38.5)	1,406 (42.2)	2,063 (45.1)	3.3	4.2	3.9	4.1
Japan	439 (26.4)	525 (21.7)	543 (16.3)	561 (12.3)	1.8	0.3	0.3	0.3
South Korea	93 (5.6)	191 (7.9)	262 (7.9)	303 (6.6)	7.5	3.2	1.5	2.3
India	187 (11.3)	322 (13.3)	452 (13.6)	684 (15.0)	5.6	3.4	4.2	3.8
Indonesia	52 (3.1)	98 (4.1)	144 (4.3)	209 (4.6)	6.5	3.9	3.8	3.9
Taiwan	48 (2.9)	83 (3.4)	110 (3.3)	132 (2.9)	5.6	2.9	1.9	2.4
Singapore	13 (0.8)	25 (1.0)	36 (1.1)	48 (1.1)	6.3	4.0	2.9	3.4
Malaysia	20 (1.2)	47 (1.9)	74 (2.2)	110 (2.4)	8.7	4.6	4.0	4.3
Philippines	18 (1.1)	33 (1.4)	57 (1.7)	96 (2.1)	5.9	5.6	5.5	5.5
Thailand	29 (1.7)	58 (2.4)	89 (2.7)	145 (3.2)	7.3	4.4	5.0	4.7
Vietnam	5.8 (0.3)	14 (0.6)	33 (1.0)	54 (1.2)	9.5	8.7	5.2	6.9
Hong Kong	11 (0.6)	15 (0.6)	18 (0.5)	20 (0.4)	3.8	1.7	1.1	1.4
Other Asian countries	71 (4.3)	80 (3.3)	111 (3.3)	144 (3.2)	1.2	3.4	2.6	3.0
Asian total	60 (100.0)	2,423 (100.0)	3,335 (100.0)	4,570 (100.0)	3.9	3.2	3.2	3.2
Developing Asia	21 (73.6)	18 (78.3)	2,792 (83.7)	4,010 (87.7)	4.5	3.9	3.7	3.8

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.
Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 3 Primary Energy Consumption in the World and Asia (by Energy Source)

World	(Unit: millions of toe)								
	Actual	Forecast		AAGR (%)		2000/		2010/	
	1990	2000	2010	2020	1990	2000	2010	2020	2000/
Coal	2,184 (28.0)	2,325 (25.7)	2,888 (26.1)	3,489 (25.7)	0.6	2.2	1.9	2.0	
Oil 3,070	3,494 (39.3)	4,140 (38.6)	5,072 (37.5)	1.3 (37.3)	1.7	2.1	1.9		
Natural gas	1,672 (21.4)	2,107 (23.3)	2,678 (24.2)	3,490 (25.7)	2.3	2.4	2.7	2.6	
Hydro	185 (2.4)	223 (2.5)	282 (2.6)	339 (2.5)	1.9	2.4	1.8	2.1	
Geothermal	34 (0.4)	45 (0.5)	73 (0.7)	123 (0.9)	2.9	5.1	5.4	5.2	
Nuclear	525 (6.7)	676 (7.5)	747 (6.8)	781 (5.7)	2.6	1.0	0.5	0.7	
Other renewables	140 (1.8)	187 (2.1)	246 (2.2)	299 (2.2)	2.9	2.8	2.0	2.4	
World total	7,811 (100.0)	9,057 (100.0)	11,053 (100.0)	13,593 (100.0)	1.5	2.0	2.1	2.1	
GDP (billions of US dollars at 1995 value)	26,505	34,251	44,901	58,570	2.6	2.7	2.7	2.7	
GDP prime units (1990 = 100)	100.0	89.7	83.5	78.8	-1.1	-0.7	-0.6	-0.7	
CO ₂ emissions (millions of tons of carbon-equivalent)	5,771	6,507	7,963	9,852	1.2	2.0	2.2	2.1	
Asia									
Coal	801 (48.2)	1,049 (43.3)	1,384 (41.5)	1,811 (39.6)	2.7	2.8	2.7	2.8	
Oil 621	938 (37.4)	1,246 (38.7)	1,720 (37.4)	4.2 (37.6)	2.9	3.3	3.1		
Natural gas	115 (6.9)	237 (9.8)	392 (11.8)	598 (13.1)	7.5	5.1	4.3	4.7	
Hydro	32 (1.9)	38 (1.6)	67 (2.0)	91 (2.0)	1.8	5.7	3.1	4.4	
Geothermal	7.2 (0.4)	16 (0.6)	28 (0.8)	52 (1.1)	8.0	6.2	6.3	6.2	

Annex table 3 continued

Annex table 3 continued

Asia	(Unit: millions of toe)							
	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/	2010/	2020/	2020/
Nuclear	77 (4.6)	132 (5.4)	189 (5.7)	247 (5.4)	5.5	3.7	2.7	3.2
Other renewables	7.1 (0.4)	13 (0.6)	29 (0.9)	52 (1.1)	6.5	8.0	6.1	7.0
Asian total	1,660 (100.0)	2,423 (100.0)	3,335 (100.0)	4,570 (100.0)	3.9	3.2	3.2	3.2
GDP (billions of US dollars at 1995 value)	6,869	9,361	12,905	17,805	3.1	3.3	3.3	3.3
GDP prime units (1990 = 100)	100.0	107.1	107.0	106.2	0.7	-0.2	-0.07	-0.04
CO ₂ emissions (millions of tons of carbon-equivalent)	1,414	1,975	2,669	3,627	3.4	3.1	3.1	3.1

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.

Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 4: Final Energy Consumption in Asia

	(Unit: millions of toe)							
	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
Breakdown by sector								
Industrial sector	574 (50.3)	708 (46.9)	902 (43.6)	118 (39.6)	2.1	2.4	2.2	2.3
Residential/Commercial sector	3 (29.1)	416 (27.5)	599 (28.9)	863 (30.5)	2.3	3.7	3.7	3.7
Transportation sector	1 (18.5)	346 (22.9)	522 (25.2)	786 (27.8)	5.1	4.2	4.2	4.2
Non-energy and other sectors	24 (2.1)	41 (2.7)	46 (2.2)	60 (2.1)	5.4	1.3	2.6	1.9
Breakdown by Energy Source								
Coal	439 (38.5)	346 (22.9)	394 (19.1)	427 (15.1)	-2.3	1.3	0.8	1.1
Oil	478 (41.8)	763 (50.5)	1,048 (50.7)	1,471 (52.0)	4.8	3.2	3.4	3.3
Natural Gas	50 (4.4)	94 (6.2)	156 (7.5)	240 (8.5)	6.5	5.2	4.4	4.8
Electricity	158 (13.8)	276 (18.3)	423 (20.5)	619 (21.9)	5.7	4.4	3.9	4.1
Renewables	17 (1.5)	32 (2.1)	47 (2.3)	69 (2.4)	6.4	4.0	3.8	3.9
Asian Total	1,142 (100.0)	1,511 (100.0)	2,069 (100.0)	2,826 (100.0)	2.8	3.2	3.2	3.2

Source:Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IIEEJ.

Note:Figures in parentheses indicate percentage shares of totals.

Annex Table 5: Power Generation in Asia

	(Unit: TWh)							
	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
Coal	871 (39.1)	2,037 (51.4)	3,177 (52.2)	4,896 (54.5)	8.9	4.5	4.4	4.5
Oil 433	384 (19.4)	382 (9.7)	420 (6.3)	-1.2 (4.7)	-0.0	0.9	0.5	
Natural gas	233 (10.4)	519 (13.1)	940 (15.4)	1,486 (16.5)	8.4	6.1	4.7	5.4
Hydro	371 (16.7)	480 (12.1)	777 (12.8)	1,057 (11.8)	2.6	4.9	3.1	4.0
Geothermal	8.3 (0.4)	18 (0.4)	33 (0.5)	60 (0.7)	7.9	6.2	6.3	6.3
Nuclear	294 (13.2)	505 (12.7)	726 (11.9)	949 (10.6)	5.5	3.7	2.7	3.2
Other renewables	17 (0.8)	22 (0.6)	54 (0.9)	116 (1.3)	2.9	9.4	7.9	8.6
Asian total	2,227 (100.0)	3,966 (100.0)	6,089 (100.0)	8,985 (100.0)	5.9	4.4	4.0	4.2

Source:Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IIEEJ

Note:1. Figures in parentheses indicate percentage shares of totals.

