

Chapter 7

Energy



A view of "*uchi-mizu*" (water-sprinkling) in summertime, performed in Ginza, Chuo-ku, Tokyo. This traditional way of cooling off is enjoyed by people from all walks of life.

1. Supply and Demand

Japan is dependent on imports for 81.2 percent of its energy supply. Since experiencing the two oil crises of the 1970s, Japan has taken measures to promote energy conservation, introduce alternatives to petroleum, and secure a stable supply of petroleum through stockpiling and other measures. As a result, its dependence on petroleum declined from 77.4 percent in fiscal 1973 to 45.2 percent in fiscal 2009. However, Japan is growing increasingly dependent on fossil fuels (including natural gas and coal) other than petroleum and this calls for steps such as the greater use of non-fossil fuel energy (renewable energy and nuclear power).

In fiscal 2009, the total primary energy supply in Japan was 21,752 petajoules, down 6.3 percent from the previous fiscal year. Its breakdown was: 45.2 percent in petroleum, 20.3 percent in coal, 17.4 percent in natural gas, 11.1 percent in nuclear power, and 3.0 percent in hydro power. Other sources were also used, though only in small quantities, including energy from waste, geothermal, and natural energy (solar energy, wind power, biomass energy, etc.).

In an effort to prevent global warming, the government has been reducing energy waste by taking such measures as energy saving and improving power generation efficiency. The government has also been promoting the introduction of methods of generating electricity that do not produce CO₂, including non-fossil fuel energy.

Energy units

Joule (J) is employed as a common unit (International System of Units: SI) for energy across all energy sources in presenting international statistical information. The unit Petajoule (PJ: 10¹⁵ or quadrillion joules) is used here to reduce the number of digits. The energy of one kiloliter of petroleum is calculated using the following formulae:

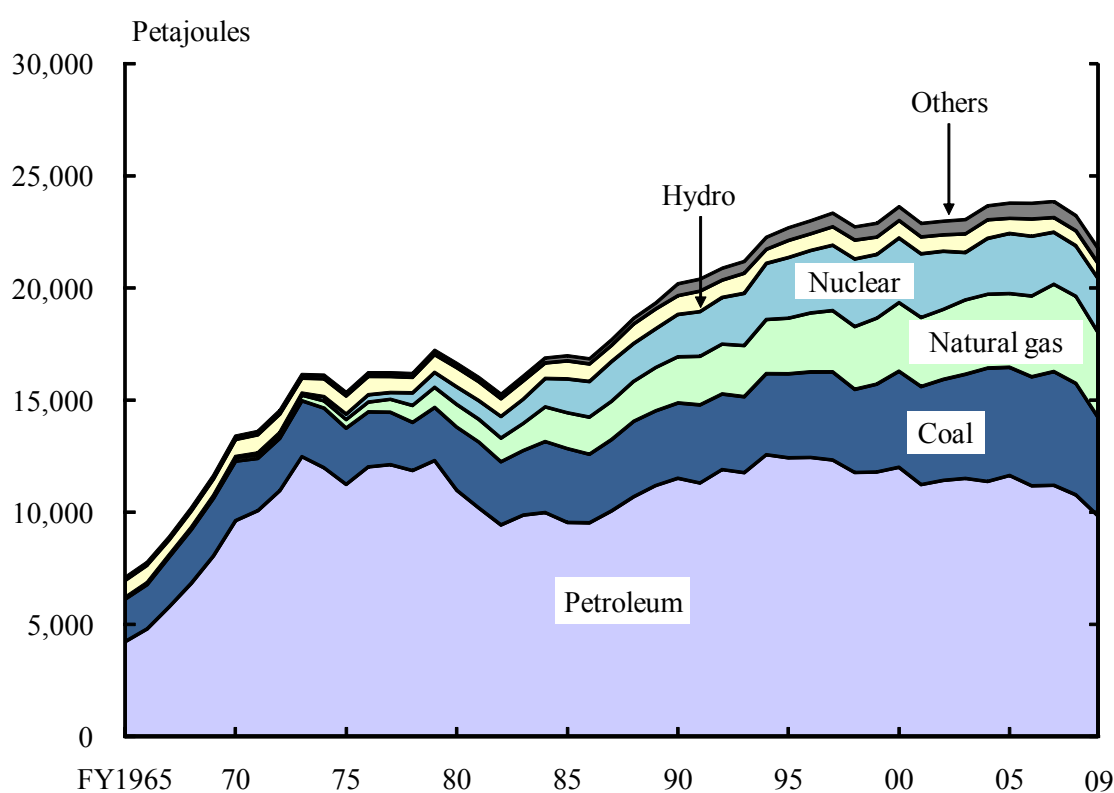
$$1 \text{ kiloliter of petroleum} = 3.87 \times 10^{10} \text{ joules}$$

$$1 \text{ petajoule} = 10^{15} \text{ joules}$$

Petroleum is traded internationally using the volume unit of barrels. One barrel equals approximately 158.987 liters.

