JAPAN

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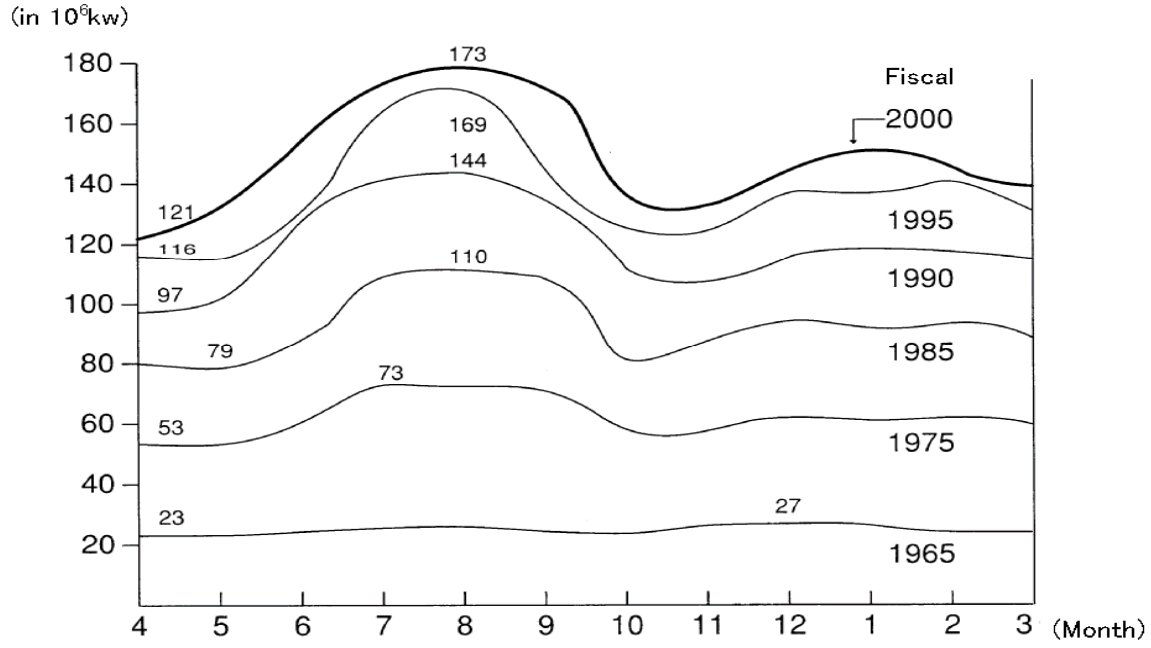
1. GENERAL INFORMATION

1.1. General Overview

Situated in the far east of Asia, Japan is subject to a monsoon climate in the Temperate Zones. Japan has four distinct seasons, which affect changes in the demand for energy or electric power. The annual fluctuation of Japan's electric power demand has two peak periods, the highest being the summer peak based on air-conditioning, and the winter peak based on heating. Figure 1 shows Japan's annual power demand fluctuations. Table 1 shows Japan's total population, its density and its rate of increase.



Composite Sum of 10 Power Companies
Source: Nuclear Power Charts 2001 Edition, Federation of Electric Power Companies

FIG. 1. Trend of Annual Power Demand

TABLE 1. POPULATION INFORMATION

	1960	1970	1980	1990	1996	1997	1998	1999	2000	2001	Growth rate (%) 1980 to 2001
Population (millions)	94.1	104.3	116.8	123.5	125.8	126.3	126.6	126.6	127.1	127.3	0.4
Population density (inhabitants/km²)	249.1	276.2	309.2	327.0	332.9	334.3	335.1	335.0	336.4	337.0	
Urban population as percent of total	63.5	72.2	76.2	77.4	78.2	78.4	78.5	78.7	N/A	N/A	
Predicted population growth rate (%) 2001 to 2010			0.7								
Area (1000 km²)			377.8								

Source: IAEA Energy and Economic Database and Country Information; Data & Statistics/The World Bank.

1.2. Economic Indicators

Table 2.1 shows Japan's total GDP and its GDP per capita and Table 2.2 GDP by sector figures and the growth rate.

TABLE 2.1. GROSS DOMESTIC PRODUCT (GDP)

	1995	1996	1997	1998	1999	2000	2001
GDP at market prices (current billion US$)	5,140	4,600	4,210	3,810	4,749	4,750	4,785
GDP growth (annual %)	1.47	5.05	1.59	-2.51	0.2		
GDP by Sector (% of GDP):							
Agriculture, value added	1.94	1.88	1.7	1.73	N/A		
Industry, value added	38.16	37.8	37.32	35.98	N/A		
Services, etc., value added	59.9	60.32	60.98	62.29	N/A		

Source: Data and Statistics, the World Bank.

TABLE 2.2. GDP BY SECTOR (%) (At current prices)

Item	1995	1996	1997	1998	1999	2000
Agriculture, Forestry and Fishery	1.8	1.8	1.5	1.5	1.4	1.6
Mining	0.2	0.2	0.1	0.1	0.1	0.2
Manufacturing	22.1	22.1	22.0	21.1	20.7	23.4
Construction	7.9	7.7	7.6	7.4	7.3	6.9
Electricity, Gas & Water Supplies	2.6	2.6	2.6	2.7	2.7	2.9
Wholesale and Retail	14.6	14.6	14.8	14.4	13.9	13.9
Finance and Insurance	5.7	5.5	5.6	5.5	6.0	6.3
Real Estate	11.5	11.6	11.6	11.9	12.2	12.1
Transportation and Communication	6.8	6.6	6.5	6.4	6.4	7.3
Others	26.7	27.3	27.5	28.9	29.2	25.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Annual Report on National Accounts 2000: Economic Planning Agency

1.3. Energy Supply and Demand Situation

A key feature of Japan's energy consumption is that the industrial sector accounts for the bulk of the total spent with 49.3% (in FY2000) compared with residential and commercial sector at 26.5% and transportation sector at 24.1%. Japan's total primary energy supply (in FY2000) was 23,385 PJ. Japan is still heavily dependent on oil, even though Japan has experienced a dramatic decline in its dependency from 77.4% in 1973 to the present 51.8%. The above-mentioned decline in oil dependency can be mainly attributed to Japanese industries' efforts in energy conservation and Japan's development of alternative energy resources. In FY2000, Japan imported 99.8% of the oil consumed in Japan (87.1% of crude oil was imported from Middle Eastern countries).

Table 3 shows the estimated energy reserves in Japan. Figures 2.1 and 2.2 presents the primary energy supply and the final energy consumption. Table 4.1 shows Japan's basic energy statistics and Table 4.2 the trend of energy consumption by sector.

1.4. Energy Policy

The Long-term Energy Supply and Demand Outlook states that energy consumption in 2010 FY will remain almost unchanged compared with that of 1999 as a result of the following measures: (1) following up on Keidanren's voluntary action plan, (2) improving efficiency of energy-consuming equipment by introducing “the top-runner method” (the Revised Law Concerning the Rational Use of Energy), and (3) changing people's lifestyles to have a greater emphasis on energy conservation.

Meanwhile, on the supply side, Japan will make maximum efforts to introduce non-fossil fuel energy sources, and will tenaciously promote the development of nuclear power as a leading part of non-fossil fuels while thoroughly ensuring its safety. Because of economic restrictions, new energy sources cannot immediately replace existing forms of energy supply. However, Japan must endeavour to expand the introduction of new energy sources as much as possible through the improvement of their performance and cost reduction.

TABLE 3. ENERGY RESERVES

Exajoule

	Estimated energy reserves					
	Solid	Liquid	Gas	Uranium [1]	Hydro [2]	Total
Total amount in place	19.23	0.29	1.31	3.60	69.22	93.65

[1] This total represents essentially recoverable reserves.

[2] For comparison purposes a rough attempt is made to convert hydro capacity to energy by multiplying the gross theoretical annual capability (World Energy Council - 1998) by a factor of 10.

Source: IAEA Energy and Economic Data Base; Country Information.

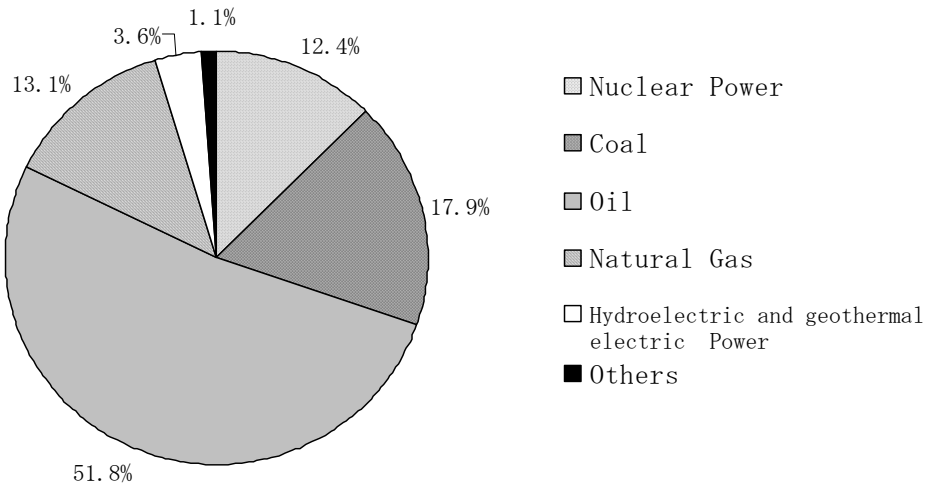


FIG. 2.1. Proportions of Primary Energy Supplies (FY2000)

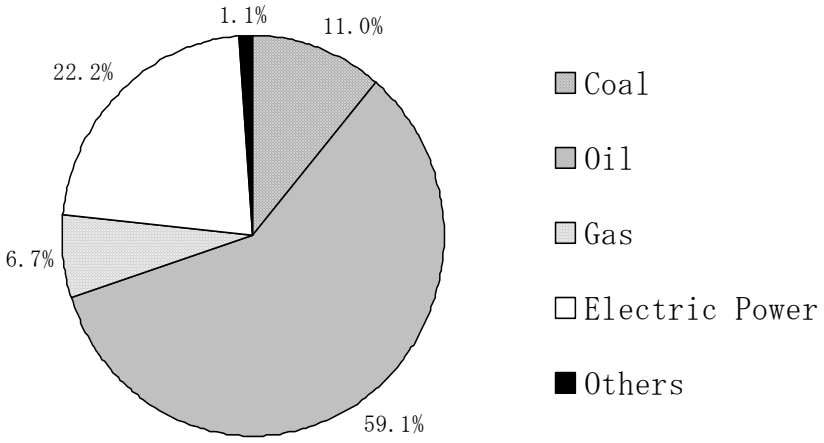


FIG. 2.2. Proportions of Total Final Energy Consumption (FY2000)

The two oil shocks in 1973 and 1979 had a direct impact on Japan's vulnerable energy structure and inflicted considerable damage to Japan's economy. Because of the first oil crisis, the Japanese

government introduced the following emergency measures: Approval of Oil Emergency Measures (1973), Enactment of Two Emergency Laws (1973), Participation in IEA (1974), Enactment of the Petroleum Stockpiling Law (1975). The first oil crisis prompted the Japanese government not only to formulate various emergency measures as stated above, but also to change the basic philosophy of its energy policy. In 1975, the Advisory Committee for Energy, an advisory council for the Minister of International Trade and Industry, submitted a report suggesting that developing a stable supply of energy should be regarded as the first priority. On the basis of this report, the following five policy pillars were set up: reducing oil dependency, diversification of non-oil energy supplies, securing a stable supply of oil through petroleum reserves oil, exploration and development by Japanese companies, promotion of energy conservation, and promotion of new energy R&D. In order to strengthen energy conservation, "The Law Concerning Rational Use of Energy" was enacted in 1979. In 1974, the Sunshine Project was implemented to promote the development of new energy technologies such as solar energy, geothermal energy, coal liquefaction, coal gasification and hydrogen energy. Various alternative energy policy measures were introduced after the second oil crisis. In 1980, “The Law Concerning the Promotion of Development and Introduction of Alternative Energy” was enacted.