2. Figures for other renewables, include photovoltaic generation, wind power, and other such sources.

Annex Table 6: World Primary Energy Consumption (Coal)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
North America	483 (22.1)	572 (24.6)	726 (25.1)	832 (23.8)	1.7	2.4	1.4	1.9
Central and South America	20 (0.9)	29 (1.2)	33 (1.1)	37 (1.1)	3.5	1.5	1.3	1.4
OECD Europe	436 (20.0)	321 (13.8)	317 (11.0)	360 (10.3)	-3.0	-0.1	1.3	0.6
Non-OECD Europe	331 (15.1)	208 (9.0)	277 (9.6)	276 (7.9)	-4.5	2.9	-0.0	1.4
Africa	74 (3.4)	90 (3.9)	90 (3.1)	89 (2.5)	2.0	0.0	-0.2	-0.1
Middle East	3 (0.1)	8 (0.3)	6 (0.2)	23 (0.7)	10.0	-2.2	14.1	5.6
Asia	801 (36.7)	1,049 (45.1)	1,384 (47.9)	1,811 (51.9)	2.7	2.8	2.7	2.8
China	535 (24.5)	6 (28.2)	878 (30.4)	1,158 (33.2)	2.1	3.0	2.8	2.9
Japan	74 (3.4)	94 (4.0)	97 (3.4)	101 (2.9)	2.4	0.4	0.3	0.4
India	107 (4.9)	176 (7.6)	217 (7.5)	305 (8.8)	5.1	2.1	3.5	2.8
Other Asian countries	85 (3.9)	124 (5.3)	191 (6.6)	246 (7.1)	3.8	4.4	2.6	3.5
Oceania	36 (1.7)	48 (2.1)	54 (1.9)	58 (1.7)	3.0	1.1	0.8	0.9
Other regions	1.0 (0.0)	.1 (0.0)	1.6 (0.1)	2.3 (0.1)	1.2	3.6	3.9	3.7
OECD country total	1,058 (48.4)	1 (46.5)	1,265 (43.8)	1,426 (40.9)	0.2	1.6	1.2	1.4
Non-OECD country total	1,127 (51.6)	4 (53.5)	1,623 (56.2)	2,063 (59.1)	1.0	2.7	2.4	2.6
World total	2,184 (100.0)	2,325 (0.0)	2,888 (100.0)	3,489 (100.0)	0.6	2.2	1.9	2.0

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.
Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 7: Primary Energy Consumption in Asia (Coal)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
China	535 (66.8)	656 (62.5)	878 (63.5)	1,158 (64.0)	2.1	3.0	2.8	2.9
Japan	74 (9.2)	94 (8.9)	97 (7.0)	101 (5.6)	2.4	0.4	0.3	0.4
South Korea	25 (3.2)	39 (3.8)	63 (4.6)	66 (3.6)	4.5	4.9	0.4	2.6
India	107 (13.3)	176 (16.7)	217 (15.7)	305 (16.9)	5.1	2.1	3.5	2.8
Indonesia	4.0 (0.5)	14 (1.3)	25 (1.8)	39 (2.2)	13.2	6.4	4.4	5.4
Taiwan	11 (1.4)	29 (2.8)	37 (2.7)	51 (2.8)	10.1	2.3	3.2	2.8
Singapore	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	-100.0	-	-	-
Malaysia	0.9 (0.1)	1.7 (0.2)	9 (0.6)	14 (0.8)	6.9	18.2	4.7	11.2
Philippines	1.3 (0.2)	5.0 (0.5)	5.1 (0.4)	6.9 (0.4)	14.5	0.2	3.1	1.6
Thailand	3.8 (0.5)	7.5 (0.7)	13 (0.9)	20 (1.1)	7.0	5.3	4.5	4.9
Vietnam	2.5 (0.3)	3.7 (0.4)	6.3 (0.5)	8.2 (0.5)	4.1	5.5	2.6	4.1
Hong Kong	5.5 (0.7)	3.7 (0.4)	6.5 (0.5)	8.7 (0.5)	-3.8	5.7	2.9	4.3
Other Asian countries	31 (3.8)	20 (1.9)	26 (1.9)	33 (1.8)	-4.3	2.9	2.3	2.6
Asian total	801 (100.0)	1,049 (100.0)	1,384 (100.0)	1,811 (100.0)	2.7	2.8	2.7	2.8
Developing Asia	727 (90.8)	955 (91.1)	1,286 (93.0)	1,710 (94.4)	2.8	3.0	2.9	3.0

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.
Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 8: World Primary Energy Consumption (Oil)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
North America	847	981	1,067	1,161	1.5	0.8	0.8	0.8
	(27.6)	(28.1)	(25.8)	(22.9)				
Central and South America	237	307	398	517	2.6	2.6	2.6	2.6
	(7.7)	(8.8)	(9.6)	(10.2)				
OECD Europe	631	685	711	743	0.8	0.4	0.4	0.4
	(20.5)	(19.6)	(17.2)	(14.6)				
Non-OECD Europe	456	212	262	307	-7.4	2.2	1.6	1.9
	(14.9)	(6.1)	(6.3)	(6.0)				
Africa	89	106	134	182	1.8	2.3	3.2	2.7
	(2.9)	(3.0)	(3.2)	(3.6)				
Middle East	142	210	258	372	4.0	2.1	3.7	2.9
	(4.6)	(6.0)	(6.2)	(7.3)				
Asia	621	938	1,246	1,720	4.2	2.9	3.3	3.1
	(20.2)	(26.8)	(30.1)	(33.9)				
China	110	222	366	592	7.2	5.1	4.9	5.0
	(3.6)	(6.3)	(8.8)	(11.7)				
Japan	253	265	260	253	0.5	-0.2	-0.3	-0.2
	(8.2)	(7.6)	(6.3)	(5.0)				
India	62	112	172	278	6.1	4.4	4.9	4.6
	(2.0)	(3.2)	(4.2)	(5.5)				
Other Asian countries	195	339	448	596	5.7	2.8	2.9	2.9
	(6.3)	(9.7)	(10.8)	(11.8)				
Oceania	37	43	48	52	1.6	1.2	0.9	1.0
	(1.2)	(1.2)	(1.2)	(1.0)				
Other regions	12	13	15	18	0.9	1.4	1.5	1.4
	(0.4)	(0.4)	(0.4)	(0.4)				
OECD country total	1,901	2,172	2,339	2,520	1.3	0.7	0.7	0.7
	(61.9)	(62.2)	(56.5)	(49.7)				
Non-OECD country total	1,170	1,322	1,801	2,552	1.2	3.1	3.5	3.3
	(38.1)	(37.8)	(43.5)	(50.3)				
World total	3,070	3,494	4,140	5,072	1.3	1.7	2.1	1.9
	(100.0)	(100.0)	(100.0)	(100.0)				

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.

Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 9: Primary Energy Consumption in Asia (Oil)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/1990	2010/2000	2020/2010	2020/2000
China	110	222	366	592	7.2	5.1	4.9	5.0
	(17.8)	(23.6)	(29.4)	(34.4)				
Japan	253	265	260	253	0.5	-0.2	-0.3	-0.2
	(40.8)	(28.3)	(20.9)	(14.7)				
South Korea	50	104	124	137	7.6	1.8	1.0	1.4
	(8.1)	(11.1)	(9.9)	(7.9)				
India	62	112	172	278	6.1	4.4	4.9	4.6
	(10.0)	(12.0)	(13.8)	(16.2)				
Indonesia	33	53	76	109	4.9	3.7	3.7	3.7
	(5.3)	(5.7)	(6.1)	(6.3)				
Taiwan	26	37	43	51	3.7	1.5	1.7	1.6
	(4.2)	(4.0)	(3.5)	(3.0)				
Singapore	13	23	34	44	5.8	3.8	2.6	3.2
	(2.1)	(2.5)	(2.7)	(2.6)				
Malaysia	13	23	37	60	5.9	4.9	4.9	4.9
	(2.1)	(2.5)	(3.0)	(3.5)				
Philippines	12	17	25	40	3.7	4.0	4.7	4.3
	(1.9)	(1.8)	(2.0)	(2.3)				
Thailand	19	32	42	65	5.3	2.8	4.4	3.6
	(3.1)	(3.4)	(3.4)	(3.8)				
Vietnam	2.9	8.3	16	30	11.2	7.1	6.2	6.6
	0.5	0.9	(1.3)	(1.7)				
Hong Kong	5.3	8.9	8.9	8.9	5.4	-0.0	0.0	-0.0
	(0.8)	(0.9)	(0.7)	(0.5)				
Other Asian countries	21	32	41	51	4.5	2.4	2.3	2.4
	(3.3)	(3.4)	(3.3)	(3.0)				
Asian total	621	938	1,246	1,720	4.2	2.9	3.3	3.1
	(100.0)	(100.0)	(100.0)	(100.0)				
Developing Asia	368	673	986	6.2	3.9	4.1	4.0	4.0
	(59.2)	(71.7)	(79.1)	(85.3)				

Source: Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.

Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 10: World Primary Energy Consumption (Gas)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/	2010/	2020/	2020/
					1990	2000	2010	2000
North America	494 (29.6)	623 (29.6)	651 (24.3)	751 (21.5)	2.4	0.4	1.4	0.9
Central and South America	76 (4.5)	120 (5.7)	189 (7.1)	310 (8.9)	4.7	4.7	5.1	4.9
OECD Europe	258 (15.4)	390 (18.5)	519 (19.4)	605 (17.3)	4.2	2.9	1.5	2.2
Non-OECD Europe	600 (35.9)	493 (23.4)	572 (21.4)	721 (20.7)	-2.0	1.5	2.3	1.9
Africa	32 (1.9)	53 (2.5)	100 (3.7)	167 (4.8)	5.1	6.6	5.2	5.9
Middle East	77 (4.6)	166 (7.9)	223 (8.3)	299 (8.6)	7.9	3.0	3.0	3.0
Asia	115 (6.9)	237 (11.3)	392 (14.6)	598 (17.1)	7.5	5.1	4.3	4.7
China	16 (0.9)	28 (1.3)	79 (3.0)	162 (4.6)	5.9	10.9	7.4	9.1
Japan	43 (2.6)	65 (3.1)	77 (2.9)	84 (2.4)	4.1	1.7	0.9	1.3
India	11 (0.6)	23 (1.1)	43 (1.6)	71 (2.0)	8.1	6.5	5.0	5.8
Other Asian countries	46 (2.7)	121 (5.8)	193 (7.2)	282 (8.1)	10.3	4.7	3.9	4.3
Oceania	19 (1.1)	24 (1.2)	31 (1.2)	38 (1.1)	2.7	2.4	2.0	2.2
Other regions	0.3 (0.0)	0.2 (0.0)	0.3 (0.0)	0.5 (0.0)	-1.4	3.1	4.5	3.8
OECD country total	840 (50.2)	1,153 (54.7)	1,357 (50.7)	1,601 (45.9)	3.2	1.6	1.7	1.7
Non-OECD country total	832 (49.8)	954 (45.3)	1,321 (49.3)	1,889 (54.1)	1.4	3.3	3.6	3.5
World total	1,672 (100.0)	2,107 (100.0)	2,678 (100.0)	3,490 (100.0)	2.3	2.4	2.7	2.6

Source:Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.