Japan's final energy consumption was increasing almost steadily since the mid-1980s. It then turned downward in fiscal 2005, but a 3.6-percent increase, relative to 1990, was recorded for final energy consumption in fiscal 2009. While energy consumption in the industrial sector has remained mostly level, there were sharp increases in energy consumption in the commercial and residential sector and in the transport sector. The transport sector includes energy consumption for all transportation purposes, whether household or commercial. In the commercial and residential sector, energy consumption by the commercial sector in particular has risen in recent years. This has been mainly caused by (i) the rise in the total floor area of office buildings and large-scale retail stores; (ii) an increase in the amount of air conditioning equipment and lighting appliances used in those facilities; and (iii) the growth of office automation.

Figure 7.1
Total Primary Energy Supply ¹⁾



1) A different statistical method was used for figures of fiscal 1989 and prior.
Source: Ministry of Economy, Trade and Industry.

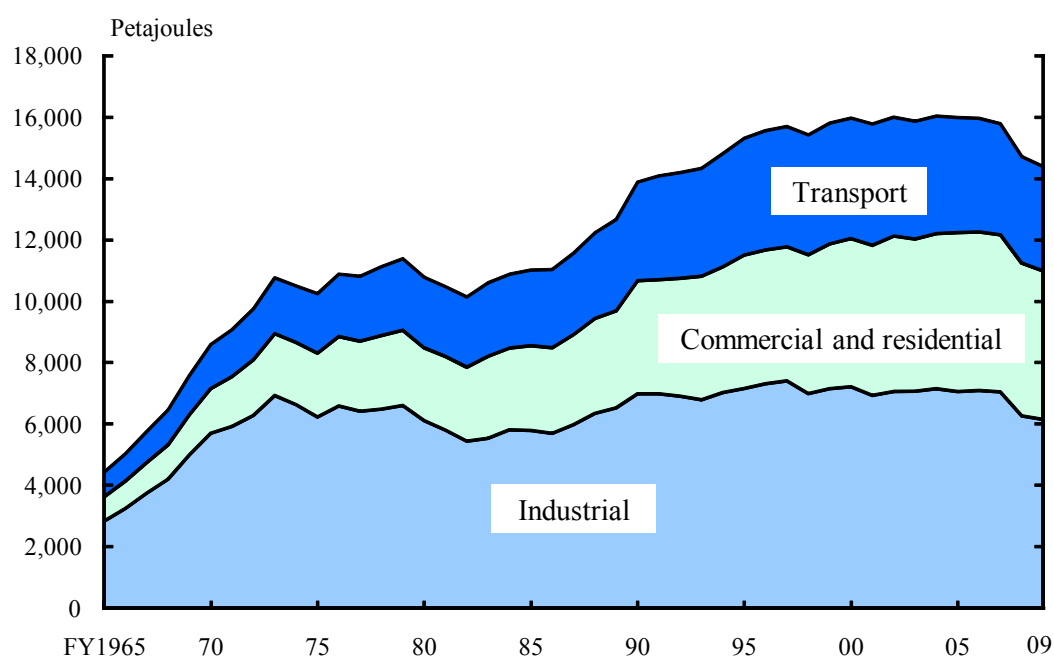
Table 7.1
Trends in Total Primary Energy Supply and Percentage
by Energy Source

(Petajoules)					
Item	FY1995	FY2000	FY2005	FY2008	FY2009
Total primary energy supply	22,685	23,622	23,784	23,218	21,752
Energy self-sufficiency (%) ¹⁾ ...	19.6	19.6	18.4	17.3	18.8
Petroleum	12,430	12,008	11,641	10,775	9,834
Coal	3,750	4,286	4,829	4,977	4,408
Natural gas	2,479	3,061	3,288	3,883	3,781
Nuclear	2,700	2,873	2,677	2,248	2,411
Hydro	761	778	672	666	663
Others	564	616	676	669	655
Percentage					
Petroleum	54.8	50.8	48.9	46.4	45.2
Coal	16.5	18.1	20.3	21.4	20.3
Natural gas	10.9	13.0	13.8	16.7	17.4
Nuclear	11.9	12.2	11.3	9.7	11.1
Hydro	3.4	3.3	2.8	2.9	3.0
Others	2.5	2.6	2.8	2.9	3.0

1) Domestic production of primary energy (including nuclear) / Domestic supply of primary energy × 100

Source: Ministry of Economy, Trade and Industry.