TABLE 4.1. ENERGY STATISTICS

Exajoule

							Average annual growth rate (%)	
	1960	1970	1980	1990	2000	2001	1960 to 1980	1980 to 2001
Energy consumption								
- Total [1]	2.00	2.05	14.63	18.12	22.38	25.38	10.46	2.66
- Solids [2]	1.40	1.15	2.52	3.37	3.83	3.65	2.97	1.78
- Liquids			9.45	10.00	10.68	10.94	47.86	0.70
- Gases	0.03	0.16	0.97	2.01	3.96	6.71	18.53	9.62
- Primary electricity [3]	0.56	0.82	1.69	2.74	3.91	4.08	5.66	4.27
Energy production								
- Total	2.13	2.14	2.27	3.06	4.13	4.30	0.33	3.08
- Solids	1.51	1.17	0.47	0.22	0.09	0.09	-5.65	-7.82
- Liquids	0.02	0.03	0.02	0.02	0.03	0.03	0.10	0.76
- Gases	0.03	0.11	0.09	0.08	0.10	0.11	4.93	1.32
- Primary electricity [3]	0.56	0.82	1.69	2.74	3.91	4.08	5.66	4.27
Net import (Import - Export)								
- Total	-0.01	0.44	13.06	15.36	19.21	24.35	-44.59	3.01
- Solids	0.00	0.00	1.98	3.13	4.00	4.16	-47.79	3.59
- Liquids	-0.01	0.39	10.19	10.28	11.09	11.38	-43.55	0.53
- Gases		0.04	0.89	1.94	4.12	8.80		11.54

[1] Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.
[2] Solid fuels include coal, lignite and commercial wood.
[3] Primary electricity = Hydro + Geothermal + Nuclear + Wind.
Source: IAEA Energy and Economic Database.

TABLE 4.2. TREND OF END-USE ENERGY CONSUMPTION

(in 100 million kilo liter of crude oil equivalent)

(fiscal year)	1973	1979	1986	1992	1995	1996	1997	1998	1999	2000	2001
End-UseEnergy Consumption	2.85	3.01	2.94	3.60	3.88	3.93	3.96	3.92	4.03	4.06	
-Industry	1.87	1.78	1.56	1.81	1.92	1.95	1.95	1.90	1.98	2.00	
-Commerce and Residence	0.52	0.63	0.72	0.93	1.02	1.02	1.03	1.03	1.05	1.08	
-Transportation	0.47	0.60	0.66	0.86	0.94	0.96	0.98	0.99	1.00	0.98	

Source: Agency of Natural Resources and Energy (METI)

2. ELECTRICITY SECTOR

2.1. Structure of the Electricity Sector

Japan is divided into nine zones with an electric power company in each zone. These are private enterprises which specialize only in electric utility operations and are the main power suppliers in each zone. Apart from these, there is also the Okinawa Electric Power Company, a smaller electric utility company, operating in Okinawa Prefecture, which is comprised of many small islands. These power companies run their own facilities from power generation to transmission and distribution as an integrated business operation.

The Electric Power Development Company, which has its own thermal and hydro electric power stations, and the Japan Atomic Power Company, which has its own nuclear power stations, are other private enterprises that produce electric power and act as wholesalers to the nine electric power companies. However, in relation to Japan's total installed capacity, their installed capacity is relatively small.

Table 5.1 shows the historical electricity production and the installed capacity and Tables 5.2 and 5.3 show the installed capacity of, and the actual energy generated by, the installers or owners of power plants.

2.2. Policy and Decision-Making Process

The Electricity Industry Committee, comprised of non-governmental professionals and experts including those from electric power companies, provides advice and recommendations to the Minister of Economy, Trade and Industry, on a regular basis, regarding the basic national policies on regional network operations for the stable supply of power, promotion of demand-oriented energy saving measures, promotion of load levelling, further development of electric power, etc. Based on this advice, the Ministry of Economy, Trade and Industry together with related Ministries and Agencies confer regularly with individual power companies to review the up-to-date demand and supply performances and to evaluate the power supply programme for the future.

TABLE 5.1. ELECTRICITY PRODUCTION AND INSTALLED CAPACITY

							Average annual growth rate (%)	
	1960	1970	1980	1990	2000	2001	1960 to 1980	1980 to 2001
Electricity production (TW.h)								
- Total [1]	67.36	132.00	577.52	857.27	901.56	939.61	11.34	2.34
- Thermal	8.88	47.08	401.75	573.27	495.92	516.80	21.00	1.21
- Hydro	58.48	80.09	92.09	95.84	97.14	97.14	2.30	0.25
- Nuclear		4.58	82.59	186.42	304.87	321.94		6.69
- Geothermal		0.24	1.09	1.74	3.58	3.66		5.93
Capacity of electrical plants (GWe)								
- Total	14.89	30.01	143.70	194.73	250.92	257.89	12.00	2.82
- Thermal	2.21	8.65	98.07	125.74	160.88	166.33	20.87	2.55
- Hydro	12.68	19.99	29.78	37.83	45.83	46.46	4.36	2.14
- Nuclear		1.34	15.69	30.89	43.49	44.29		5.07
- Geothermal		0.03	0.16	0.27	0.72	0.81		7.98
- Wind					0.01			

[1] Electricity losses are not deducted.
Source: IAEA Energy and Economic Database.

TABLE 5.2. POWER GENERATION CAPACITY OF EACH PLANT OWNER (for electric utility) (as of March 2002) (MWe)

Owner Name	Nuclear Power		Hydroelectric Power		Thermal Power*		Total	
	Power Generation	Proportion	Power Generation	Proportion	Power Generation	Proportion	Power Generation	Proportion
Hokkaido Electric Power Co.	1,158	19.6	1,245	21.1	3,500	59.3	5,904	100
Tohoku Electric Power Co.	2,174	13.5	2,452	15.3	11,451	71.2	16,076	100
Tokyo Electric Power Co.	17,308	28.7	8,519	14.1	34,548	57.2	60,375	100
Chubu Electric Power Co.	3,617	11.2	5,214	16.2	23,401	72.6	32,231	100
Hokuriku Electric Power Co.	540	8.0	1,812	26.8	4,406	65.2	6,759	100
Kansai Electric Power Co.	9,768	27.4	8,130	22.8	17,687	49.7	35,585	100
Chugoku Electric Power Co.	1,280	10.5	2,884	23.7	8,024	65.8	12,188	100
Shikoku Electric Power Co.	2,022	29.4	1,125	16.4	3,730	54.2	6,877	100
Kyushu Electric Power Co.	5,258	27.2	2,371	12.3	11,707	60.5	19,336	100
Okinawa Electric Power Co.	---	---	---	---	1,676	100	1,676	100
Japan Atomic Power Co.	2,617	100.0	---	---	---	---	2,617	100
Electric Power Development Co.	---	---	8,261	53.3	7,212	46.6	15,485	100
Others	---	---	2,870	19.2	12,061	80.8	14,931	100
Total	45,742	19.9	44,883	19.5	139,415	60.6	230,040	100

Source: Summary of Thermal Power Facilities the Federation of Electric Power Companies
* : Thermal Power includes Geothermal Power.

TABLE 5.3. ENERGY GENERATION OF EACH PLANT OWNER (for electric utility) (in fiscal 2001) (TWh)

Owner Name	Nuclear Power		Hydroelectric Power		Thermal Power*		Total	
	Energy Generation	Proportion	Energy Generation	Proportion	Energy Generation	Proportion	Energy Generation	Proportion
Hokkaido Electric Power Co.	8.6	30.1	4.0	14.0	16.0	55.9	28.6	100
Tohoku Electric Power Co.	11.9	15.5	9.4	12.2	55.4	72.1	76.8	100
Tokyo Electric Power Co.	121.5	47.3	13.7	5.3	121.8	47.4	257.0	100
Chubu Electric Power Co.	22.0	19.0	8.6	7.4	85.0	73.5	115.6	100
Hokuriku Electric Power Co.	4.0	15.6	5.8	22.7	15.8	61.7	25.6	100
Kansai Electric Power Co.	72.3	59.2	13.7	11.2	36.2	29.6	122.2	100
Chugoku Electric Power Co.	10.3	23.1	3.7	8.3	30.5	68.5	44.5	100
Shikoku Electric Power Co.	14.0	48.8	2.2	7.7	12.6	43.9	28.7	100
Kyushu Electric Power Co.	36.7	50.5	3.6	5.0	32.4	44.6	72.7	100
Okinawa Electric Power Co.	---	---	---	---	5.9	100	5.9	100
Japan Atomic Power Co.	18.4	100.0	---	---	---	---	18.4	100
Electric Power Development Co.	---	---	11.4	20.4	44.4	79.6	55.8	100
Others	---	---	10.5	14.9	59.7	85.1	70.1	100
Total	319.6	34.6	86.5	9.5	515.8	55.9	922.0	100

Source: Summary of Thermal Power Facilities the Federation of Electric Power Companies
* : Thermal Power includes Geothermal Power

2.3. Main Indicators

Table 6 shows the trends in various energy and electricity ratios. Table 7 and Figure 3 show the trends of installed generation capacity and energy generated in Japan.

2.4. Impact of Open Electricity Markets in the Nuclear Sector

With the amendment of the Electricity Utility Industry Law in 2000, a number of system reforms were implemented, such as partial liberalization of the retail supply to extra high-voltage customers. To make competition effective, moreover, the government established fair and equal rules allowing suppliers other than electric utilities (new entrants) to use power transmission lines owned by power utilities ("wheeling rules"). Also, electric utilities are obliged to notify METI of the wheeling service rates.

As of now, nine new entrants have submitted a notice of intent to establish an "Electric Company of Specified Scale", seven of which already supply electricity. Compared with power utilities, however, their combined share in the liberalized market (for specified-scale demand) remained at only 0.5% as of March 2002.

To investigate future systems, a series of meetings of the Advisory Committee for the Natural Resources and Energy Agency's Electricity Industry Committee were held in the beginning of November 2001. The Committee is studying specific ways of optimising the future electricity utility system.

The safety restrictions for electrical installations are being examined, taking into consideration the individual responsibility of each corporation, thereby minimizing national involvement. However, nuclear power generation facilities are excluded.