Note:Figures in parentheses indicate percentage shares of totals.

Annex Table 11: Primary Energy Consumption in Asia (Gas)

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/	2010/	2020/	2020/
					1990	2000	2010	2000
China	16 (13.7)	28 (11.8)	79 (20.2)	162 (27.1)	5.9	10.9	7.4	9.1
Japan	43 (37.5)	65 (27.3)	77 (19.6)	84 (14.0)	4.1	1.7	0.9	1.3
South Korea	2.7 (2.4)	17 (7.2)	28 (7.2)	44 (7.4)	20.1	5.2	4.6	4.9
India	11 (9.2)	23 (9.7)	43 (11.1)	71 (11.8)	8.1	6.5	5.0	5.8
Indonesia	14 (12.0)	28 (12.0)	40 (10.1)	57 (9.4)	7.5	3.4	3.6	3.5
Taiwan	1.7 (1.5)	5.5 (2.3)	13 (3.4)	16 (2.7)	12.1	9.4	2.0	5.6
Singapore	0 (0.0)	1.2 (0.5)	2.3 (0.6)	4.2 (0.7)	-	7.1	6.1	6.6
Malaysia	6.1 (5.3)	2 (9.1)	27 (6.8)	34 (5.7)	13.5	2.1	2.5	2.3
Philippines	0 (0.0)	0 (0.0)	2.2 (0.6)	2.0 (0.3)	-	73.4	-0.9	31.1
Thailand	5 (4.4)	18 (7.4)	31 (8.0)	58 (9.7)	13.1	6.0	6.3	6.2
Vietnam	0 (0.0)	1.1 (0.5)	6.7 (1.7)	11 (1.8)	81.1	19.3	5.0	11.9
Hong Kong	0 (0.0)	2.0 (0.8)	2.0 (0.5)	2.0 (0.3)	-	0.0	0.0	0.0
Other Asian countries	16 (14.0)	27 (11.4)	40 (10.3)	54 (9.0)	5.3	4.1	2.9	3.5
Asian total	115 (100.0)	237 (100.0)	392 (100.0)	598 (100.0)	7.5	5.1	4.3	4.7
Developing Asia	72 (62.5)	173 (72.7)	315 (80.4)	515 (86.0)	9.1	6.2	5.0	5.6

Source:Based on data from "Energy Balances of OECD Countries" and "Energy Balances of Non-OECD Countries," IEA; forecast figures prepared by the IEEJ.

Note:Figures in parentheses indicate percentage shares of totals.

Annex Table 12 CO₂ Emissions in Asia

(Unit: millions of toe)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/ 1990	2010/ 2000	2020/ 2010	2020/ 2000
China	680 (48.1)	900 (45.6)	1,285 (48.1)	1,819 (50.1)	2.8	3.6	3.5	3.6
Japan	294 (20.8)	331 (16.7)	342 (12.8)	344 (9.5)	1.2	0.3	0.1	0.2
South Korea	65 (4.6)	118 (6)	161 (6)	182 (5.9)	6.1	3.2	1.2	2.2
India	168 (11.9)	281 (14.2)	386 (14.4)	577 (15.9)	5.3	3.2	4.1	3.7
Indonesia	40 (2.8)	76 (3.9)	116 (4.3)	169 (4.7)	6.8	4.2	3.9	4
Taiwan	32 (2.3)	62 (3.1)	75 (2.8)	96 (2.7)	6.9	1.9	2.5	2.2
Singapore	10 (0.7)	18 (0.9)	25 (0.9)	32 (0.9)	6.3	3.5	2.6	3.1
Malaysia	16 (1.1)	34 (1.7)	57 (2.1)	86 (2.4)	8.3	5.1	4.2	4.7
Philippines	11 (0.8)	20 (1)	28 (1)	41 (1.1)	5.8	3.5	4.1	3.8
Thailand	23 (1.7)	46 (2.3)	68 (2.6)	111 (3.1)	7	4	5	4.5
Vietnam	5 (0.4)	12 (0.6)	25 (0.9)	41 (1.1)	8.7	7.9	5.1	6.5
Hong Kong	10 (0.7)	13 (0.6)	16 (0.6)	18 (0.5)	2.1	2.1	1.4	1.8
Other Asian countries	60 (4.3)	65 (3.3)	87 (3.3)	112 (3.3)	0.7	3	2.5	2.8
Asian total	1,414 (100)	1,975 (100)	2,669 (100)	3,627 (100)	3.4	3.1	3.1	3.1
Developing Asia	1,120 (79.2)	1,644 (83.3)	2,327 (87.2)	3,283 (90.5)	3.9	3.5	3.5	3.5

Source: Based on data from "Energy Balances of OECD Countries" (IEA) and other sources; forecast figures prepared by the IIEJ.

Annex Table 13: GDPs in Asia

(Unit: billions of US dollars at 1995 value)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/ 1990	2010/ 2000	2020/ 2010	2020/ 2000
China	398 (5.8)	1,042 (11.1)	2,200 (17.0)	4,184 (23.5)	10.1	7.8	6.6	7.2
Japan	4,936 (71.9)	5,688 (60.8)	6,595 (51.1)	7,373 (41.4)	1.4	1.5	1.1	1.3
South Korea	342 (5.0)	620 (6.6)	996 (7.7)	1,439 (8.1)	6.2	4.8	3.7	4.4
India	284 (4.1)	482 (5.1)	841 (6.5)	1,436 (8.1)	5.4	5.7	5.5	5.6
Indonesia	138 (2.0)	209 (2.2)	318 (2.5)	494 (2.8)	4.2	4.3	4.5	4.4
Taiwan	186 (2.7)	347 (3.7)	476 (3.7)	668 (3.8)	6.4	3.2	3.4	3.3
Singapore	54 (0.8)	113 (1.2)	167 (1.3)	241 (1.4)	7.7	3.9	3.7	3.8
Malaysia	56 (0.8)	112 (1.2)	178 (1.4)	290 (1.6)	7.0	4.8	5.0	4.9
Philippines	67 (1.0)	88 (0.9)	136 (1.1)	206 (1.2)	2.9	4.4	4.2	4.3
Thailand	111 (1.6)	172 (1.8)	293 (2.3)	477 (2.7)	4.4	5.5	5.0	5.2
Vietnam	14 (0.2)	28 (0.3)	53 (0.4)	95 (0.5)	7.5	6.7	6.0	6.3
Hong Kong	107 (1.6)	165 (1.8)	236 (1.8)	326 (1.8)	4.4	3.6	3.3	3.5
Other Asian countries	176 (2.6)	296 (3.2)	417 (3.2)	576 (3.2)	5.3	3.5	3.3	3.4
Asian total	6,869 (100.0)	9,361 (100.0)	12,905 (100.0)	17,805 (100.0)	3.1	3.3	3.3	3.3
Developing Asia	1,933 (28.1)	3,673 (39.2)	6,310 (48.9)	10,432 (58.6)	6.6	5.6	5.2	5.4

Based on data from "World Development Indicators" (World Bank) and other sources; forecast figures prepared by the IIEJ.

Note: Figures in parentheses indicate percentage shares of totals.

