

日本 에너지 統計

GENERAL FEATURES OF THE ENERGY ECONOMY

Japan is inhabited by about 120 million people and its area covers nearly 378,000km². By this, Japan belongs to countries with the highest density of population.

At the same time, Japan is one of the most industrialized countries. The Gross National Product (GNP) is accordingly high with more than 10,000US-Dollar per capita (nominal). Iron and Steel, automobiles, machines, electronics, chemicals and engineering industries are the most important branches which provide considerable contribution to the GNP.

According to the high levels of production and living standards, the energy consumption per capita amounts to more than 3 Toe (134GJ), which is confronted with only small domestic resources. Besides negligible natural gas and oil sources, only hydropower and solid fuels (coal) are available in some amounts. The percentages of hydropower, domestic solid fuels and nuclear energy shared in the total primary energy supply are about 6%, 3% and 11% respectively. Therefore, Japan depends on imported energy for about 84%.

Crude oil and oil products take the greatest part of the import energies (nearly 70%). The Government of Japan aims at a smaller dependency of energy supply on oil imports. By this, considerable successes have already been reached. In 1973 the oil imports amounted to nearly 282 Mtoe whereas in 1987 only near 227 Mtoe crude oil and oil products were imported. So the share in percentage concerning the total primary energy consumption dropped from 83% to 58% in the period from 1973 till today.

Besides the decrease of the oil import dependency, the general reduction of the energy consumption is fixed in the energy program. The measures taken by

the government and private sectors had the effect that the primary energy consumption increased by 14.3% from 1973 to 1987 despite the increase in GNP by 66.1% in the same period.

In recent days of 1989, the energy situations is becoming favorable to Japan with higher exchange rate for the Japanese yen and lower price for imported oil. However as before, Japan should continue to develop the domestic energy resources, such as renewable and nuclear energy, and promote further energy conservation, because Japan still depends on imported energy for the greatest part of the primary energy.

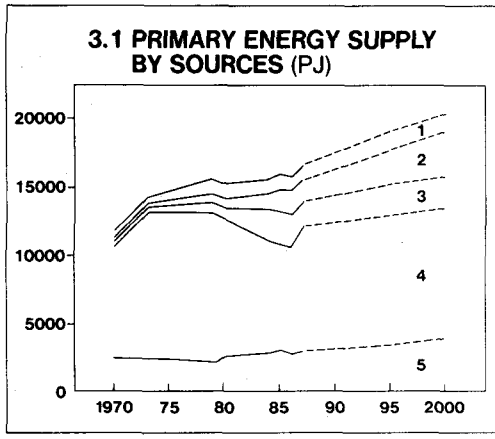
Therefore, Japanese government is preparing 217.9 billion yen for the energy programs in fiscal 1989.

A more intensive use of nuclear power is also intended, therefore the nuclear power activities of Japan up to December 1988 are significant and of great consequence:

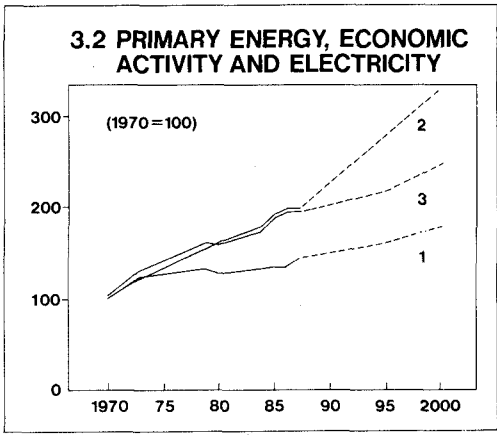
| | |
|---------------------------|--------------|
| in operation | net 26929 MW |
| in course of construction | net 12329 MW |
| project | net 5396 MW |

This Energy Date Profile is published by Japanese National Committee, World Energy Conference c/o Japan Power Association; Uchisaiwai Bld., 1-4-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100 Japan, and compiled by The Institute of Applied Energy; Shinbashi SY Bld., 1-14-2 Nishi Shinbashi, Minato-ku, Tokyo, 105, JAPAN. Source of Data: "SOHGO ENERUGHI TOHKEI 1989" (General Energy Statistics 1989) compiled by Agency of Natural Resources and Energy, Ministry of International Trade and Industry.