TABLE 6. ENERGY AND ELECTRICITY RATIOS

	1960	1970	1980	1990	1996	1997	1998	1999	2000	2001
Energy consumption per capita (GJ/capita)	42	119	136	158	176	177	165	165	176	199
Electricity per capita (kW·h/capita)	1,227	3,447	4,945	6,941	8,023	8,218	7,812	7,958	6,873	7,594
Electricity production/Energy production (%)	57	162	218	231	218	211	227	229	210	211
Nuclear/Total electricity (%)	0	1	14	24	30	31	31	30	34	34
Ratio of external dependency (%)[1]	40	85	84	83	81	80	81	81	86	96
Load factor of electricity plants										
- Total (%)	56	60	46	50	49	49	49	49	41	42
- Thermal	59	67	47	51	48	46	46	46	35	35
- Hydro	53	46	35	29	23	26	26	28	24	24
- Nuclear		39	60	73	81	81	81	80	80	83

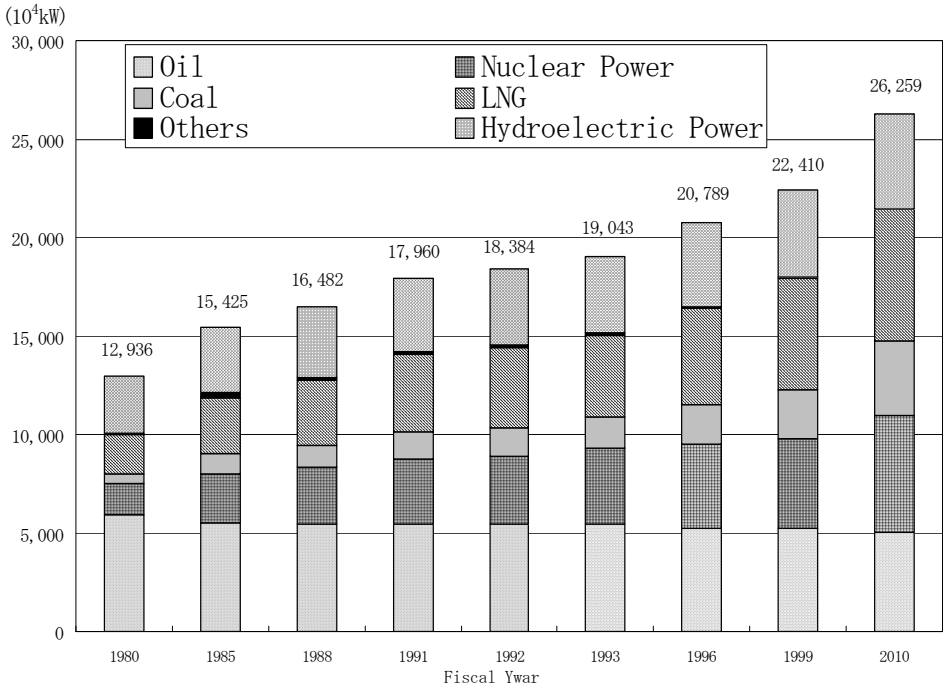
[1] *Net import / Total energy consumption*

Source: IAEA Energy and Economic Database and Country Information.

TABLE 7. POWER PLANT CAPACITY OUTLOOK FOR ELECTRIC UTILITIES

(10^4 kW)

Source of supply	1980	1985	1988	1991	1992	1993	1996	1999	2010
Oil	5,948	5,526	5,463	5,428	5,442	5,450	5,243	5,270	5,010
Nuclear Power	1,551	2,452	2,870	3,324	3,442	3,838	4,255	4,492	5,970
Coal	526	1,034	1,112	1,362	1,467	1,597	2.028	2,488	3,784
LNG	1,971	2,855	3,306	3,949	4,095	4,173	4,914	5,677	6,651
Others	73	238	118	124	124	126	52	52	54
Hydroelectric Power	2,867	3,319	3,613	3,773	3,815	3,859	4,297	4,433	4,810
Total	12,936	15,425	16,482	17,960	18,384	19,043	20,788	22,410	26,259



Source: Interim Report, Demand/Supply Subcommittee, Electric Utility Industry Council (June 2001)

FIG. 3. Electric Power Plant Capacity Outlook (for Electric Utilities)

3. NUCLEAR POWER SITUATION

3.1. Historical Development

Enactment of the Atomic Energy Law (1955) introduced the promotion of atomic energy development and utilization toward peaceful objectives in compliance with the three basic principles of Democratic Management, Voluntary Action, and Open Information. Inauguration of the Atomic Energy Commission (1956) established an advisory board for the Prime Minister on matters regarding promotion of atomic energy development and utilization.

Long-term planning for atomic power development began in 1956. Today, it is the basic programme for the nation on nuclear power development and utilization. The plan is revised and updated every five years. The Ministry of International Trade and Industry was reorganized in 1966 to accommodate its increasing workload. This change provided additional rules and regulations for the introduction of commercial light water reactors in Japan after 1966.

In 1974, three basic laws for the promotion of electric power development were made into law; namely, the “Law for the Adjustment of Areas Adjacent to Power Generating Facilities”, the “Electric Power Development Promotion Tax Law”, and the “Special Account Law for Electric Power Promotion”. These laws also advanced the siting of nuclear power stations.

In 1978, the Nuclear Safety Commission was formed as a separate entity from the Atomic Energy Commission. Safety assurance measures were enhanced in 1980 to reflect the lessons learned from the TMI-2 Accident (1979) and, later, the Chernobyl No. 4 Accident in 1986.

The overall appraisal of the Vision of Nuclear Power in 1986 provided long-range prospects of energy availability and electric power requirements through 2030, and a programme for enhancement of safety called “Safety 21”, which further reinforced safety assurance measures. In 1990, Japan revised its supply targets to include alternative energy sources to mitigate its growing demand for oil and its part in the greenhouse effect on the Earth.

TABLE 8. STATUS OF NUCLEAR POWER PLANTS

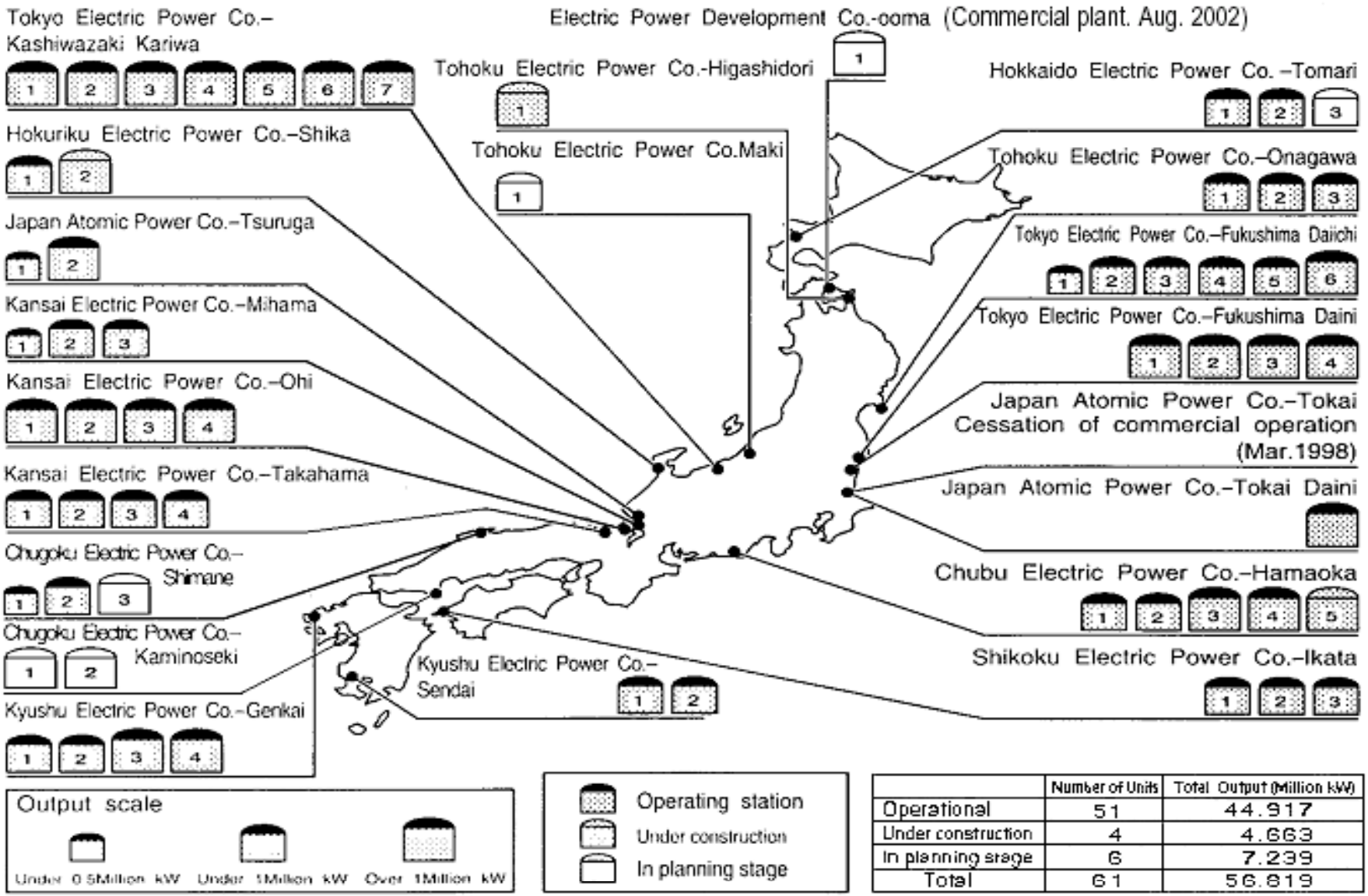
Station	Type	Capacity (Net) (Mwe)	Operator	Status	Reactor Supplier	Construction Date	Criticality Date	Grid Date	Commercial Date	Shutdown Date
FUKUSHIMA-DAIICHI-1	BWR	439	TEPCO	Operational	GE	25-Jun-67	10-Oct-70	17-Nov-70	26-Mar-71	
FUKUSHIMA-DAIICHI-2	BWR	760	TEPCO	Operational	GE/TOSHIBA	09-Jun-69	10-May-73	24-Dec-73	18-Jul-74	
FUKUSHIMA-DAIICHI-3	BWR	760	TEPCO	Operational	TOSHIBA	28-Dec-70	06-Sep-74	26-Oct-74	27-Mar-76	
FUKUSHIMA-DAIICHI-4	BWR	760	TEPCO	Operational	HITACHI	12-Feb-73	28-Jan-78	24-Feb-78	12-Oct-78	
FUKUSHIMA-DAIICHI-5	BWR	760	TEPCO	Operational	TOSHIBA	22-May-72	26-Aug-77	22-Sep-77	18-Apr-78	
FUKUSHIMA-DAIICHI-6	BWR	1067	TEPCO	Operational	GE/TOSHIBA	26-Oct-73	09-Mar-79	04-May-79	24-Oct-79	
FUKUSHIMA-DAINI-1	BWR	1067	TEPCO	Operational	TOSHIBA	16-Mar-76	17-Jun-81	31-Jul-81	20-Apr-82	
FUKUSHIMA-DAINI-2	BWR	1067	TEPCO	Operational	HITACHI	25-May-79	26-Apr-83	23-Jun-83	03-Feb-84	
FUKUSHIMA-DAINI-3	BWR	1067	TEPCO	Operational	TOSHIBA	23-Mar-81	18-Oct-84	14-Dec-84	21-Jun-85	
FUKUSHIMA-DAINI-4	BWR	1067	TEPCO	Operational	HITACHI	28-May-81	24-Oct-86	17-Dec-86	25-Aug-87	
GENKAI-1	PWR	529	KYUSHU	Operational	MHI	15-Sep-71	28-Jan-75	14-Feb-75	15-Oct-75	
GENKAI-2	PWR	529	KYUSHU	Operational	MHI	01-Feb-77	21-May-80	03-Jun-80	30-Mar-81	
GENKAI-3	PWR	1127	KYUSHU	Operational	MHI	01-Jun-88	28-May-93	15-Jun-93	18-Mar-94	
GENKAI-4	PWR	1127	KYUSHU	Operational	MHI	15-Jul-92	23-Oct-96	12-Nov-96	25-Jul-97	
HAMAOKA-1	BWR	515	CHUBU	Operational	TOSHIBA	10-Jun-71	20-Jun-74	13-Aug-74	17-Mar-76	
HAMAOKA-2	BWR	806	CHUBU	Operational	TOSHIBA	14-Jun-74	28-Mar-78	04-May-78	29-Nov-78	
HAMAOKA-3	BWR	1056	CHUBU	Operational	TOSHIBA	18-Apr-83	21-Nov-86	20-Jan-87	28-Aug-87	
HAMAOKA-4	BWR	1092	CHUBU	Operational	TOSHIBA	13-Oct-89	02-Dec-92	27-Jan-93	03-Sep-93	
IKATA-1	PWR	538	SHIKOKU	Operational	MHI	15-Jun-73	29-Jan-77	17-Feb-77	30-Sep-77	
IKATA-2	PWR	538	SHIKOKU	Operational	MHI	21-Feb-78	31-Jul-81	19-Aug-81	19-Mar-82	
IKATA-3	PWR	846	SHIKOKU	Operational	MHI	01-Nov-86	23-Feb-94	29-Mar-94	15-Dec-94	
KASHIWAZAKI KARIWA-1	BWR	1067	TEPCO	Operational	TOSHIBA	05-Jun-80	12-Dec-84	13-Feb-85	18-Sep-85	
KASHIWAZAKI KARIWA-2	BWR	1067	TEPCO	Operational	TOSHIBA	18-Nov-85	30-Nov-89	08-Feb-90	28-Sep-90	
KASHIWAZAKI KARIWA-3	BWR	1067	TEPCO	Operational	TOSHIBA	20-Jun-85	19-Oct-92	08-Dec-92	11-Aug-93	
KASHIWAZAKI KARIWA-4	BWR	1067	TEPCO	Operational	HITACHI	07-Mar-89	01-Nov-93	21-Dec-93	11-Aug-94	
KASHIWAZAKI KARIWA-5	BWR	1067	TEPCO	Operational	HITACHI	05-Mar-90	20-Jul-89	12-Sep-89	10-Apr-90	
KASHIWAZAKI KARIWA-6	BWR	1315	TEPCO	Operational	TOSHIBA/GE	03-Nov-92	18-Dec-95	29-Jan-96	07-Dec-96	
KASHIWAZAKI KARIWA-7	BWR	1315	TEPCO	Operational	HITACHI/GE	01-Jul-93	01-Nov-96	17-Dec-96	02-Jul-97	
MIHAMA-1	PWR	320	KEPCO	Operational	WH	01-Feb-67	29-Jul-70	08-Aug-70	28-Nov-70	
MIHAMA-2	PWR	470	KEPCO	Operational	WH/MHI	29-May-68	10-Apr-72	21-Apr-72	25-Jul-72	
MIHAMA-3	PWR	780	KEPCO	Operational	MHI	07-Aug-72	28-Jan-76	19-Feb-76	01-Dec-76	