Annex Table 14: Automobile Ownership Volume in Asia

(Unit: millions of vehicles)

	Actual		Forecast		AAGR (%)			
	1990	2000	2010	2020	2000/ 1990	2010/ 2000	2020/ 2010	2020/ 2000
China	5.5 (6.4)	16 (11.5)	52 (24.1)	119 (35.4)	11.3	12.5	8.6	10.5
Japan	58 (67.2)	73 (52.0)	79 (36.4)	81 (24.2)	2.3	0.8	0.3	0.6
South Korea	3.4 (4.0)	12 (8.6)	20 (9.1)	26 (7.7)	13.5	5.0	2.8	3.9
India	4.3 (5.0)	9.4 (6.7)	20 (9.4)	38 (11.4)	8.1	7.9	6.6	7.3
Indonesia	2.8 (3.2)	5.5 (3.9)	7.9 (3.6)	12 (3.5)	7.1	3.6	4.1	3.9
Taiwan	2.8 (3.2)	5.5 (4.0)	8.0 (3.7)	11 (3.3)	7.2	3.7	3.3	3.5
Singapore	0.4 (0.5)	0.6 (0.4)	0.7 (0.3)	0.7 (0.2)	2.7	1.7	0.7	1.2
Malaysia	2.4 (2.8)	5.2 (3.8)	8.1 (3.8)	13 (4.0)	8.0	4.5	5.2	4.8
Philippines	1.2 (1.4)	2.5 (1.8)	4.6 (2.1)	8.0 (2.4)	7.4	6.3	5.7	6.0
Thailand	2.8 (3.3)	6.1 (4.4)	10.4 (4.8)	18 (5.5)	8.1	5.4	5.8	5.6
Vietnam	0.2 (0.2)	0.2 (0.2)	0.4 (0.2)	0.8 (0.2)	2.2	6.7	6.0	6.3
Hong Kong	0.4 (0.4)	0.5 (0.4)	0.7 (0.3)	0.8 (0.3)	2.7	3.3	2.3	2.8
Other Asian countries	2.0 (2.3)	3.4 (2.4)	4.6 (2.1)	6.4 (1.9)	5.5	3.2	3.4	3.3
Asian total	86 (100.0)	140 (100.0)	216 (100.0)	336 (100.0)	5.0	4.4	4.5	4.5
Developing Asia	28 (32.8)	67 (48.0)	137 (63.6)	254 (75.8)	9.1	7.4	6.4	6.9

Based on data from "World Motor Vehicle Statistics" published by the Japan Automobile Manufacturers Association, Inc. and other sources; forecast figures prepared by the IEEJ.

Results of the energy supply and demand forecast for the world, Asia, and Select Asian countries

- World
- Asia
- China
- Japan
- South Korea
- India
- Indonesia
- Malaysia
- Philippines
- Thailand

Results of the Energy Supply and Demand Forecast for the World, Asia, and Select Asian Countries

World

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	6,481	9,057	11,053	13,593	100	100	100	100	1.7	2.0	2.1	2.1
Coal	1,782	2,325	2,888	3,489	27	26	26	26	1.3	2.2	1.9	2.0
Oil	3,008	3,494	4,140	5,072	46	39	37	37	0.8	1.7	2.1	1.9
Natural gas	1,239	2,107	2,678	3,490	19	23	24	26	2.7	2.4	2.7	2.6
Nuclear	186	676	747	781	2.9	7.5	6.8	5.7	6.6	1.0	0.5	0.7
Hydro	148	223	282	339	2.3	2.5	2.6	2.5	2.1	2.4	1.8	2.1
Geothermal	12	45	73	123	0.2	0.5	0.7	0.9	6.6	5.1	5.4	5.2
Other renewables	106	187	246	299	1.6	2.1	2.2	2.2	2.9	2.8	2.0	2.4
Final energy consumption (million of toe)												
Total	4,684	6,103	7,308	8,900	100	100	100	100	1.3	1.8	2.0	1.9
Industry	1,896	2,154	2,482	2,944	40	35	34	33	0.6	1.4	1.7	1.6
Transportation	1,146	1,781	2,198	2,730	24	29	30	31	2.2	2.1	2.2	2.2
Residential/Commercial	1,466	1,987	2,412	2,974	31	33	33	33	1.5	2.0	2.1	2.0
Non-energy, etc.	176	180	216	251	3.8	3.0	3.0	2.8	0.1	1.8	1.5	1.7
Energy source												
Total	4,684	6,103	7,308	8,900	100	100	100	100	1.3	1.8	2.0	1.9
Coal	699	524	575	618	15	8.6	7.9	6.9	-1.4	0.9	0.7	0.8
Oil	2,347	2,970	3,565	4,379	50	49	49	49	1.2	1.8	2.1	2.0
Natural gas	832	1,151	1,326	1,578	18	19	18	18	1.6	1.4	1.8	1.6
Electricity	585	1,088	1,461	1,935	12	18	20	22	3.1	3.0	2.8	2.9
Heat	120	237	247	262	2.6	3.9	3.4	2.9	3.4	0.4	0.6	0.5
Renewables	100	133	135	128	2.1	2.2	1.8	1.4	1.4	0.1	-0.5	-0.2

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20				
Total	8,246	15,375	20,691	27,518	100	100	100	100	3.2	3.0	2.9	3.0
Coal	3,139	6,014	8,099	10,842	38	39	39	39	3.3	3.0	3.0	3.0
Oil	1,655	1,225	1,367	1,689	20	8.0	6.6	6.1	-1.5	1.1	2.1	1.6
Natural gas	991	2,679	4,604	7,318	12	17	22	27	5.1	5.6	4.7	5.2
Nuclear	713	2,591	2,867	2,998	8.7	17	14	11	6.7	1.0	0.5	0.7
Hydro	1,719	2,632	3,281	3,941	21	17	16	14	2.2	2.0	1.8	2.0
Geothermal	14	50	82	140	0.2	0.3	0.4	0.5	6.7	5.1	5.5	5.3
Other renewables	14	185	393	589	0.2	1.2	1.9	2.1	13.7	7.8	4.1	6.0
CO ₂ emissions (millions of tons of carbon-equivalent)												
Total	5,038	6,507	7,963	9,852	100	100	100	100	1.3	2.0	2.2	2.1
Coal-derived	1,925	2,512	3,119	3,768	38	39	39	38	1.3	2.2	1.9	2.0
Oil-derived	2,319	2,645	3,128	3,847	46	41	39	39	0.7	1.7	2.1	1.9
Natural-gas-derived	794	1,351	1,716	2,237	16	21	22	23	2.7	2.4	2.7	2.6
Energy and economic indicators												
GDP (billions of US dollars at 1995 value)												
Population (millions of people)	19,923	34,251	44,901	58,570	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
GDP per capita of population (US dollars at 1995 value/person)	4,505	6,179	6,949	7,710	1.6	1.6	1.6	1.6	1.6	1.2	1.0	1.1
Primary energy consumption per capita of population (toe/person)	4,423	5,544	6,461	7,596	1.1	1.1	1.1	1.1	1.5	1.5	1.6	1.6
Primary energy consumption per unit of GDP**	1.44	1.47	1.59	1.76	0.1	0.1	0.8	1.0	0.8	1.0	0.9	0.9
CO ₂ emissions per unit of GDP**	325	264	246	232	-1.03	-0.71	-0.71	-0.59	-0.65	-0.53	-0.61	-0.61
CO ₂ emissions per unit of primary energy consumption***	0.777	0.718	0.720	0.725	-0.39	0.03	0.06	0.04	0.03	0.06	0.06	0.04
Automobile ownership volume (millions of vehicles)	418	757	964	1,222	3.0	2.4	2.4	2.4	3.0	2.4	2.4	2.4
Automobile ownership volume per thousand of population (vehicles per thousand of population)	93	123	139	159	1.4	1.3	1.3	1.3	1.4	1.3	1.3	1.3

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Asia

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	1,054	2,423	3,335	4,570	100	100	100	100	4.2	3.2	3.2	3.2
Coal	469	1,049	1,384	1,811	44	43	41	40	4.1	2.8	2.7	2.8
Oil	485	938	1,246	1,720	46	39	37	38	3.3	2.9	3.3	3.1
Natural gas	52	237	392	598	4.9	9.8	12	13	7.9	5.1	4.3	4.7
Nuclear	25	132	189	247	2.4	5.4	5.7	5.4	8.6	3.7	2.7	3.2
Hydro	20	38	67	91	1.9	1.6	2.0	2.0	3.3	5.7	3.1	4.4
Geothermal	2.6	16	28	52	0.2	0.6	0.8	1.1	9.4	6.2	6.3	6.2
Other renewables	0.4	13	29	52	0	0.6	0.9	1.1	19.8	8.0	6.1	7.0
Final energy consumption (million of toe)												
Total	755	1,511	2,069	2,826	100	100	100	100	3.5	3.2	3.2	3.2
Industry	393	708	902	1,118	52	47	44	40	3.0	2.4	2.2	2.3
Transportation	133	346	522	786	18	23	25	28	4.9	4.2	4.2	4.2
Residential/Commercial	208	416	599	863	27	28	29	31	3.5	3.7	3.7	3.7
Non-energy, etc.	21	41	46	60	2.8	2.7	2.2	2.1	3.3	1.3	2.6	1.9
Energy source												
Total	755	1,511	2,069	2,826	100	100	100	100	3.5	3.2	3.2	3.2
Coal	302	346	394	427	40	23	19	15	0.7	1.3	0.8	1.1
Oil	333	763	1,048	1,471	44	50	51	52	4.2	3.2	3.4	3.3
Natural gas	25	94	156	240	3.3	6.2	7.5	8.5	6.9	5.2	4.4	4.8
Electricity	88	276	423	619	12	18	20	22	5.9	4.4	3.9	4.1
Heat	7.5	28	43	64	1.0	1.9	2.1	2.3	6.9	4.3	4.1	4.2
Renewables	0	3.7	4.0	4.4	0	0.2	0.2	0.2	-	0.7	1.1	0.9
Electricity generation (TWh)												
Total	1,193	3,966	6,089	8,985	100	100	100	100	6.2	4.4	4.0	4.2
Coal	301	2,037	3,177	4,896	25	51	52	54	10.0	4.5	4.4	4.5
Oil	470	384	382	420	39	9.7	6.3	4.7	-1.0	0.0	0.9	0.5