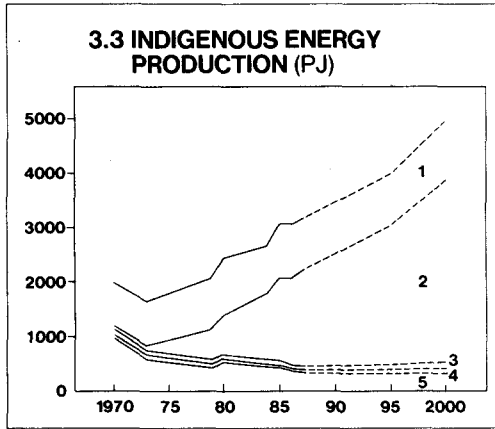
WEC 第16次 총회(1995年) 개최국이며 戰後 經濟大國으로 발전한 日本의 에너지 경제 실태를 파악하기 위하여 WEC 에서 蒐集한 에너지 통계 자료를 게재한다



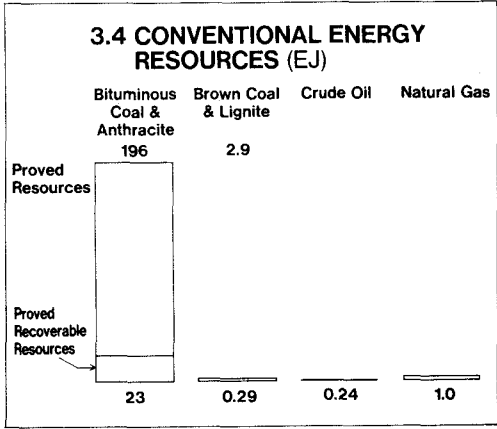
1 Hydro Power 3 Natural Gas 5 Solid Fuels
2 Nucl. Power 4 Crude Oil, Petr. Prod.



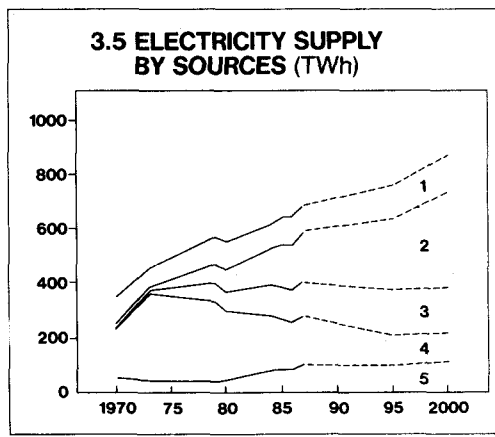
1 Primary Energy Supply 3 Electricity
2 GNP



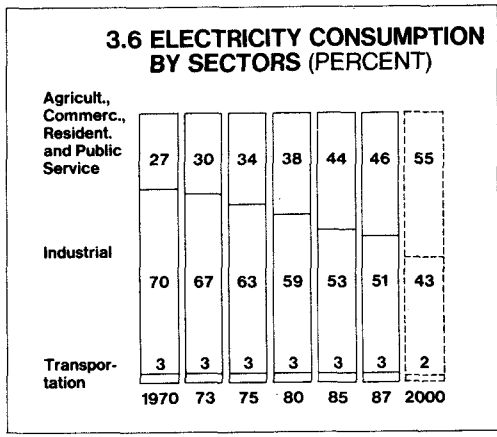
1 Hydro 3 Natural Gas 5 Solid Fuels
2 Nucl. Power 4 Crude Oil