Source: Informed Data from Japan to IAEA Power Reactor Information System as of 31-Jan-2001; Nuclear Power Plants In The World 2000, Japan Atomic Industrial Forum.

TABLE 8. STATUS OF NUCLEAR POWER PLANTS (Continued)

Station	Type	Capacity (Net) (Mwe)	Operator	Status	Reactor Supplier	Construction Date	Criticality Date	Grid Date	Commercial Date	Shutdown Date
MONJU	FBR	246	PNC	Under Construction	MHI	10-May-86	05-Apr-94	29-Aug-94		
OHI-1	PWR	1120	KEPCO	Operational	WH	26-Oct-72	02-Dec-77	23-Dec-77	27-Mar-79	
OHI-2	PWR	1120	KEPCO	Operational	WH	08-Dec-72	14-Sep-78	11-Oct-78	05-Dec-79	
OHI-3	PWR	1127	KEPCO	Operational	MHI	03-Oct-87	17-May-91	07-Jun-91	18-Dec-91	
OHI-4	PWR	1127	KEPCO	Operational	MHI	13-Jun-88	28-May-92	19-Jun-92	02-Feb-93	
ONAGAWA-1	BWR	498	TOHOKU	Operational	TOSHIBA	08-Jul-80	18-Oct-83	18-Nov-83	01-Jun-84	
ONAGAWA-2	BWR	796	TOHOKU	Operational	TOSHIBA	12-Apr-91	02-Nov-94	23-Dec-94	28-Jul-95	
ONAGAWA 3	BWR	796	TOHUKU	Operational	TOSHIBA	23-Jan-98	26-Apr-01	30-May-01	30-Jan-02	
SENDAI-1	PWR	846	KYUSHU	Operational	MHI	15-Dec-79	25-Aug-83	16-Sep-83	04-Jul-84	
SENDAI-2	PWR	846	KYUSHU	Operational	MHI	12-Oct-81	18-Mar-85	05-Apr-85	28-Nov-85	
SHIKA-1	BWR	505	HOKURIKU	Operational	HITACHI	01-Jul-89	20-Nov-92	12-Jan-93	30-Jul-93	
SHIMANE-1	BWR	439	CHUGOKU	Operational	HITACHI	02-Jul-70	01-Jun-73	02-Dec-73	29-Mar-74	
SHIMANE-2	BWR	789	CHUGOKU	Operational	HITACHI	02-Feb-85	25-May-88	11-Jul-88	10-Feb-89	
TAKAHAMA-1	PWR	780	KEPCO	Operational	WH	25-Apr-70	14-Mar-74	27-Mar-74	14-Nov-74	
TAKAHAMA-2	PWR	780	KEPCO	Operational	MHI	09-Mar-71	20-Dec-74	17-Jan-75	14-Nov-75	
TAKAHAMA-3	PWR	830	KEPCO	Operational	MHI	12-Dec-80	17-Apr-84	09-May-84	17-Jan-85	
TAKAHAMA-4	PWR	830	KEPCO	Operational	MHI	19-Mar-81	11-Oct-84	01-Nov-84	05-Jun-85	
TOKAI-2	BWR	1056	JAPCO	Operational	GE	03-Oct-73	18-Jan-78	13-Mar-78	28-Nov-78	
TOMARI-1	PWR	550	HEPCO	Operational	MHI	02-Jul-85	16-Nov-88	06-Dec-88	22-Jun-89	
TOMARI-2	PWR	550	HEPCO	Operational	MHI	05-Aug-86	25-Jul-90	27-Aug-90	12-Apr-91	
TSURUGA-1	BWR	341	JAPCO	Operational	GE	24-Nov-66	03-Oct-69	16-Nov-69	14-Mar-70	
TSURUGA-2	PWR	1115	JAPCO	Operational	MHI	06-Nov-82	28-May-86	19-Jun-86	17-Feb-87	
HIGASHI DORI 1	BWR	1067	TOHUKU	Under Construction	TOSHIBA	Mar-01			Jul-05	
MAKI	BWR	796	TOHOKU	Planned		01-Jan-02			2012	
SHIKA-2	ABWR	1358(Gross)	HOKURIKU	Under Construction	HITACHI	Jul-01			01-Mar-06	
HAMAOKA-5	ABWR	1325	CHUBU	Under Construction	TOSHIBA				01-Aug-05	
OMA	ABWR	1383(Gross)	Electric Power Development	Planned		Mar-02			Jul-07	
KAMINOSEKI-1	ABWR	1373	CHUGOKU	Planned		2007			2012	
KAMINOSEKI-2	ABWR	1373	CHUGOKU	Planned		2010			2015	
TOMARI-3	PWR	866	HEPCO	Planned		2003			2008	
SIMANE-3	ABWR	1373(Gross)	CHUGOKU	Planned		2003			2010	
JPDR-II	BWR	13	JAERI	Shut Down	GE	01-Dec-60	22-Aug-63	26-Oct-63	26-Oct-63	06-Dec-82
TOKAI-1	GCR	159	JAPCO	Shut Down	GEC	01-Mar-61	04-May-65	10-Nov-65	25-Jul-66	31-Mar-98

Source: Informed Data from Japan to IAEA Power Reactor Information System as of 31-Jan-2002 ; Nuclear Power Plants In The World 2001, Japan Atomic Industrial Forum



	Number of Units	Total Output (Million kW)
Operational	51	44.917
Under construction	4	4.663
In planning srage	6	7.239
Total	61	56.819

FIG.4. Nuclear Power Stations in Japan

3.2. Status and Trends of Nuclear Power

Table 8 and Figure 4 provide lists and locations of the nuclear power plants in operation, under construction and definitely planned, together with those out of service in Japan. At the end of 2000, Japan's total installed capacity of nuclear power plants was 45,082 MW. The total installed capability of nuclear power plants under construction and in the plan are 3,996.0 Mwe (4 plants) and 7,164 Mwe (6 plants) respectively.

Table 9 lists future nuclear power plants that will be built at either new or existing sites in Japan.

TABLE 9. EXPANSION OF NPPS IN FUTURE

Power Plant Name	Owner Name	Gross Capacity MW	Construction Start (FY)	Commissioning (FY)	Note
Namie Kodaka	TOHOKU	825	2005	2012	
Higashi-Dori	TOHOKU	1385	2003	2011	
Fukushima Daiichi-7	TEPCO	1380	2003 - 4	2007 -10	BWR
Fukushima Daiichi-8	TEPCO	1380	2003 - 4	2008 -10	BWR
Higashi-Dori-1	TEPCO	1380	2002	2010	
Higashi-Dori-2	TEPCO	1380	2002	2010	
SUZU-1	HOKURIKU	1350	2004	2012	
SUZU-2	HOKURIKU	1350	2004	2012	
TSURUGA-3	JAPCO	1538	2004	2009	PWR
TSURUGA-4	JAPCO	1538	2004	2010	PWR
Total 10 Power Plants		13,506			

Source: Outlook of Electric Power Supply Plan, MITI (March 2001, FY)

3.3. Current Policy Issues

Since the first Long-Term Programme for Research, Development and Utilization of Nuclear Energy (Long-Term Programme) was published in Japan in 1956, the Atomic Energy Commission (AEC) has formulated a total of eight Long-Term Programmes, one approximately every five years. In November 2000, the AEC formulated a new Long-Term Programme. This programme plays a key role in the systematic implementation of research, development and utilization of nuclear energy in Japan. The Long-Term Programme consists of two parts. Part I includes messages to the Japanese people and the international community, and Part Ⅱ includes specific description information on promoting nuclear research, development and utilization, including research and development of innovative nuclear reactors with high economic efficiency and safety, suitable for diversified energy supply applications such as heat utilization, and for other wider reactor uses as well. This programme was released to the Japanese people, the international community, and all those employed in the nuclear power industry in Japan to have a better understanding of these issues.

3.4. Organizational Chart

Figure 5 shows Japan's organization chart in nuclear power, comprising government regulatory authorities, electric power companies and contracting engineers/suppliers.

The Japanese government carried out administrative reform in January 2001. The AEC and Nuclear Safety Commission (NSC) of the Cabinet Office should give high-level independent and proper directions to other ministries and agencies.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) was created through a merger between the Former Ministry of Education, Science, Sports and Culture (MOE) and the Science and Technology Agency (STA). In MEXT, three Bureaus and four Divisions are in charge of nuclear energy. MEXT is responsible for the administration of nuclear energy for science and technology. Its key roles are nuclear research and development (including nuclear fuel cycle, FBR, quantum research, fusion, and accelerator), utilization of radiation and radioisotopes, nuclear liability, safety regulation and disaster prevention for nuclear reactors for testing and research, use of nuclear

fuel material, and regulation for ensuring peaceful use and safeguards. It is also responsible for supervision of the National Institute of Radiological Science, the Japan Atomic Energy Research Institute (JAERI) and the Japan Nuclear Cycle Development Institute (JNC).