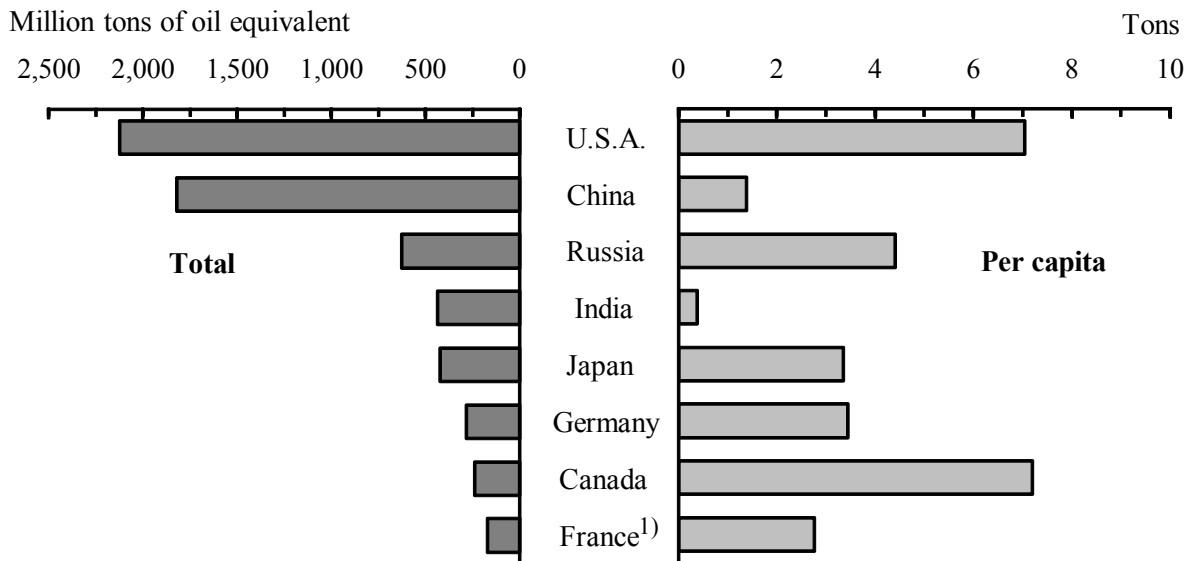
Figure 7.2
Trends in Final Energy Consumption by Sector ¹⁾



1) A different statistical method was used for figures of fiscal 1989 and prior.

Source: Ministry of Economy, Trade and Industry.

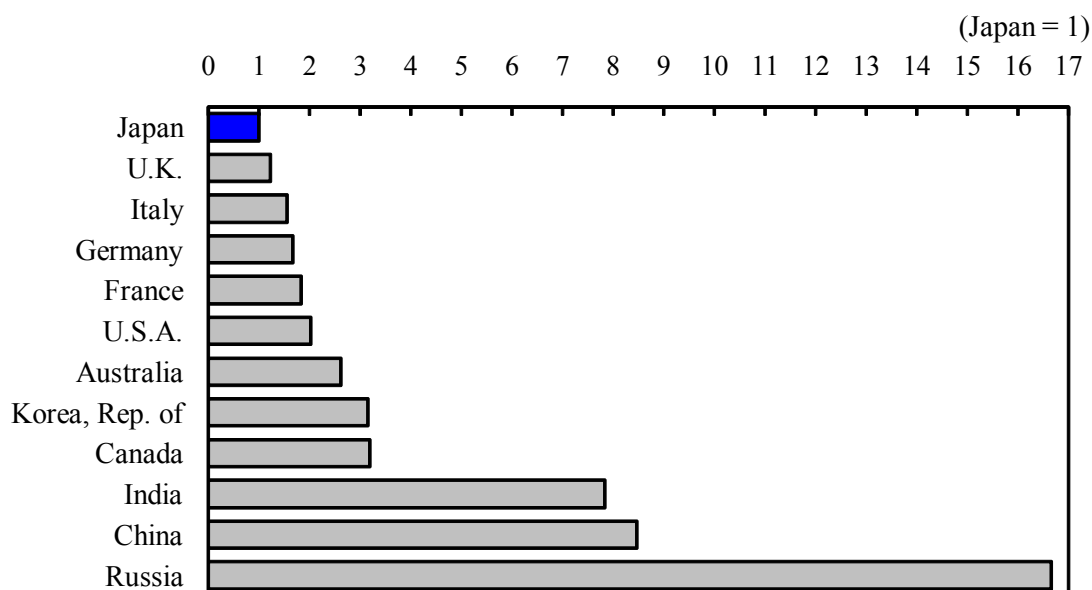
Figure 7.3
Consumption of Commercial Energy by Country (2007)



1) Including Monaco.
 Source: United Nations.