Source : WEC Energy Resources 1986



1 Hydro and Other 4 Oil
2 Nuclear 5 Solid Fuels
3 Gas



| 4.1 GENERAL ENERGY DATA | | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|-------------------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Population | 10 ⁶ | 105 | 109 | 116 | 117 | 120 | 121 | 122 | 122 |
| GNP | 10 ⁹ US \$ (1980) | 678 | 813 | 1026 | 1067 | 1238 | 1292 | 1326 | 1351 |
| GNP | 10 ⁹ YEN (1980) | 153915 | 184569 | 232878 | 242130 | 281102 | 293333 | 300948 | 316611 |
| GNP | US \$ (1980) | 6458 | 7459 | 8844 | 9117 | 10317 | 10679 | 10867 | 11071 |
| GNP/Capita | 10 ³ YEN (1980) | 1466 | 1693 | 2008 | 2069 | 2343 | 2424 | 2467 | 2513 |
| Primary Energy Supply | | | | | | | | | |
| Total | PJ | 11832 | 14279 | 15395 | 15154 | 15370 | 15684 | 15560 | 16325 |
| Total | Mtoe | 282 | 340 | 367 | 361 | 366 | 373 | 370 | 389 |
| Per Capita | GJ | 113 | 131 | 133 | 130 | 128 | 130 | 128 | 134 |
| Per GNP | MJ/US \$ (1980) | 17 | 18 | 15 | 14 | 12 | 12 | 12 | 12 |
| Per GNP | MJ/YEN (1980) | 0.077 | 0.077 | 0.066 | 0.063 | 0.055 | 0.053 | 0.052 | 0.053 |
| Electricity Supply | | | | | | | | | |
| Total | TWh | 360 | 470 | 580 | 577 | 646 | 672 | 686 | 719 |
| Per Capita | kWh | 3429 | 4312 | 5000 | 4932 | 5383 | 5554 | 5623 | 5893 |
| Per GNP | Wh/US \$ (1980) | 531 | 578 | 565 | 541 | 521 | 520 | 517 | 532 |
| Per GNP | Wh/YEN (1980) | 2.34 | 2.55 | 2.49 | 2.38 | 2.30 | 2.29 | 2.28 | 2.34 |

| 4.2 PRIMARY ENERGY SUPPLY (PJ) | | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|--------------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|
| Indigenous Production | | | | | | | | | |
| Solid Fuels | | 992 | 619 | 473 | 524 | 446 | 436 | 345 | 323 |
| Crude Oil & NGL ¹⁾ | | 34 | 31 | 21 | 18 | 19 | 25 | 26 | 28 |
| Natural Gas | | 102 | 107 | 96 | 88 | 91 | 88 | 82 | 87 |
| Nuclear Power | | 44 | 91 | 663 | 778 | 1264 | 1502 | 1584 | 1768 |
| Hydro Power | | 888 | 815 | 969 | 1032 | 904 | 1022 | 1006 | 960 |
| Other Commercial | | — | — | — | — | — | — | — | — |
| Non Commercial ²⁾ | | — | — | — | — | — | — | — | — |
| Total Production | | 2060 | 1663 | 2222 | 2440 | 2724 | 3073 | 3043 | 3166 |
| (Mtoe) | | 49 | 40 | 53 | 58 | 65 | 73 | 72 | 75 |
| Imports (+) | | | | | | | | | |
| Solid Fuels | | 1535 | 1750 | 1780 | 2152 | 2566 | 2696 | 2568 | 2702 |
| Crude Oil | | 7655 | 10668 | 10221 | 9180 | 7803 | 7227 | 6873 | 6892 |
| Refined Petroleum Products | | 1449 | 1156 | 1443 | 1233 | 1660 | 1812 | 2145 | 2632 |
| Natural Gas | | 48 | 116 | 713 | 821 | 1301 | 1351 | 1409 | 1449 |
| Electricity | | — | — | — | — | — | — | — | — |
| Total Imports | | 10687 | 13690 | 14157 | 13386 | 13330 | 13086 | 12995 | 13675 |
| (Mtoe) | | 254 | 326 | 337 | 319 | 317 | 312 | 309 | 326 |
| Exports (-) | | | | | | | | | |
| Solid Fuels | | 3 | 19 | 65 | 61 | 67 | 66 | 70 | 93 |
| Crude Oil | | — | — | — | — | — | — | — | — |
| Refined Petroleum Products | | 88 | 117 | 91 | 92 | 122 | 136 | 146 | 171 |
| Natural Gas | | — | — | — | — | — | — | — | — |
| Electricity | | — | — | — | — | — | — | — | — |
| Total Exports | | 91 | 136 | 156 | 153 | 189 | 202 | 216 | 264 |
| (Mtoe) | | 2 | 3 | 4 | 4 | 5 | 5 | 5 | 6 |
| Marine-Bunkers (-) | | 633 | 764 | 559 | 545 | 336 | 319 | 282 | 271 |
| Change in Stocks (±) | | -191 | -174 | -269 | 27 | -159 | 45 | 21 | 18 |
| Total Primary Energy Supply | | 11832 | 14279 | 15395 | 15154 | 15370 | 15684 | 15560 | 16325 |
| (Mtoe) | | 282 | 340 | 367 | 361 | 366 | 373 | 370 | 389 |