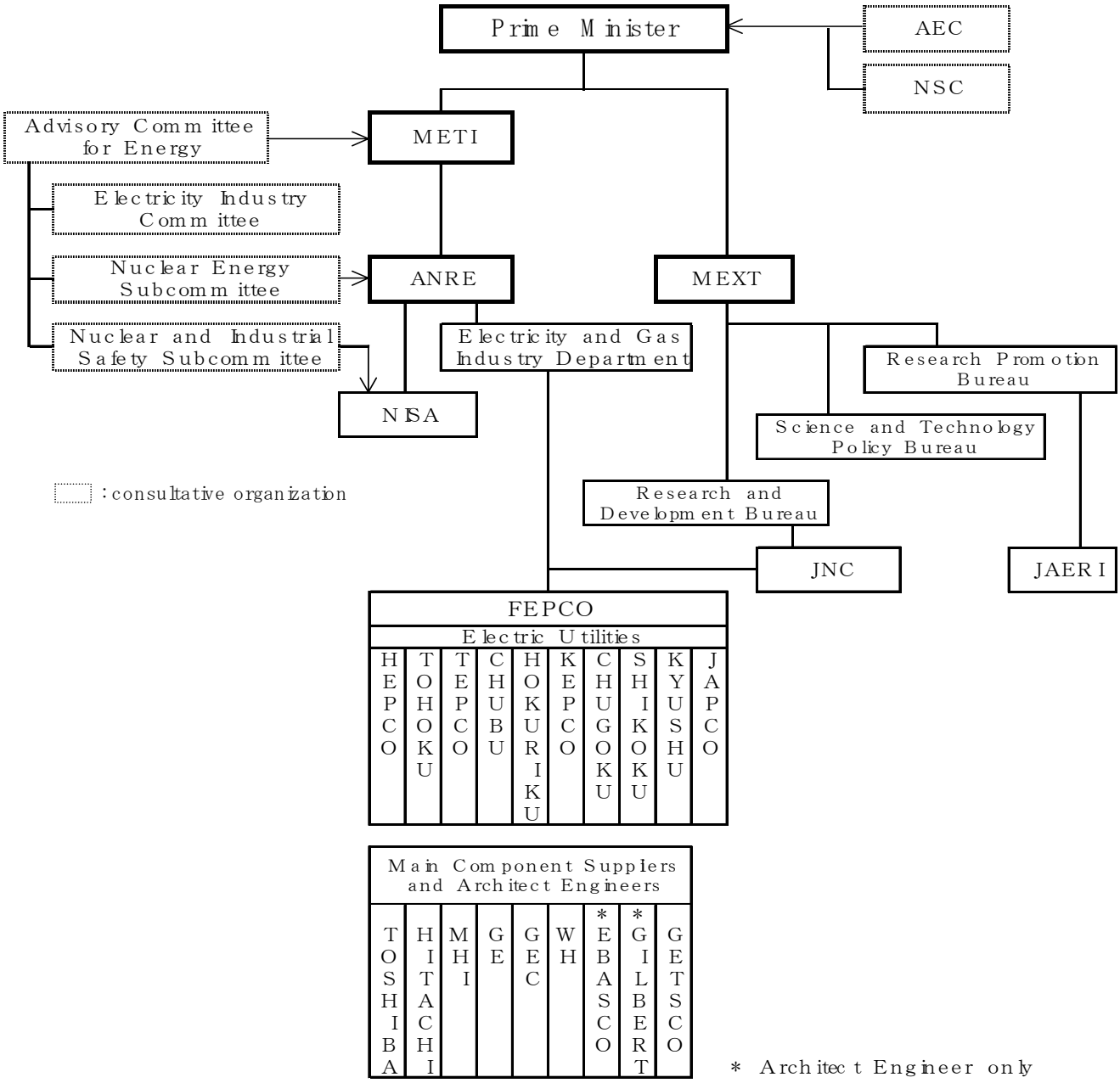


FIG.5. Japan's Organization Chart

Legend to Figure 5:

AEC: Atomic Energy Commission
NSC: Nuclear Safety Commission
METI: Ministry of Economy, Trade and Industry
ANRE: Agency of Natural Resources and Energy
NISA: Nuclear and Industrial Safety Agency

MEXT:	Ministry of Education, Culture, Sports, Science and Technology
JAERI:	Japan Atomic Energy Research Institute
JNC:	Japan Nuclear Cycle Development Institute
FEPCO:	Federation of Electric Power Companies
HEPCO:	Hokkaido Electric Power Co.
TOHOKU:	Tohoku Electric Power Co.
TEPCO:	Tokyo Electric Power Co.
CHUBU:	Chubu Electric Power Co.
HOKURIKU:	Hokuriku Electric Power Co.
KEPCO:	Kansai Electric Power Co.
CHUGOKU:	Chugoku Electric Power Co.
SHIKOKU:	Shikoku Electric Power Co.
KYUSHU:	Kyushu Electric Power Co.
JAPCO:	The Japan Atomic Power Co.
TOSHIBA:	Toshiba Corporation
HITACHI:	Hitachi Ltd.
MHI:	Mitsubishi Heavy Industries Ltd.
GE:	General Electric Co.
GEC:	The General Electric Co. Ltd.
WH:	Westinghouse Electric Corporation
EBASCO:	Ebasco Services Incorporated
GILBERT:	Gilbert/Commonwealth International
GETSCO:	General Electric Technical Services Co.

The Ministry of Economy, Trade and Industry (METI) will be in charge not only of those areas that it had been involved in previously - as the Ministry of International Trade and Industry (MITI) – or taken over from STA - on nuclear fuel cycle business (refining, enrichment, fabrication, reprocessing and waste disposal) -, but also regulation of nuclear reactors including Monju and Fugen, that are in the research and development stage for use in generating electricity. Nuclear power related issues will continue to be the responsibility of the Agency of Natural Resources and Energy. In addition, the Nuclear and Industrial Safety Agency (NISA), with its seven sections related to nuclear energy, was added as a special institution, to take a central role in safety regulations for industrialized nuclear power. NISA is responsible for regulating nuclear safety. The drafting of safety regulations and the licensing of milling and refining, nuclear fuel fabrication, spent nuclear fuel reprocessing and storage, disposal of radioactive waste and decommissioning of nuclear power plants, are now carried out by the NISA. Double check system of safety review to nuclear facilities by the NSC and the NISA or the MEXT is adopted continuously.

4. NUCLEAR POWER INDUSTRY

The development of light water reactors in Japan began with PWRs from Westinghouse and BWRs from G.E. As nuclear power technologies are incorporated by the domestic industry, successive expansion projects of nuclear power plants are of Japanese design and construction. Today, Toshiba, Hitachi and Mitsubishi Heavy Industries have emerged as Japan's representative suppliers of nuclear steam supply systems (NSSS). Construction of nuclear power plants is made possible by an industrial system with one or more of the above-mentioned three companies acting as the prime contractor (s), and forming a joint venture with contract engineers or construction companies as subcontractors.

The development of the Advanced Boiling Water Reactor (ABWR) started in 1978 as a project of international co-operation among five BWR vendors. The resulting conceptual design plan was highly evaluated by TEPCO and other Japanese utilities, and as a result, the ABWR was included in the third standardization programme starting in 1981. The preliminary design and numerous development and verification tests were carried out by Toshiba, Hitachi and GE together with six Japanese utilities and the Japanese government. Two ABWRs, the Kashiwazaki-Kariwa units 6 and 7, were ordered by TEPCO and began successful commercial operation in November 1996 and July 1997, respectively. Two more ABWRs are under construction at Hamaoka-5 and Shika-2, another ABWR is under licensing review at Ohma-1, and eight more ABWRs are in the planning stage. These eight future ABWRs will achieve a significant reduction in generation costs compared to the current ABWRs. The cost reduction is to be obtained by the following means: standardization, design

modifications, and improvements in project management. In addition, all of the experience of the ABWRs currently operating will contribute to cost reduction.

4.1. Supply of Nuclear Power Plants

In Japan, five companies have provided nuclear steam supply: for BWRs these are Toshiba, Hitachi, G.E., and G.E. and Toshiba jointly, while for PWRs these are Mitsubishi, Westinghouse, and Westinghouse and Mitsubishi jointly.

Many companies are capable of supplying equipment and services to Japan's nuclear power industry. These range from the suppliers of major equipment and machinery to those supplying ordinary equipment or offering engineering services. They also include firms related to the nuclear fuel cycle or nuclear fuel recycling.

4.2. Operation of Nuclear Power Plants

Figure 5 shows the nine electric power companies, which operate commercial light water reactors, and one company which is a producer and wholesaler of electricity from nuclear power in Japan.

Regarding nuclear power plant operator training in Japan, both the BWR and PWR groups have their own training centres. These were financed, built and utilized jointly by the member companies of each group, comprised of electric power companies and contract engineering firms. In addition, each electric power company has its own training facility. Engineering qualification tests for operator certification are conducted at training centres jointly operated by the member companies.

The representative suppliers of Japan's maintenance services are Toshiba, Hitachi and Mitsubishi. The electric power companies contract with these maintenance service companies. Efforts are made to enable the contractors to assume responsibility for repair and maintenance services for their nuclear power plants.

4.3. Fuel Cycle and Waste Management Service Supply

The fuel cycle activities in Japan comprise enrichment, conversion, fuel fabrication, zircaloy cladding, reprocessing and radioactive waste activities. Figure 6 shows the affiliated enterprises.

4.4. Research and Development Activities

The Atomic Energy Commission (AEC), amongst other responsibilities, advises on R&D. The long-term programme for the development and use of nuclear energy is revised by the AEC every five years; the latest revision was in November 2000. Government responsibilities for R&D are shared between the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy, Trade and Industry (METI). The MEXT is responsible for the planning and administration of nuclear energy for science and technology. It has three bureaus, each with several divisions. The MEXT plays a key role for nuclear research and development, including nuclear fuel cycle, FBR, fusion research and accelerators. The MEXT supervises the work of the Japan Nuclear Cycle Development Institute (JNC), established in 1998, and also that of the Japan Atomic Energy Research Institute (JAERI), established in 1956. JNC is the main channel for the development of advanced reactors and establishment of the fuel cycle. In both there is close collaboration with the private sector, including shared funding on some projects. Since 1985, the Nuclear Ship Research and Development Agency has been integrated in JAERI. The Agency of Natural Resources and Energy carries out various activities, which include studies of improvements in reactor design and approval of design modifications proposed by utilities, and decommissioning.