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	91	519	940	1,486	7.6	13	15	17	9.1	6.1	4.7	5.4
Nuclear	97	505	726	949	8.2	13	12	11	8.6	3.7	2.7	3.2
Hydro	231	480	777	1,057	19	12	13	12	3.7	4.9	3.1	4.0
Geothermal	3.0	18	33	60	0.2	0.4	0.5	0.7	9.4	6.2	6.3	6.3
Other renewables	0	2.2	5.4	11.6	0	0.6	0.9	1.3	-	9.4	7.9	8.6
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	916	1,975	2,669	3,627	100	100	100	100	3.9	3.1	3.1	3.1
Coal-derived	507	1,133	1,494	1,955	55	57	56	54	4.1	2.8	2.7	2.8
Oil-derived	376	690	923	1,288	41	35	35	36	3.1	3.0	3.4	3.2
Natural-gas-derived	33	152	251	383	3.6	7.7	9.4	11	7.9	5.1	4.3	4.7
Energy and economic indicators												
					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
GDP (billions of US dollars at 1995 value)					4,302	9,361	12,905	17,805	4.0	3.3	3.3	3.3
Population (millions of people)					2,413	3,322	3,719	4,095	1.6	1.1	1.0	1.1
GDP per capita of population (US dollars at 1995 value/person)					1,782	2,818	3,470	4,348	2.3	2.1	2.3	2.2
Primary energy consumption per capita of population (toe/person)					0.44	0.73	0.90	1.12	2.6	2.1	2.2	2.1
Primary energy consumption per unit of GDP*					245	259	258	257	0.27	-0.02	-0.07	-0.04
CO ₂ emissions per unit of GDP**					213	211	207	204	-0.05	-0.20	-0.15	-0.18
CO ₂ emissions per unit of primary energy consumption***					0.869	0.815	0.800	0.794	-0.32	-0.18	-0.09	-0.13
Automobile ownership volume (millions of vehicles)					48	140	216	336	5.5	4.4	4.5	4.5
Automobile ownership volume per thousand of population (vehicles per thousand of population)					20	42	58	82	3.8	3.3	3.5	3.4

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

China

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	413	932	1,406	2,063	100	100	100	100	4.2	4.2	4.2	3.9
Coal	307	656	878	1,158	74	70	62	56	3.9	3.0	2.8	2.9
Oil	89	222	366	592	22	24	26	29	4.7	5.1	4.9	5.0
Natural gas	12	28	79	162	2.9	3.0	5.6	7.8	4.4	10.9	7.4	9.1
Nuclear	0	4.4	31	61	0	0.5	2.2	3.0	-	21.5	7.2	14.1
Hydro	5.0	19	37	54	1.2	2.1	2.6	2.6	6.9	6.8	3.8	5.3
Geothermal	0	0.1	0.3	0.5	0	0	0	0	-	6.1	7.2	6.6
Other renewables	0.3	3.5	15	35	0	0.4	1.0	1.7	12.8	15.6	9.1	12.3
Final energy consumption (million of toe)												
Total	313	559	826	1,195	100	100	100	100	2.9	4.0	3.8	3.9
Industry	188	319	407	489	60	57	49	41	2.7	2.5	1.9	2.2
Transportation	25	74	153	278	7.8	13	18	23	5.7	7.5	6.2	6.8
Residential/Commercial	92	153	250	407	29	27	30	34	2.6	5.0	5.0	5.0
Non-energy, etc.	8.3	13	17	22	2.7	2.4	2.0	1.8	2.4	2.3	2.6	2.4
Energy source												
Total	313	559	826	1,195	100	100	100	100	2.9	4.0	3.8	3.9
Coal	218	247	279	290	70	44	34	24	0.6	1.2	0.4	0.8
Oil	59	179	310	508	19	32	38	43	5.7	5.7	5.1	5.4
Natural gas	6.8	18	37	75	2.2	3.2	4.5	6.3	4.9	7.7	7.2	7.5
Electricity	21	90	161	263	6.8	16	20	22	7.4	6.0	5.0	5.5
Heat	7.4	25	39	58	2.4	4.6	4.7	4.9	6.4	4.3	4.1	4.2
Renewables	0	0	0	0	0	0	0	0	-	-	-	-
Electricity generation (TWh)												
Total	301	1,357	2,477	4,061	100	100	100	100	7.8	6.2	5.1	5.6
Coal	164	1,062	1,770	2,853	55	78	71	70	9.8	5.2	4.9	5.1
Oil	78	46	46	46	26	3.4	1.9	1.1	-2.6	0.0	0.0	0.0

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	0.7	6.4	94	234	0.2	0.5	3.8	5.8	11.8	30.9	9.5	19.7
Nuclear	0	17	117	235	0	1.2	4.7	5.8	-	21.5	7.2	14.1
Hydro	58	222	429	624	19	16	17	15	6.9	6.8	3.8	5.3
Geothermal	0	0.2	0.3	0.6	0	0	0	0	-	6.1	7.2	6.6
Other renewables	0	2.8	20	69	0	0.2	0.8	1.7	-	21.3	13.4	17.3
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	413	900	1,285	1,819	100	100	100	100	4.0	3.6	3.5	3.6
Coal-derived	331	708	949	1,251	80	79	74	69	3.9	3.0	2.8	2.9
Oil-derived	75	174	285	464	18	19	22	26	4.3	5.1	5.0	5.0
Natural-gas-derived	7.7	18	51	104	1.9	2.0	3.9	5.7	4.4	10.9	7.4	9.1
Energy and economic indicators												
GDP (billions of US dollars at 1995 value)												
Population (millions of people)												
GDP per capita of population (US dollars at 1995 value/person)												
Primary energy consumption per capita of population (toe/person)												
Primary energy consumption per unit of GDP*												
CO ₂ emissions per unit of GDP**												
CO ₂ emissions per unit of primary energy consumption***												
Automobile ownership volume (millions of vehicles)												
Automobile ownership volume per thousand of population (vehicles per thousand of population)												
1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20	
164	1,042	2,200	4,184	164	1,042	2,200	4,184	9.7	7.8	6.6	7.2	
987	1,270	1,355	1,442	987	1,270	1,355	1,442	1.3	0.7	0.6	0.6	
166	821	1,623	2,902	166	821	1,623	2,902	8.3	7.1	6.0	6.5	
0.42	0.59	0.73	0.91	0.42	0.59	0.73	0.91	1.7	2.2	2.2	2.2	
2,524	892	639	493	2,524	892	639	493	-5.07	-3.28	-2.56	-2.92	
2,526	864	584	435	2,526	864	584	435	-5.22	-3.84	-2.91	-3.38	
1.001	1.011	0.969	0.936	1.001	1.011	0.969	0.936	0.05	-0.43	-0.34	-0.39	
1.8	16	52	119	1.8	16	52	119	11.6	12.5	8.6	10.5	
1.8	13	38	82	1.8	13	38	82	10.2	11.7	7.9	9.8	

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Japan

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	347	525	543	561	100	100	100	100	2.1	2.1	0.3	0.3
Coal	60	94	97	101	17	18	18	18	2.3	2.3	0.4	0.4
Oil	236	265	260	253	68	51	48	45	0.6	0.6	-0.2	-0.2
Natural gas	21	65	77	84	6.2	12	14	15	5.7	5.7	1.7	0.9
Nuclear	22	84	91	104	6.2	16	17	19	7.0	7.0	0.8	1.4
Hydro	7.6	7.5	7.6	7.6	2.2	1.4	1.4	1.4	-0.1	-0.1	0.1	0.0
Geothermal	0.8	3.1	3.3	3.5	0.2	0.6	0.6	0.6	7.2	7.2	0.7	0.4
Other renewables	0	6.5	6.8	7.8	0	1.2	1.3	1.4	37.0	37.0	0.5	1.4
Final energy consumption (million of toe)												
Sector	233	347	356	361	100	100	100	100	2.0	2.0	0.3	0.1
Total	111	137	134	138	47	40	38	38	1.1	1.1	-0.2	0.3
Industry	55	94	93	88	24	27	26	24	2.7	2.7	-0.1	-0.5
Transportation	59	106	119	125	25	30	33	35	3.0	3.0	1.2	0.5
Residential/Commercial	8.3	9.8	9.8	9.8	3.5	2.8	2.8	2.7	0.8	0.8	0.1	-0.1
Non-energy, etc.												
Energy source	233	347	356	361	100	100	100	100	2.0	2.0	0.3	0.1
Total	21	22	19	18	9.2	6.2	5.3	5.0	0.1	0.1	-1.3	-0.6
Coal	158	215	210	203	68	62	59	56	1.6	1.6	-0.2	-0.3
Oil	9.7	23	27	31	4.2	6.7	7.7	8.5	4.5	4.5	1.6	1.1
Natural gas	44	83	95	104	19	24	27	29	3.2	3.2	1.4	0.9
Electricity	0.1	0.5	0.5	0.5	0	0.2	0.1	0.1	8.7	8.7	-0.6	0.0
Heat	0	3.6	3.5	3.8	0	1.0	1.0	1.0	-	-	0.0	0.6
Electricity generation (TWh)												
Total	573	1,082	1,218	1,314	100	100	100	100	3.2	3.2	1.2	0.8
Coal	55	254	294	328	9.6	24	24	25	8.0	8.0	1.5	1.1
Oil	265	159	165	148	46	15	14	11	-2.5	-2.5	0.4	-1.1