Japan's energy consumption is thus expanding fairly consistently, yet the volume of primary energy required to generate the same level of GDP (primary energy supply per GDP) is lower in Japan compared to other industrialized countries. This indicates that Japan is one of the most energy-efficient countries in the world.

Figure 7.4
International Comparison of Energy/GDP Ratio ¹⁾ (2008)



1) Total primary energy supply (tons of oil equivalent) / GDP. Converted on the basis of Japan = 1.
 Source: International Energy Agency.

2. Electric Power

Approximately half of Japan's primary energy supply of petroleum, coal and other energy sources is converted into electric power.

Electricity output (including in-house power generation) in Japan totaled 1,113 billion kWh in fiscal 2009, down 2.9 percent from the previous fiscal year. Of this total, thermal power accounted for 66.7 percent; nuclear power, 25.1 percent; hydro power, 7.5 percent; and other sources, 0.6 percent. In the field of thermal power generation, huge replacement has been made from petroleum to natural gas.

Table 7.2
Trends in Electricity Output and Power Consumption¹⁾

	(Million kWh)				
Item	FY1995	FY2000	FY2005	FY2008	FY2009
Electricity Output					
Total	989,880	1,091,500	1,157,926	1,146,269	1,112,622
Thermal	604,206	669,177	761,841	798,930	742,522
Nuclear	291,254	322,050	304,755	258,128	279,750
Hydro	91,216	96,817	86,350	83,504	83,832
Others	3,204	3,456	4,980	5,707	6,518
Percentage					
Total	100.0	100.0	100.0	100.0	100.0
Thermal	61.0	61.3	65.8	69.7	66.7
Nuclear	29.4	29.5	26.3	22.5	25.1
Hydro	9.2	8.9	7.5	7.3	7.5
Others	0.3	0.3	0.4	0.5	0.6
Electric Power Consumption					
Total	881,559	982,066	1,043,800	1,035,532	1,003,226
Generated by electric power suppliers ...	776,511	858,078	918,265	925,503	896,668
Consumption of in-house generation	105,048	123,988	125,535	110,029	106,558

1) Including in-house generation.

Source: Ministry of Economy, Trade and Industry.

3. Gas

Gas production was 1,241 petajoules in fiscal 2009, down 2.2 percent from the previous fiscal year. Of this total, natural gas plus liquefied natural gas (LNG) accounted for 96.7 percent; and the remaining 3.3 percent were petroleum gases, such as volatile oil, liquefied petroleum gas, etc. Gas purchases for fiscal 2009 totaled 230 petajoules.

Gas sales for fiscal 2009 totaled 1,416 petajoules, or year-on-year drop of 1.9 percent. Of this total, 49.4 percent was sold to industry, 28.5 percent to residential use, 13.6 percent to the commercial sector, and 8.5 percent to other sources of demand.

Table 7.3
Trends in Production and Purchases, and Sales of Gas ¹⁾

Item	(Petajoules)			
	FY2000	FY2005	FY2008	FY2009
Production and purchases	1,061	1,394	1,495	1,472
Production	952 (100.0)	1,235 (100.0)	1,270 (100.0)	1,241 (100.0)
Coal gases	2 (0.2)	- (-)	- (-)	- (-)
Petroleum gases	111 (11.7)	67 (5.4)	40 (3.1)	41 (3.3)
Natural gas and LNG	839 (88.2)	1,168 (94.6)	1,230 (96.9)	1,200 (96.7)
Others	- (-)	- (-)	- (-)	- (-)
Purchases	109 (100.0)	159 (100.0)	225 (100.0)	230 (100.0)
Coal gases	8 (7.2)	2 (1.3)	0 (0.0)	- (-)
Petroleum gases	15 (13.9)	10 (6.4)	8 (3.4)	7 (2.9)
Natural gas and LNG	86 (78.8)	147 (92.3)	217 (96.5)	224 (97.1)
Others	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sales	1,047 (100.0)	1,359 (100.0)	1,444 (100.0)	1,416 (100.0)
Residential	397 (37.9)	416 (30.6)	404 (28.0)	403 (28.5)
Commercial	170 (16.2)	205 (15.1)	199 (13.8)	193 (13.6)
Industrial	391 (37.4)	619 (45.5)	722 (50.0)	699 (49.4)
Others	89 (8.5)	120 (8.8)	119 (8.3)	121 (8.5)

1) Figures in parentheses indicate percentage.

Source: Ministry of Economy, Trade and Industry.