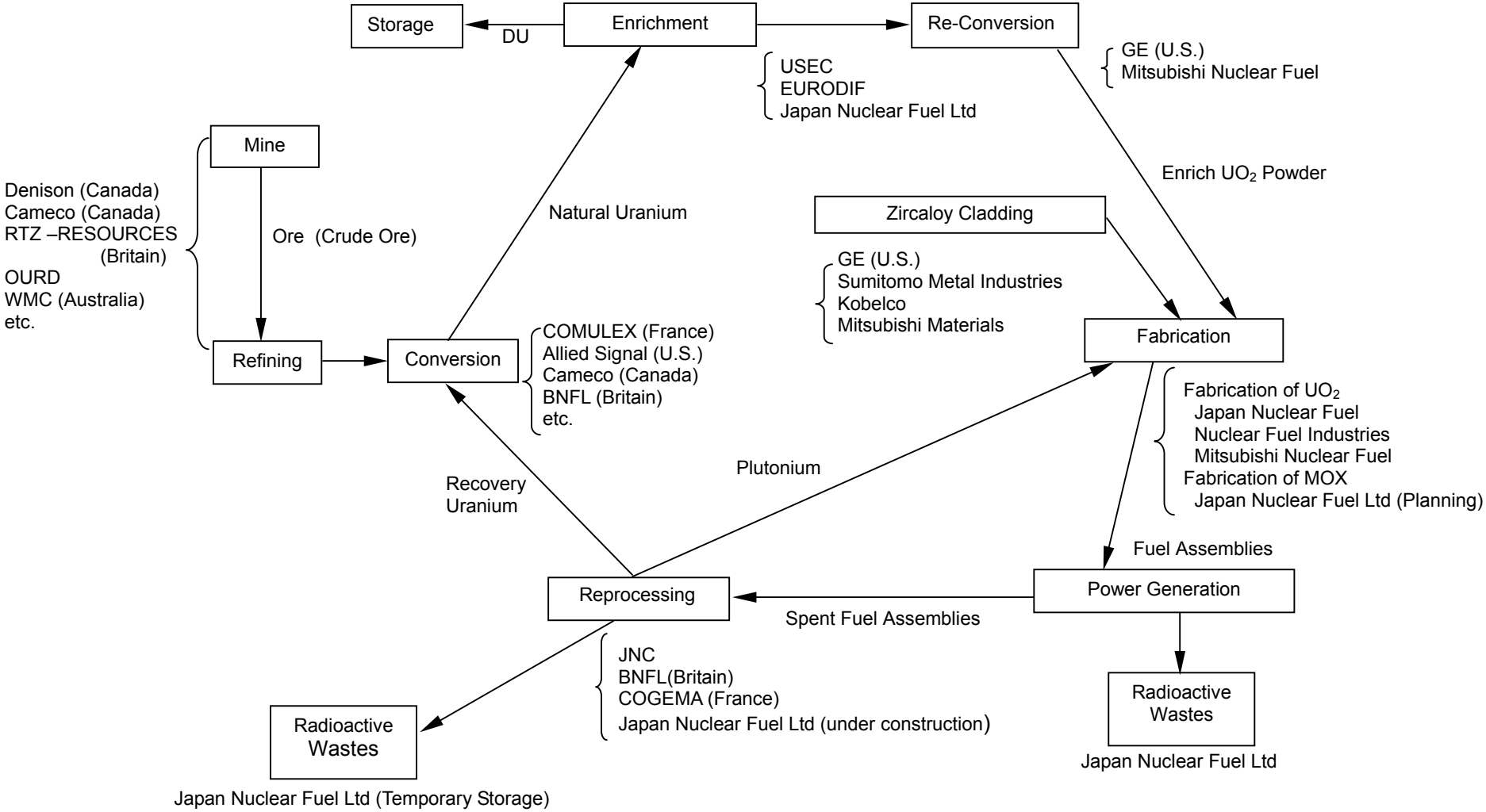


FIG. 6. Nuclear Fuel Cycle Diagram

In addition to the LWRs for power production, Japan is active in developing other types of reactors, such as small LWRs, HTGRs and FBRs. JAERI is developing an integral-type reactor with thermal power up to 300MW aiming at multipurpose use such as small grid electricity generation, heat supply and desalination, on the basis of the MRX ship reactor design. Toshiba Corporation and the Tokyo Institute of Technology are developing a natural circulation, simplified LSBWR with passive safety systems and a long operating cycle: within 100 – 300 MWe power capacity and 15 years core life.

HTGR development is at the stage of construction and operation of a test reactor. The principal focus of Japan's HTGR development programme is the High Temperature Engineering Test Reactor (HTTR) at the JAERI site in Oarai, Ibaraki Pref. Initial criticality of the HTTR was achieved in November 1998. This 30 MW (th) helium-cooled reactor is being utilized to establish and upgrade the technology of advanced HTGR, and to demonstrate the effectiveness of selected high temperature heat utilization systems. The HTTR accomplished a full power operation of 30 MWth and a gas temperature of 850 ℃ at the reactor outlet in December 2001.Also, a project has been initiated to develop a 600 MWth gas turbine HTGR design for electricity generation.

JNC is conducting research and development (R&D) on FBRs and nuclear fuel reprocessing technology to establish an economical nuclear fuel cycle. The experimental fast reactor (JOYO) operated from 1982 to 2000 with a MK-II core (100 MWt). The reactor and its cooling system is currently being upgraded to the MK-III core (140 MWt). The initial criticality of the MK-III core is scheduled for 2003. The prototype LMFR MONJU with a capacity of 280 MW(e) reached initial criticality in April 1994, and was connected to the grid in August 1995. Reactor operation was interrupted in December 1995 due to a sodium leak in the non-radioactive secondary cooling system. Legal application for improvement of the MONJU plant, mainly for countermeasures against sodium leakage, was launched in June 2001. The MONJU reactor is considered to be a cornerstone for R&D activities and considerable effort is being made to resume its operation. In addition to this mainstream development work, a Feasibility Study on Commercialized Fast Reactor Cycle Systems is in progress with the objective of presenting an optimal commercialization vision of LMFR technologies and a research and development programme.

4.5. International Co-operation in the Field of Nuclear Power Development and Implementation

4.5.1. Implementation of Co-operation under Bilateral Nuclear Power Agreements

Bilateral nuclear power co-operation agreements have been concluded for the purpose of promoting the peaceful use of nuclear power while ensuring that nuclear power equipment and materials, including nuclear materials, have solely peaceful applications. Japan has concluded such bilateral nuclear power co-operation treaties with six nations: the United States, Britain, France, Canada, Australia and the People’s Republic of China. Under these agreements, the parties exchange expertise and information on the peaceful use of nuclear power, and provide and receive nuclear equipment, materials and services.

4.5.2. Co-operation with Neighbouring Asian States and Developing Countries

Japan cooperates with Asian and developing nations through the International Conference for Nuclear Co-operation in Asia, under the framework of Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology, and under various bilateral co-operation agreements.

4.5.3. Co-operation with former USSR Nations, Middle and Eastern European Nations

Japan, together with Western countries, provides safety technology assistance to former USSR nation, and Middle and Eastern Europe nations, under bilateral or multilateral frameworks.

4.5.4. Implementation of Research and Development by International Co-operation

- Co-operation in the activities of international organizations
  - Activities with IAEA: Japan has contributed to IAEA projects such as the NUSS programme by dispatching Nuclear Safety Commission members who are experts in related fields. Regarding the Convention on Nuclear Safety, Japan has dispatched experts from the draft planning stage. Japan has also participated in review activities after submission of National Reports.
  - Activities with OECD/NEA: Japan has dispatched representatives to committees such as CSNI, CRPPH, RWMC, and CNRA since their establishment.
- Multilateral co-operation
  - Based on agreements, bilateral co-operation conferences are held regularly to exchange opinions related to safety. Especially, international co-operation research such as the JAERI's ROSA project and projects using the NSRR's facility were sponsored by Japan in co-operation with the USA, Germany, and France. Japan has also participated in many other international co-operation research endeavours including the Halden Reactor Project and LACE.

5. REGULATORY FRAMEWORK

5.1. Safety Authority and the Licensing Procedures

Figure 7 shows the process of approval of or permission for nuclear power plants in Japan.

5.2. Main National Laws and Regulations

Figure 8 show the main laws controlling nuclear power plants in Japan.

It is Japan's fundamental policy to dismantle and remove decommissioned nuclear power generation facilities which have completed their service life, while ensuring complete safety in that process. Based on this fundamental policy, the standard procedure (standard work schedule) is one of 'safe storage plus disassembly/removal'. It is appropriate to choose a safe storage period of five to ten years and a disassembly/removal period of three to four years.

The estimated cost of reactor decommissioning in Japan (referring to precedents in other countries), is approximately 30 billion yen (1984 prices) for a 1,100 MW class nuclear power plant, when its safe storage period is five years. The Agency of Natural Resources and Energy is implementing verification tests of reactor decommissioning technology such as techniques of decommissioning waste processing, and techniques of reactor remote dismantling, which are important in ensuring better safety and reliability. For the installation of a commercial nuclear power plant, it is necessary to go through licensing procedures based on more than 30 laws. Many of the laws also apply to general industrial facilities.

Main nuclear-related laws and regulations are systematized according to organizations, research and development, regulations, and compensation based on the Atomic Energy Laws, as shown in Fig. 7. Among them, laws concerning the safety regulations reactors are the Law for Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors (hereafter called LRNR) and the Electricity Utilities Industry Law (hereafter called EUIL). The purpose of the LRNR is to enforce regulations based on the potential danger of nuclear reactors and nuclear substances, whereas EUIL aims to provide a good supply of electricity, ensuring the safety of hydroelectric power plants, thermoelectric power plants and power transmission lines as well as nuclear power plants, with a view to a stable supply of electricity. Thus, the two laws stand on different viewpoints.