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	81	239	299	323	14	22	25	25	5.6	5.6	2.3	0.8
Nuclear	83	322	350	401	14	30	29	30	7.0	7.0	0.8	1.4
Hydro	88	87	88	88	15	8.1	7.2	6.7	-0.1	-0.1	0.1	0.0
Geothermal	0.9	3.3	3.6	3.8	0.2	0.3	0.3	0.3	6.8	6.8	0.7	0.4
Other renewables	0	17	19	23	0	1.5	1.6	1.8	-	-	1.3	2.0
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	255	331	342	344	100	100	100	100	1.3	1.3	0.3	0.1
Coal-derived	64	101	105	109	25	31	31	32	2.3	2.3	0.4	0.3
Oil-derived	177	188	187	182	69	57	55	53	0.3	0.3	0.0	-0.3
Natural-gas-derived	14	42	49	54	5.4	13	14	16	5.7	5.7	1.7	0.9
Energy and economic indicators												
GDP (billions of US dollars at 1995 value)					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Population (millions of people)					3,304	5,688	6,595	7,373	2.8	1.5	1.1	1.3
GDP per capita at 1995 value/person					117	127	127	124	0.4	0.0	-0.3	-0.1
Primary energy consumption per capita of population (toe/person)					28,296	44,830	51,745	59,448	2.3	1.4	1.4	1.4
Primary energy consumption per unit of GDP*					2.97	3.55	4.14	4.21	0.9	1.5	0.2	0.8
CO ₂ emissions per unit of GDP**					105	92	82	76	-0.64	-1.13	-0.80	-0.96
CO ₂ emissions per unit of primary energy consumption***					77	58	52	47	-1.41	-1.15	-1.04	-1.09
Automobile ownership volume (millions of vehicles)					0.736	0.669	0.630	0.631	-0.48	-0.60	0.01	-0.29
Automobile ownership volume per thousand of population (vehicles per thousand of population)					38	73	79	81	3.3	0.8	0.3	0.6
Automobile ownership volume per thousand of population					324	573	617	657	2.9	0.8	0.6	0.7

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

South Korea

Primary energy consumption (Millions of toe)	Share (%)				AAGR (%)								
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20	
Total	41	191	262	303	100	100	100	100	8.0	3.2	3.2	1.5	2.3
Coal	13	39	63	66	33	21	24	22	5.5	4.9	0.4	2.6	1.8
Oil	27	104	124	137	65	54	47	45	7.0	1.8	1.0	1.4	1.4
Natural gas	0	17	28	44	0	8.9	11	15	-	5.2	4.6	4.9	4.9
Nuclear	0.9	28	43	52	2.2	15	16	17	18.8	4.2	1.9	3.0	3.0
Hydro	0.2	0.3	0.4	0.4	0.4	0.2	0.1	0.1	3.6	0.6	0.5	0.5	0.5
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-	-
Other renewables	0	2.2	3.6	4.6	0	1.1	1.4	1.5	-	5.1	2.6	3.9	3.9
Final energy consumption (million of toe)													
Total	31	126	172	202	100	100	100	100	7.2	3.1	1.6	2.4	2.4
Industry	13	56	72	79	41	44	42	39	7.6	2.6	0.9	1.8	1.8
Transportation	5.1	30	44	53	16	24	25	26	9.3	3.8	2.0	2.9	2.9
Residential/Commercial	13	38	52	64	42	30	30	32	5.4	3.3	2.1	2.7	2.7
Non-energy, etc.	0.3	2.2	3.7	4.9	1.0	1.8	2.2	2.4	10.1	5.3	2.9	4.1	4.1
Energy source													
Total	31	126	172	202	100	100	100	100	7.2	3.1	1.6	2.4	2.4
Coal	9.7	6.7	8.1	8.3	31	5.3	4.7	4.1	-1.9	2.0	0.2	1.1	1.1
Oil	19	86	107	119	60	68	62	59	7.9	2.2	1.1	1.6	1.6
Natural gas	0	11	21	30	0	8.7	12	15	-	6.9	3.6	5.2	5.2
Electricity	2.8	20	32	39	9.0	16	19	19	10.3	4.8	2.0	3.4	3.4
Heat	0	2.2	3.6	5.1	0	1.8	2.1	2.5	-	5.0	3.6	4.3	4.3
Renewables	0	0.1	0.2	0.2	0	0.1	0	0	-	0.6	0.7	0.6	0.6
Electricity generation (TWh)													
Total	37	264	407	496	100	100	100	100	10.3	4.4	2.0	3.2	3.2
Coal	2.5	98	180	198	6.7	37	44	40	20.2	6.3	0.9	3.6	3.6
Oil	29	25	22	18	79	9.3	5.3	3.7	-0.9	-1.2	-1.6	-1.4	-1.4

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Electricity generation (TWh)	Share (%)				AAGR (%)								
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20	
Natural gas	0	28	32	70	0	11	7.8	14	-	1.2	8.2	4.7	4.7
Nuclear	3.5	109	165	199	9.3	41	40	40	18.8	4.2	1.9	3.0	3.0
Hydro	2.0	4.0	4.2	4.4	5.3	1.5	1.0	0.9	3.6	0.6	0.5	0.5	0.5
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-	-
Other renewables	0	0.5	3.9	5.6	0	0.2	1.0	1.1	-	23.5	3.7	13.2	13.2
CO ₂ emissions (Millions of tons of carbon-equivalent)													
Total	34	118	161	182	100	100	100	100	6.4	3.2	1.2	2.2	2.2
Coal-derived	15	43	68	71	42	36	42	39	5.5	4.9	0.4	2.6	2.6
Oil-derived	20	65	75	82	58	55	46	45	6.1	1.5	1.0	1.2	1.2
Natural-gas-derived	0	11	18	28	0	9.2	11	16	-	5.2	4.6	4.9	4.9
Energy and economic indicators													
GDP (billions of US dollars at 1995 value)													
Population (millions of people)													
GDP per capita of population (US dollars at 1995 value/person)													
Primary energy consumption per capita of population (toe/person)													
Primary energy consumption per unit of GDP*													
CO ₂ emissions per unit of GDP**													
CO ₂ emissions per unit of primary energy consumption***													
Automobile ownership volume (millions of vehicles)													
Automobile ownership volume per thousand of population (vehicles per thousand of population)													
Primary energy consumption per capita of population													
GDP (billions of US dollars at 1995 value)													
Population (millions of people)													
GDP per capita of population (US dollars at 1995 value/person)													
Primary energy consumption per capita of population (toe/person)													
Primary energy consumption per unit of GDP*													
CO ₂ emissions per unit of GDP**													
CO ₂ emissions per unit of primary energy consumption***													
Automobile ownership volume (millions of vehicles)													
Automobile ownership volume per thousand of population (vehicles per thousand of population)													

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

India

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	95	322	452	684	100	100	100	100	6.3	3.4	4.2	3.8
Coal	55	176	217	305	58	55	48	45	5.9	2.1	3.5	2.8
Oil	34	112	172	278	36	35	38	41	6.2	4.4	4.9	4.6
Natural gas	1.3	2.3	4.3	7.1	1.3	7.2	10	10	15.6	6.5	5.0	5.8
Nuclear	0.8	4.4	8.6	15	0.8	1.4	1.9	2.2	9.0	6.9	5.5	6.2
Hydro	4.0	6.4	10	14	4.2	2.0	2.3	2.0	2.4	5.0	2.8	3.9
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	0.3	0.7	1.0	0	0	0.1	0.1	-	10.1	4.0	7.0
Final energy consumption (million of toe)												
Total	63	177	271	430	100	100	100	100	5.3	4.3	4.7	4.5
Industry	27	78	111	166	43	44	41	39	5.5	3.5	4.1	3.8
Transportation	18	45	83	143	29	25	31	33	4.5	6.4	5.6	6.0
Residential/Commercial	16	46	69	109	25	26	25	25	5.5	4.2	4.6	4.4
Non-energy, etc.	2.2	8.7	8.0	12	3.5	4.9	3.0	2.9	7.1	-0.8	4.3	1.7
Energy source												
Total	63	177	271	430	100	100	100	100	5.3	4.3	4.7	4.5
Coal	27	35	41	49	43	20	15	11	1.3	1.6	1.8	1.7
Oil	28	100	160	265	44	56	59	62	6.6	4.8	5.2	5.0
Natural gas	0.7	1.2	2.0	3.1	1.1	6.6	7.2	7.1	15.0	5.4	4.5	5.0
Electricity	7.7	31	51	85	12	18	19	20	7.2	5.0	5.3	5.2
Heat	0	0	0	0	0	0	0	0	-	-	-	-
Renewables	0	0	0	0	0	0	0	0	-	-	-	-

Electricity generation (TWh)

Total	119	554	860	1,405	100	100	100	100	8.0	4.5	5.0	4.8
Coal	60	434	600	987	51	78	70	70	10.4	3.3	5.1	4.2
Oil	8.2	7.5	9.7	17	6.9	1.4	1.1	1.2	-0.4	2.5	5.8	4.2

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	1.2	2.0	89	173	1.0	3.6	10	12	15.2	16.1	6.9	11.4
Nuclear	3.0	17	33	56	2.5	3.1	3.8	4.0	9.0	6.9	5.5	6.2
Hydro	47	75	122	161	39	13	14	11	2.4	5.0	2.9	3.9
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	1.6	6.3	10	0	0.3	0.7	0.7	-	14.9	4.7	9.7

CO₂ emissions (Millions of tons of carbon-equivalent)

Total	85	281	386	577	100	100	100	100	6.2	3.2	4.1	3.7
Coal-derived	60	190	234	330	70	68	61	57	5.9	2.1	3.5	2.8
Oil-derived	24	76	124	201	29	27	32	35	5.9	5.0	5.0	5.0
Natural-gas-derived	0.8	15	28	45	1.0	5.3	7.2	7.9	15.6	6.5	5.0	5.8

Energy and economic indicators

	AAGR (%)							
	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
GDP (billions of US dollars at 1995 value)	162	482	841	1,436	5.6	5.7	5.5	5.6
Population (millions of people)	687	1,016	1,173	1,302	2.0	4.2	1.0	1.2
GDP per capita of population (US dollars at 1995 value/person)	235	474	717	1,103	3.6	4.2	4.4	4.3
Primary energy consumption per capita of population (toe/person)	0.14	0.22	0.32	0.36	2.4	3.7	1.3	2.5
Primary energy consumption per unit of GDP*	589	668	538	476	0.63	-2.15	-1.20	-1.67
CO ₂ emissions per unit of GDP**	526	582	459	402	0.51	-2.36	-1.32	-1.84
CO ₂ emissions per unit of primary energy consumption***	0.892	0.896	0.871	0.866	0.02	-0.28	-0.06	-0.17
Automobile ownership volume (millions of vehicles)	1.7	9.4	20	38	9.0	7.9	6.6	7.3
Automobile ownership volume per thousand of population (vehicles per thousand of population)	2.4	9.3	17	30	6.9	6.4	5.5	6.0

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Indonesia

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	26	98	144	209	100	100	100	100	6.8	6.8	3.9	3.8
Coal	0.2	14	25	39	0.6	14	18	19	24.6	24.6	6.4	4.4
Oil	21	53	76	109	80	54	53	52	4.7	3.7	3.7	3.7
Natural gas	4.9	28	40	57	19	29	28	27	9.1	3.4	3.6	3.5
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	0.1	0.8	0.9	1.2	0.4	0.8	0.6	0.6	10.0	0.9	3.0	2.0
Geothermal	0	2.3	2.1	2.8	0	2.3	1.4	1.3	-	-1.0	3.0	1.0
Other renewables	0	0	0.1	0.2	0	0	0	0	-	-	4.0	-
Final energy consumption (million of toe)												
Sector	21	67	99	144	100	100	100	100	6.1	4.0	3.8	3.9
Total	7.7	23	36	52	37	35	36	36	5.7	4.4	3.9	4.2
Industry	6.2	21	30	43	30	32	30	30	6.4	3.4	3.7	3.6
Transportation	6.4	21	33	47	31	32	33	33	6.2	4.3	3.7	4.0
Residential/Commercial	0.3	0.7	1.0	1.4	1.2	1.1	1.0	1.0	5.4	3.0	3.6	3.3
Non-energy, etc.												
Energy source	21	67	99	144	100	100	100	100	6.1	4.0	3.8	3.9
Total	0.1	5.7	7.0	9.2	0.6	8.6	7.1	6.4	21.4	2.1	2.8	2.4
Coal	17	45	63	87	85	68	64	61	4.8	3.4	3.3	3.4
Oil	2.4	9.1	17	26	12	14	17	18	7.0	6.3	4.5	5.4
Natural gas	0.6	6.8	12	21	2.7	10	12	15	13.3	6.0	5.6	5.8
Electricity	0	0	0	0	0	0	0	0	-	-	-	-
Heat	0	0	0	0	0	0	0	0	-	-	-	-
Electricity generation (TWh)												
Total	8.4	93	167	288	100	100	100	100	12.7	6.0	5.6	5.8
Coal	0	29	72	129	0	31	43	45	-	9.7	6.0	7.8
Oil	7.1	20	28	46	84	22	17	16	5.4	3.3	5.2	4.2

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	0	32	52	93	0	34	31	32	-	5.1	5.9	5.5
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	1.3	9.1	10.0	13	16	9.8	6.0	4.7	10.0	0.9	3.0	2.0
Geothermal	0	2.6	2.4	3.2	0	2.9	1.4	1.1	-	-1.0	3.0	1.0
Other renewables	0	0	1.5	2.3	0	0	0.9	0.8	-	-	4.0	-
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	21	76	116	169	100	100	100	100	6.7	4.2	3.9	4.0
Coal-derived	0.2	15	28	42	0.9	19	24	25	24.6	6.4	4.4	5.4
Oil-derived	17	44	63	90	84	57	54	53	4.7	3.7	3.7	3.7
Natural-gas-derived	3.2	18	25	36	15	24	22	21	9.1	3.4	3.6	3.5
Energy and economic indicators												
GDP (billions of US dollars at 1995 value)					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Population (millions of people)					75	209	318	494	5.3	4.3	4.5	4.4
GDP per capita of population (US dollars at 1995 value/person)					148	210	240	274	1.8	1.3	1.3	1.3
Primary energy consumption per capita of population (toe/person)					0.18	0.29	0.47	0.55	2.5	4.8	1.7	3.2
Primary energy consumption per unit of GDP*					352	470	454	423	1.45	-0.34	-0.69	-0.52
CO ₂ emissions per unit of GDP**					278	366	363	342	1.38	-0.07	-0.61	-0.34
CO ₂ emissions per unit of primary energy consumption***					0.790	0.759	0.779	0.791	-0.20	0.25	0.15	0.20
Automobile ownership volume (millions of vehicles)					1.3	5.5	7.9	12	7.5	3.6	4.1	3.9
Automobile ownership volume per thousand of population (vehicles per thousand of population)					8,723	26,145	32,732	42,781	5.6	2.3	2.7	2.5

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Malaysia

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	11	47	74	110	100	100	100	100	7.7	4.6	4.0	4.3
Coal	0	1.7	8.9	14	0.5	3.5	12	13	18.8	18.2	4.7	11.2
Oil	8.4	2.3	37	60	79	49	50	55	5.2	4.9	4.9	4.9
Natural gas	2.0	2.2	27	34	19	46	36	31	12.6	2.1	2.5	2.3
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	0.1	0.6	1.0	1.6	1.1	1.3	1.3	1.5	8.4	5.0	5.0	5.0
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	0	0	0	0	0	0	0	-100.0	-	-	-
Final energy consumption (million of toe)												
Total	6.5	29	47	73	100	100	100	100	7.9	4.9	4.4	4.6
Industry	2.9	1.3	22	33	45	43	47	46	7.6	5.9	4.0	4.9
Transportation	2.5	1.2	18	30	38	41	39	41	8.3	4.4	4.8	4.6
Residential/Commercial	0.8	4.0	5.1	8.2	13	14	11	11	8.1	2.6	4.8	3.7
Non-energy, etc.	0.3	0.6	1.1	1.6	4.2	2.1	2.4	2.3	4.3	6.0	3.9	5.0
Energy source												
Total	6.5	29	47	73	100	100	100	100	7.9	4.9	4.4	4.6
Coal	0	1.0	1.6	2.2	0.8	3.4	3.4	3.0	15.8	5.0	3.2	4.1
Oil	5.6	2.0	31	47	87	67	65	65	6.4	4.6	4.4	4.5
Natural gas	0	3.5	5.2	8.5	0.5	1.2	11	12	26.6	4.2	5.0	4.6
Electricity	0.7	5.3	9.6	15	1.2	1.8	20	21	10.3	6.2	4.6	5.4
Heat	0	0	0	0	0	0	0	0	-	-	-	-
Renewables	0	0	0	0	0	0	0	0	-	-	-	-
Electricity generation (TWh)												
Total	10	69	126	197	100	100	100	100	10.1	6.2	4.5	5.4
Coal	0	1.8	34	59	0	2.6	27	30	-	34.1	5.5	19.0
Oil	8.5	6.1	0.3	0.5	8.5	8.8	0.3	0.3	-1.7	-24.9	4.5	-11.4

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	0.1	54	80	119	1.2	79	63	60	35.6	4.0	4.0	4.0
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	1.4	7.0	11	18	14	10	9.0	9.4	8.4	5.0	5.0	5.0
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	0	0	0	0	0	0	0	-	-	-	-
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	8.1	34	57	86	100	100	100	100	7.5	5.1	4.2	4.7
Coal-derived	0	1.8	9.6	15	0.7	5.2	17	18	18.8	18.2	4.7	11.2
Oil-derived	6.8	19	30	49	83	54	53	57	5.2	4.9	4.9	4.9
Natural-gas-derived	1.3	14	17	22	16	40	30	26	12.6	2.1	2.5	2.3
Energy and economic indicators												
					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
GDP (billions of US dollars at 1995 value)						32	112	178	290	6.5	4.8	5.0
Population (millions of people)						14	23	29	35	2.7	2.0	2.1
GDP per capita of population						2,297	4,797	6,165	8,254	3.7	2.5	3.0
(US dollars at 1995 value/person)												
Primary energy consumption per capita of population						0.77	1.12	2.02	2.30	1.9	6.1	1.3
(toe/person)												
Primary energy consumption per unit of GDP*						334	421	413	377	1.16	-0.18	-0.91
CO ₂ emissions per unit of GDP**						257	309	319	295	0.92	0.33	-0.77
CO ₂ emissions per unit of primary energy consumption***						0.769	0.765	0.733	0.763	-0.03	-0.42	0.40
Automobile ownership volume (millions of vehicles)						0.9	5.2	8.1	13	9.2	4.5	5.2
Automobile ownership volume per thousand of population						65	225	261	366	6.4	1.5	3.5
(vehicles per thousand of population)												