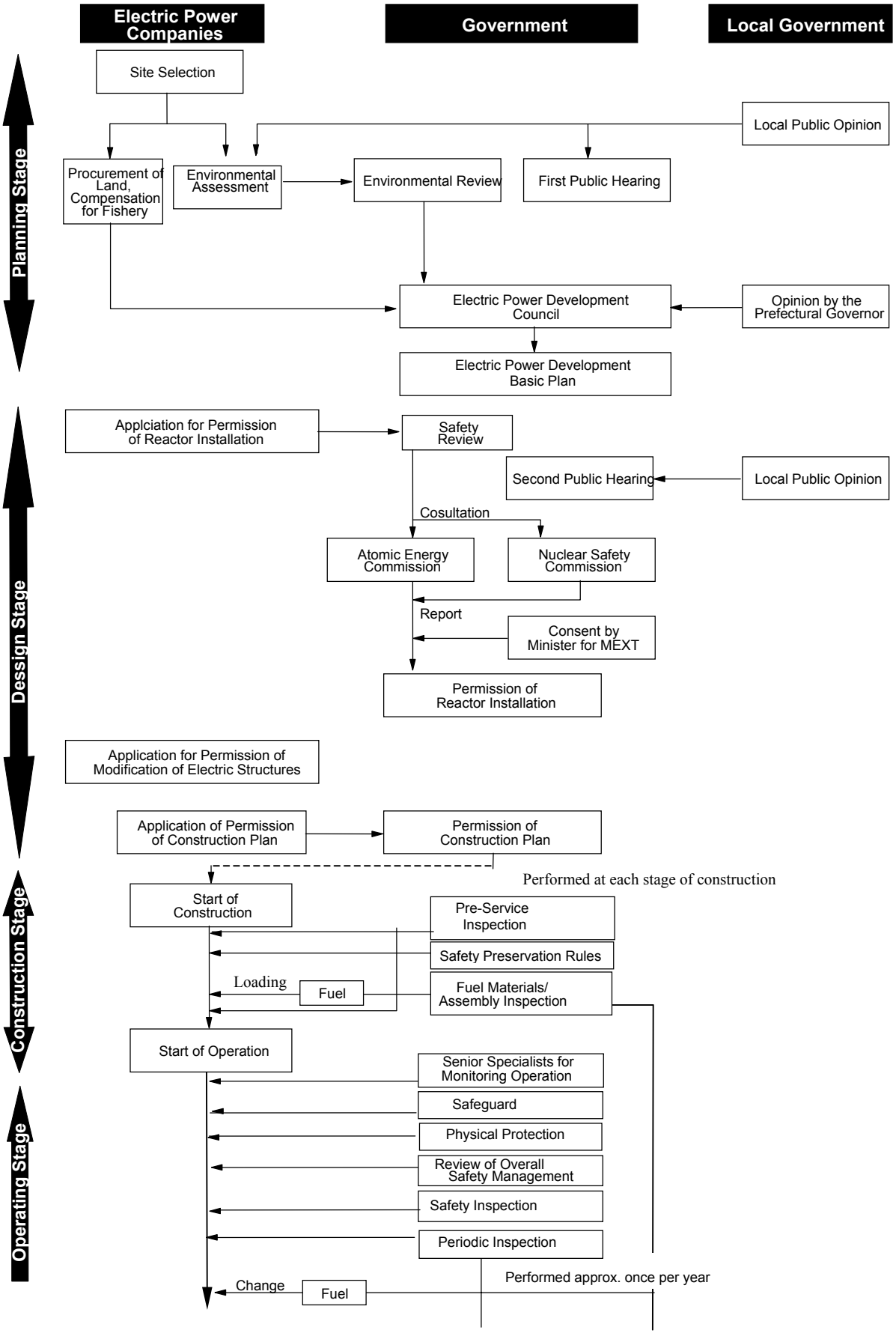


FIG. 7. Process of Approval or Permission of Nuclear Power Plant in Japan

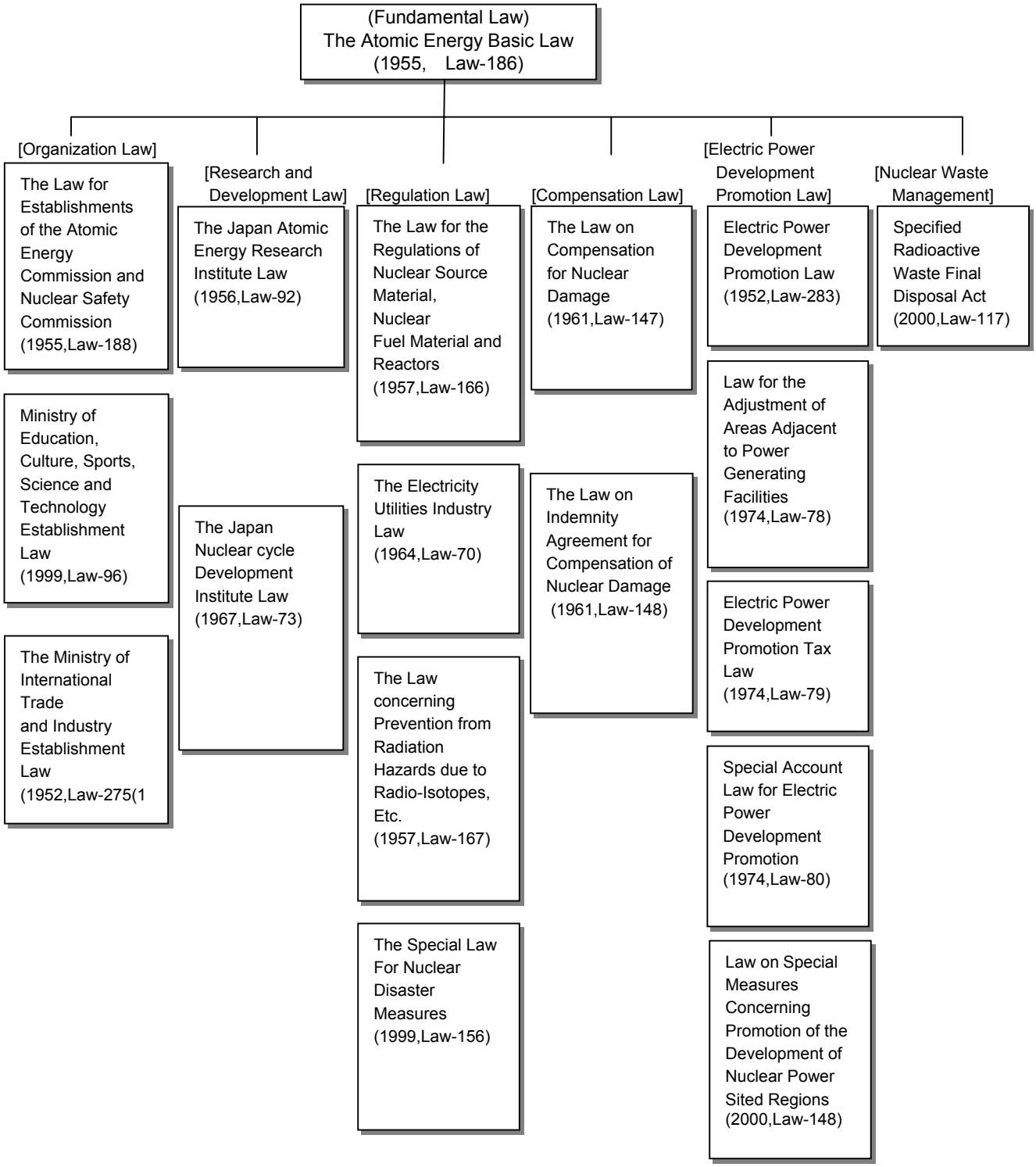


FIG. 8. Scheme Diagram of major Nuclear Laws in Japan

The main nuclear-related laws and regulations are as follows:

1. The Atomic Energy Basic Law (1955.12.19 - Publications)

The research, development and use of nuclear energy shall be limited only for the peaceful purposes aiming at safety assurance. The Act prescribes three principles:

1) Under a democratic management
2) Voluntarily
3) Open information

Nuclear-related laws and regulations are enacted based on the spirit of the Act.

2. The Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (1957.6.10 - Publications)

The Law, usually abbreviated as LRNR, prescribes regulations necessary for the installation and operation of reactors, refining, processing, and disposal of nuclear wastes. Following are the main regulations concerning the installation and operation of reactors:

- Permission for reactor installation (basic design)
- Permission for construction plan (detailed design)
- Pre-use inspection
- Notification of operation plan
- Measures taken for safety
- Approval of safety regulations
- Appointment of Chief Reactor Engineer
- Periodical inspections

LRNR excludes permission for a construction plan, pre-use inspection and periodical inspection, for which the Electricity Utilities Industry Law applies.

3. The Electricity Utilities Industry Law (1964.7.11 - Publications)

The Law intends to protect benefits, ensure safety, and facilitate sound development of electricity utilities for users of electricity:

- Main regulations for nuclear power plants
- Permission for construction plan (detailed design)
- Pre-use inspection
- Periodical inspections
- Appointment of Chief Electric Engineer and Boiler and Turbine Engineers
- Decree of conformity with technical standards (and subordinate rules specifying technical standards)

4. The Law concerning Prevention of Radiation Hazards due to Radioisotopes, Etc. (1957.6.10 - Publications)

The Law intends to prevent radiation hazards by regulating the use and disposal of radioisotopes and the use of radiation producers. In a nuclear power plant, the Law applies when neutron sources are used or radioisotopes are employed for calibration of equipment.

5. The Special Law for Nuclear Disaster Measures (1999.12.17 – Publications)

- Taking quick initial action and ensuring integrated co-operation from the governments of the nation, prefectures and municipalities
- Strengthening national emergency preparedness system in response to nuclear disaster case
- Clarification of undertaker's role in preventing nuclear disasters

6 The Law on Compensation for Nuclear Damage (1961.6.17 - Publication)

Nuclear energy enterprises (electric power companies) owe no-fault liability for compensation to the injured when nuclear damage is caused by the operation of nuclear reactors and the like. In such cases, liability focuses on the nuclear energy enterprises concerned.

Nuclear energy enterprises are compelled to deposit a constant amount of money (30 billion yen at the most) for the measures taken for the fulfillment of the compensation for damage:

- To make an insurance contract for compensation for damage with private insurers
- To execute an indemnity contract with the government

When damage is more than the deposited amount for compensation, the government will assist if necessary.

7. Electric Power Development Promotion Laws:
(1974.6.6 - Publications)

- Electric Power Development Promotion Tax Law
- Special Account Law for Electric Power Development Promotion
- Law for the Adjustment of Areas Adjacent to Power-Generating Facilities
- Law on Special Measures Concerning Promotion of the Development of Nuclear Power Site Regions

Those Laws intend to promote electric power development by returning benefits gained for the whole country from a stable supply of electricity through the siting of a power plant, to the local area.

The Electric Power Development Promotion Tax Law is for collecting the tax of the promotion for Electric Power Development (according to electric power sold), the Special Account Law for Electric Power Development Promotion is for clarifying the government accounts of the undertakings performed by the tax revenue, the Law for the Adjustment of Areas Adjacent to Power Generating Facilities is for smoothly setting up generating Facilities by the promotion of completing public institutions, and the Law on the Special Account Law for Electric Power Development Promotion is to promote the development of nuclear power site regions by giving financial assistance and so on, especially considering protection against the spread of nuclear accidents.

8. Specified Radioactive Waste Final Disposal Act (2000.6.7 – Publications)

The law prescribes a funding system for final disposal, the establishment of an entity to implement final disposal and the designation of an entity to manage the fund.

5.3. International, Multilateral and Bilateral Agreements

AGREEMENTS WITH THE IAEA

• Amendments to Articles VI & XIV Of the Agency Statute	Ratified:	31 May 2000
• Agreement on privileges and immunities	Entry into force:	18 April 1963
• NPT related safeguards agreement INFCIRC/255	Entry into force:	2 December 1977
• Additional Protocol	Entry into force:	16 December 1999
• Multilateral safeguards agreement Japan/France INFCIRC/171	(The application of which has not yet been suspended) Entry into force:	22 September 1972
• Regional Cooperative Agreement for Research, Development and Training Related Nuclear Science and Technology (RCA)	Entry into force:	11 September 1992

MAIN INTERNATIONAL TREATIES

• Non-Proliferation Treaty	Entry into force:	8 June 1976
• Convention on physical protection of nuclear material	Entry into force:	27 November 1988
• Convention on early notification of a nuclear accident	Entry into force:	10 July 1987
• Convention on assistance in the case of a nuclear accident or radiological emergency	Entry into force:	10 July 1987
• Vienna Convention on civil liability for nuclear damage	Non-Party	
• Protocol to amend the Vienna Convention on civil liability for nuclear damage	Not signed	
• Convention on supplementary compensation for nuclear damage	Not signed	
• Convention on nuclear safety	Entry into force:	24 October 1996
• Joint convention on the safety of spent fuel management and on the	Not signed	

safety of radioactive waste management

OTHER RELEVANT INTERNATIONAL TREATIES

• Improved procedures for designation of safeguards inspectors	Prefers present system	
• ZANGGER Committee	Member	
• Nuclear Suppliers Group	Member	
• Nuclear Export Guidelines	Adopted	
• Acceptance of NUSS Codes	Japanese measures, legislation and regulations basically consistent with Codes. Letter of:	19 April 1989

BILATERAL AGREEMENTS[1]

• Agreement for: (i) provision of information; (ii) provision of nuclear materials, facilities and equipment; (iii) transfer of patent rights; (iv) use of facilities and equipment; (v) provision of technical aid and services. (The above content is an example only. Other forms of co-operation are not to be neglected.)	Canada Effective Date: Agreement Revised: (valid for 10 years, terminated thereafter by notice 6 months prior to the said termination)	 27 July 1960 2 September 1980
• Agreement for: (i) provision and exchange of information; (ii) provision of nuclear materials, facilities and equipment; (iii) provision of services. (iv) other means	United Kingdom Effective Date: Agreement Revised (valid for 30 years)	 15 October 1968 12 October 1998
• Agreement for: (i) exchange of experts; (ii) exchange of information; (iii) provision of nuclear materials, facilities and secrecy technologies; (iv) provision of services; (v) co-operation in mining and the exploitation and use of mines; (vi) other means.	France Agreement Revised (valid for 45 years starting on the effective date of the current Japan-France Agreement. Terminated thereafter by notice 6 months prior to the said termination date.)	 19 July 1990

[1] Source: Nuclear Power Pocket Book 1994, Japan Atomic Industrial Forum, Inc.