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Philippines

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	13	33	57	96	100	100	100	100	4.6	4.6	5.6	5.5
Coal	0.4	5.0	5.1	6.9	2.7	15	9.0	7.2	14.1	7.2	0.2	3.1
Oil	1.1	17	25	40	8.2	52	45	42	2.3	4.0	4.0	4.7
Natural gas	0	0	2.2	2.0	0	0	3.9	2.1	-	73.4	-0.9	31.1
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	0.3	0.7	1.3	2.2	2.3	2.0	2.3	2.3	4.1	7.0	5.2	6.1
Geothermal	1.8	10.0	23	45	13	30	40	47	9.0	8.5	7.1	7.8
Other renewables	0	0	0	0	0	0	0	0	-	-	-	-
Final energy consumption (million of toe)												
Sector	7.9	18	29	47	100	100	100	100	4.1	4.1	5.2	4.9
Total	3.1	3.6	4.7	6.0	39	20	16	13	0.8	0.8	2.7	2.6
Industry	1.9	8.3	15	25	24	47	52	54	7.5	6.1	5.3	5.7
Transportation	2.7	5.3	8.7	15	33	30	30	31	3.5	5.0	5.3	5.1
Residential/Commercial	0.3	0.4	0.7	1.2	3.4	2.1	2.4	2.5	1.7	6.4	5.2	5.8
Non-energy, etc.												
Energy source	7.9	18	29	47	100	100	100	100	4.1	4.1	5.2	4.9
Total	0.2	0.8	0.7	0.9	2.6	4.6	2.4	2.0	7.1	-1.6	3.0	0.7
Coal	6.3	14	23	38	79	77	79	80	4.0	5.4	5.0	5.2
Oil	0	0	0	0	0	0	0	0	-	-	-	-
Natural gas	1.5	3.1	5.2	8.4	18	18	18	18	3.9	5.2	4.8	5.0
Electricity	0	0	0	0	0	0	0	0	-	-	-	-
Heat	0	0	0	0	0	0	0	0	-	-	-	-
Electricity generation (TWh)												
Total	18	45	73	116	100	100	100	100	4.7	4.7	4.9	4.7
Coal	0.2	17	18	26	1.0	37	25	23	25.4	1.0	3.6	2.3
Oil	12	9.2	2.8	1.7	6.8	2.0	3.8	1.5	-1.4	-11.2	-4.9	-8.1

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	0	0	10	10.0	0	0	14	8.6	-	89.8	-0.3	37.5
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	3.5	7.8	15	25	2.0	17	21	22	4.1	7.0	5.2	6.1
Geothermal	2.1	12	26	52	12	26	36	45	9.0	8.5	7.1	7.8
Other renewables	0	0	0	0	0	0	0	0	-	-	-	-
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	9.2	2.0	28	41	100	100	100	100	3.9	3.5	4.1	3.8
Coal-derived	0.4	5.4	5.5	7.5	4.3	28	20	18	14.1	0.2	3.1	1.6
Oil-derived	8.8	14	21	33	96	72	75	79	2.4	3.9	4.6	4.3
Natural-gas-derived	0	0	1.4	1.3	0	0	5.1	3.1	-	73.4	-0.9	31.1
Energy and economic indicators												
GDP (billions of US dollars at 1995 value)					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Population (millions of people)					56	88	136	206	2.3	4.4	4.2	4.3
GDP per capita of population (US dollars at 1995 value/person)					48	76	90	107	2.3	1.8	1.7	1.8
Primary energy consumption per capita of population (toe/person)					1,173	1,167	1,503	1,921	0.0	2.6	2.5	2.5
Primary energy consumption per unit of GDP*					0.28	0.30	0.44	0.53	0.4	3.7	2.0	2.9
CO ₂ emissions per unit of GDP**					236	373	416	467	2.31	1.11	1.16	1.13
CO ₂ emissions per unit of primary energy consumption***					163	222	204	201	1.58	-0.88	-0.13	-0.50
Automobile ownership volume (millions of vehicles)					0.689	0.606	0.597	0.521	-0.64	-0.15	-1.35	-0.75
Automobile ownership volume per thousand of population (vehicles per thousand of population)					0.9	2.5	4.6	8.0	5.5	6.3	5.7	6.0
					18	33	51	75	3.1	4.4	3.9	4.2

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

Thailand

Primary energy consumption (Millions of toe)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Total	12	58	89	145	100	100	100	100	8.1	14.8	14.8	4.7
Coal	0.5	7.5	13	20	3.9	13	14	14	14.8	5.3	4.4	4.9
Oil	12	32	42	65	95	55	48	45	5.3	2.8	4.4	3.6
Natural gas	0	18	31	58	0	30	36	40	-	6.0	6.3	6.2
Nuclear	0	0	0	0	0	0	0	0	0	-	-	-
Hydro	0.1	0.5	0.6	0.8	0.9	0.9	0.7	0.5	8.1	2.3	2.0	2.1
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	0.2	1.6	1.6	0.5	0.4	1.8	1.1	6.7	21.1	-0.1	10.0
Final energy consumption (million of toe)												
Total	9.2	42	64	102	100	100	100	100	7.9	4.2	4.8	4.5
Industry	2.7	15	23	35	29	36	36	35	9.1	4.3	4.3	4.3
Transportation	4.0	17	28	46	43	41	43	45	7.6	4.7	5.2	4.9
Residential/Commercial	2.4	8.5	12	19	26	20	18	18	6.6	3.1	4.9	4.0
Non-energy, etc.	0.2	1.0	1.3	2.4	1.7	2.3	2.1	2.4	9.5	3.3	6.0	4.7
Energy source												
Total	9.2	42	64	102	100	100	100	100	7.9	4.2	4.8	4.5
Coal	0	3.4	7.0	12	1.0	8.2	11	12	19.7	7.3	5.5	6.4
Oil	8.0	30	42	65	87	71	66	64	6.8	3.5	4.4	4.0
Natural gas	0	1.3	1.5	2.6	0	3.0	2.3	2.6	-	1.7	5.9	3.7
Electricity	1.1	7.6	13	22	12	18	20	22	10.0	5.4	5.6	5.5
Heat	0	0	0	0	0	0	0	0	-	-	-	-
Renewables	0	0	0	0	0	0	0	0	-	-	-	-
Electricity generation (TWh)												
Total	14	94	150	270	100	100	100	100	9.9	4.7	6.1	5.4
Coal	1.4	18	25	37	9.8	19	17	14	13.5	3.7	3.8	3.7
Oil	12	10.0	1.4	2.6	81	10.6	0.9	1.0	-0.8	-17.8	6.3	-6.5

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Electricity generation (TWh)	Share (%)					AAGR (%)						
	1980	2000	2010	2020	1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
Natural gas	0	61	114	219	0	64	76	81	-	6.5	6.8	6.6
Nuclear	0	0	0	0	0	0	0	0	-	-	-	-
Hydro	1.3	6.0	7.5	9.2	8.8	6.4	5.0	3.4	8.1	2.3	2.0	2.1
Geothermal	0	0	0	0	0	0	0	0	-	-	-	-
Other renewables	0	0.0	1.5	1.8	0	0.0	1.0	0.7	-	94.0	1.8	40.5
CO ₂ emissions (Millions of tons of carbon-equivalent)												
Total	10	46	68	111	100	100	100	100	7.9	4.0	5.0	4.5
Coal-derived	0.5	8.1	14	21	5.0	18	20	19	14.8	5.3	4.5	4.9
Oil-derived	9.6	27	34	53	95	58	50	48	5.3	2.5	4.4	3.4
Natural-gas-derived	0	11	20	37	0	24	30	33	-	6.0	6.3	6.2
Energy and economic indicators												
					1980	2000	2010	2020	1980-00	2000-10	2010-20	2000-20
GDP (billions of US dollars at 1995 value)												
					52	172	293	477	6.1	5.5	5.0	5.2
Population (millions of people)												
					47	61	66	70	1.3	0.8	0.6	0.7
GDP per capita of population (US dollars at 1995 value/person)												
					1,117	2,826	4,458	6,812	4.7	4.7	4.3	4.5
Primary energy consumption per capita of population (toe/person)												
					0.26	0.51	0.95	1.16	3.5	6.4	2.0	4.2
Primary energy consumption per unit of GDP*												
					233	337	302	304	1.86	-1.08	0.05	-0.52
CO ₂ emissions per unit of GDP**												
					194	269	232	233	1.64	-1.46	0.01	-0.73
CO ₂ emissions per unit of primary energy consumption***												
					0.834	0.820	0.798	0.777	-0.08	-0.27	-0.28	-0.27
Automobile ownership volume (millions of vehicles)												
					0.9	6.1	10	18	10.2	5.4	5.8	5.6
Automobile ownership volume per thousand of population (vehicles per thousand of population)												
					19	101	158	261	8.7	4.6	5.2	4.9

* Toe/millions of US dollar at 1995 value

** Tons of carbon-equivalent/millions of US dollar at 1995 value

*** Tons of carbon-equivalent/toe

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