- Agreement for:
  (i) exchange of experts
  (ii) provision and exchange of information
  (iii) provision of nuclear materials, facilities and secrecy technologies
  (iv) provision of services
  (v) other means

  Australia
  Effective date: 17 August 1982
  (Valid for 30 years, terminated thereafter by notice 6 months prior to the said termination date.)

- Agreement for:
  (i) exchange of experts
  (ii) provision and exchange of information
  (iii) provision of nuclear materials, facilities and secrecy technologies
  (iv) provision of services
  (v) other means

  China
  Effective date: 10 July 1986
  (Valid for 15 years, automatically extended thereafter for 5 years unless notice is provided 6 months prior to the termination date)

- Agreement for:
  (i) exchange of experts
  (ii) provision and exchange of information
  (iii) provision of nuclear materials and facilities
  (iv) provision of services
  (v) other means

  USA
  Effective date: 17 July 1988
  (Valid for 30 years, terminated thereafter by notice 6 months prior to the said termination date.)

Table 10 shows Japan's the co-operation with major international organisations.

TABLE 10. CO- OPERATION WITH INTERNATIONAL ORGANIZATIONS

Organization	Outline of co-operation
IAEA	Promotion of peaceful uses of atomic energy (safety related co-operation, technical aid to developing countries and R&D), and provision of safeguards to ensure that nuclear activities are not transferred for military purposes. Japan participates positively in INSAG (International Nuclear Safety Advisory group), NUSSAC (Nuclear Safety Standard Advisory Committee), ASSET (Assessment of Safety Significant Event Team), OSART and special safety evaluation studies of former USSR reactors. Japan has Extrabudgetary Contribution to the IAEA for 1) the Expanded programme of public understanding of nuclear energy (EPPUNE), 2) Nuclear Safety and 3) Waste Management and Disposal.
OECD/NEA	The purpose is to provide useful information to member countries through technological study and mutual co-operation regarding problems common in nuclear energy use in the advanced countries. Japan participates positively in CNRA (Committee for Nuclear Regulatory Activities), CSNI (Committee for Safety of Nuclear Installation), RWMC (Radioactive Waste Management Committee) and NDC (Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle).
Assistance to G7 for nuclear safety	Participation for the improved safety of former USSR reactors was proposed at the Munich Summit in 1992. Japan has played a positive role along the theme of the declaration. Currently, the major problem is the closing of the Chernobyl Power Plant.
Nuclear Safety Assistance Co-ordination to G24	G24 mandate was extended to the former USSR area to adjust multi-national or bilateral support activities in the former USSR and central and eastern Europe. The G24 Nuclear Safety Support Adjustment Committee was established to carry out the related activities.

REFERENCES

[1] The New Long-Range Plan for Development and Utilisation of Nuclear Energy (Revised November 2000)

[2] IAEA Energy and Economic Data Base (EEDB).

[3] IAEA Power Reactor Information System (PRIS).

[4] Organization and Staff of Electric Utilities and Corporation Related, Japan Electric Association.

[5] Nuclear Power Yearbook, Japan Atomic Industrial Forum Inc.

Appendix

DIRECTORY OF THE MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER-RELATED ACTIVITIES

NATIONAL ATOMIC ENERGY AUTHORITY

Atomic Energy Commission (AEC)
c/o Cabinet Office
Central Government Building No. 4, 7F
3-1-1 Kasumigaseki, Chiyoda-ku
Tokyo, Japan

Tel.: +81-3 3581 6690
Fax: +81-3 3581 9827

http://aec.jst.go.jp/

GOVERNMENT ORGANIZATIONS

Ministry of Education, Culture, Sports,
Science and Technology (MEXT)
2-2-1 Kasumigaseki, Chiyoda-ku
Tokyo, Japan

Tel.: +81-3 5253 4160
Fax: +81-3 5253 4162
http://www.mext.go.jp/

Ministry of Economy, Trade
and Industry (METI)
1-3-1 Kasumigaseki, Chiyoda-ku
Tokyo, Japan

Tel.: +81-3 3501 1991
Fax: +81-3 3508 8447

http://www.meti.go.jp/

CORPORATIONS RELATED TO NUCLEAR POWER

Japan Atomic Energy Research Institute (JAERI)
Office of Planning
2-2, Uchisaiwaicho 2-Chome
Chiyoda-ku, Tokyo

Tel: 03-3592-2100
Fax: 03-3592-2119
http://www.jaeri.go.jp/

Japan Nuclear Cycle Development Institute (JNC)
Executive Office for Policy Planning and Administration
4-49, Muramatsu
Tokai-Mura
Naka-Gun, Ibaragi Prefecture

Tel: 029-282-1122
Fax: 029-282-4917
http://www.jnc.go.jp/

Nuclear Power Engineering Corporation (NUPEC)
Safety Information Research Center
17-1, Toranomon 3-Chome
Minato-ku, Tokyo

Tel: 03-3435-3406
Fax: 03-3435-3410
http://www.nupec.or.jp/

Japan Atomic Industrial Forum Inc. (JAIF)
Department of Information & Research
1-13, Shinbashi 1-Chome
Minato-ku, Tokyo

Tel: 03-3508-2411
Fax: 03-3508-2094
http://www.jaif.or.jp/

SUPPLIERS OF NPPS

Toshiba Corporation (TOSHIBA)
General Planning Department,
Nuclear Energy Systems & Services Division
Power Systems & Services Company

Tel: 03-3457-3717

4-6, Kanda-surugadai
Chiyoda, Tokyo
Fax: 03-5444-9191
http://www.toshiba.co.jp/

Hitachi Ltd. (HITACHI)
Nuclear Systems Tokyo Division,
Power & Industrial Systems
1-13, Shinbashi 1-Chome
Chiyoda-ku, Tokyo
Tel: 03-5295-5394
Fax: 03-3258-2348
http://www.hitachi.co.jp/

Mitsubishi Heavy Industries Ltd. (MHI)
Nuclear Energy Systems Department
5-1, Marunouchi 2-Chome
Chiyoda-ku, Tokyo
Tel: 03-3212-3111
Fax: 03-3214-9857,9858
http://www.mhi.co.jp/index.html

OWNERS/OPERATORS

The Federal of Electric Power Companies (FEPCO)
Nuclear Power Department
9-4, Otemachi 1-Chome
Chiyoda-ku, Tokyo
Tel: 03-3279-2187
Fax: 03-3241-1780
http://www.fepc.co.jp/

Hokkaido Electric Power Co., Inc. (HEPCO)
Higashi 1-Chome, Ohdori
Chuoku, Sapporo
Tel: 011-251-1111
http://www.hepco.co.jp/

Tohoku Electric Power Co., Inc. (TOHOKU)
7-1, Ichibancho 3-Chome
Aoba-ku, Sendai
Tel: 022-225-2111
http://www.tohoku-epco.co.jp/

Tokyo Electric Power Co., Inc. (TEPCO)
1-3, Uchisaiwai-cho
1-Chome, Chiyoda-ku, Tokyo
Tel: 03-3501-8111
http://www.tepco.co.jp/

Chubu Electric Power Co., Inc. (CHUBU)
Ichibanchi Toshin-Cho,
Higashi-ku, Nagoya
Tel: 052-951-8211
http://www.chuden.co.jp/

Hokuriku Electric Power Co., Inc. (HOKURIKU)
15-1, Ushijima, Toyama
Tel: 076-441-2511
http://www.rikuden.co.jp/

Kansai Electric Power Co., Inc. (KEPCO)
3-22, Nakanoshima 3-chome
Kita-ku, Osaka
Tel: 06-441-8821
http://www.kepco.co.jp/

Chugoku Electric Power Co., Inc. (CHUGOKU)
4-33, Komachi
Naka-ku, Hiroshima
Tel: 082-241-0211
http://www.energia.co.jp/

Shikoku Electric Power Co., Inc. (SHIKOKU)
2-5, Marunouchi,
Takamatsu
Tel: 087-821-5061
http://www.yonden.co.jp/

Kyushu Electric Power Co., Inc. (KYUSHU)
2-1-82, Watanabe-Dori,
Chuo-ku, Fukuoka
Tel: 092-761-3031
http://www.kyuden.co.jp

Japan Atomic Power Co., Inc. (JAPCO)
6-1, 1-Chome, Ohtemachi,
Chiyoda-ku, Tokyo
Tel: 03-3201-6631
http://www.japc.co.jp/

Central Research Institute
of Electric Power Industry (CRIEPI)
http://criepi.denken.or.jp/

World Association of Nuclear Operators (WANO) http://www.wano-tc.or.jp/

FUEL CYCLE

Japan Nuclear Cycle Development Institute, (JNC)
4-49, Muramatsu, Tokai-Mura, Naka-Gun,
Ibaragi Prefecture
Tel: 029-282-1122
http://www.jnc.go.jp/

Japan Nuclear Fuel, Ltd.
2-2-2 Uchisaiwai-cho, Chiyoda-Ku, Tokyo
Tel: 03-3581-8831
http://www.inf.co.jp/corp/main.html

Mitsubishi Nuclear Fuel, Inc.
1-6-1 Otemachi, Chiyoda-Ku, Tokyo
Tel: 03-3214-0051
http://www.mnf.co.jp

Japan Nuclear Fuels, Inc.
2-3-1 Uchikawa, Yokosuka City
Kanagawa Prefecture
Tel: 0468-33-2323
http://www.jnf.co.jp/corp/main.html

Nuclear Fuel Industries, Inc.
3-13, Toranomon 4-Chome
Minato-ku, Tokyo
Tel: 03-3433-1093
http://www.nfi.co.jp/

Sumitomo Metal Industries, Inc.
1-1-3 Otemachi
Chiyoda-Ku, Tokyo
Tel: 03-3282-6111
http://www.smm.co.jp/main.html/

Kobelco, Inc.
1-3-18 Wakihama-Cho
Chuo-Ku, Kobe City, Hyogo Prefecture
Tel: 03-3586-3311
http://www.kobelco.co.jp/

Mitsubishi Materials, Inc.
1-5-1 Otemachi
Chiyoda-Ku, Tokyo
Tel: 03-5252-5200
http://www.mmc.co.jp/english/top_e.html

UNIVERSITIES

Hiroshima University
http://www.hiroshima-u.ac.jp/index.html

Hokkaido University
http://www.hokudai.ac.jp/

Kyushu University
http://www.kyushu-u.ac.jp/

Musashi Institute of Technology
http://www.musashi-tech.ac.jp/

Nagoya University
http://www.nagoya-u.ac.jp/

Osaka University	http://www.osaka-u.ac.jp/
Ritsumeikan University	http://www.ritsumei.ac.jp/index-e.html
Tohoku University	http://www.tohoku.ac.jp/
Tokai University	http://www.u-tokai.ac.jp/
Tokyo Institute of Technology (TITECH)	http://www.titech.ac.jp/
University of Tokyo	http://www.u-tokyo.ac.jp/

OTHER ORGANIZATIONS

Atomic Energy Society of Japan	http://wwwsoc.nacsis.ac.jp/aesj/index-e.html