| 4.3 TRANSFORMATION SECTOR (PJ) | | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|--------------------------------|--|------|------|------|------|------|------|------|------|
| Conversion | | 2528 | 3055 | 3630 | 3592 | 3795 | 3963 | 3961 | 4185 |
| Energy Sector Own Use | | 653 | 882 | 955 | 904 | 863 | 863 | 819 | 845 |
| Statistical Differences (±) | | 206 | -266 | -383 | 68 | -3 | 12 | -106 | -112 |
| Total Use in Transformation | | 3387 | 3671 | 4202 | 4564 | 4655 | 4838 | 4674 | 4918 |
| (Mtoe) | | 81 | 88 | 100 | 109 | 111 | 115 | 111 | 117 |

| 4.4 FINAL ENERGY DEMAND (PJ) | | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|------------------------------|--|------|-------|-------|-------|-------|-------|-------|-------|
| (Mtoe) | | 8445 | 10608 | 11193 | 10590 | 10715 | 10846 | 10886 | 11407 |
| | | 201 | 252 | 267 | 252 | 255 | 258 | 259 | 272 |

¹⁾ unrefined liquids.²⁾ includes wood, waste and other (peat, black, liquor, etc.)

| 5.1 FINAL ENERGY DEMAND BY SOURCES AND SECTOR (PJ) | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|---|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Solid Fuels ¹⁾ | | | | | | | | |
| Industrial | 1201 | 1435 | 1374 | 1546 | 1590 | 1581 | 1454 | 1512 |
| Transportation | 43 | 7 | — | — | — | — | — | — |
| Other ²⁾ | 90 | 48 | 45 | 41 | 50 | 48 | 36 | 33 |
| Non Energy Use ³⁾ | — | — | — | — | — | — | — | — |
| Total Solid Fuels (Mtoe) | 1334 32 | 1490 35 | 1419 34 | 1587 38 | 1640 39 | 1629 39 | 1490 35 | 1545 37 |
| Refined Petroleum Production ²⁾ | | | | | | | | |
| Industrial | 3055 | 3731 | 3320 | 2725 | 2323 | 2297 | 2328 | 2450 |
| Transportation | 1281 | 1674 | 2161 | 2134 | 2231 | 2285 | 2366 | 2463 |
| Other ²⁾ | 1062 | 1490 | 1623 | 1512 | 1542 | 1572 | 1600 | 1677 |
| Non Energy Use | 240 | 323 | 298 | 275 | 296 | 290 | 314 | 322 |
| Total Refined Petroleum Product (Mtoe) | 5638 134 | 7218 172 | 7402 176 | 6646 158 | 6392 152 | 6444 153 | 6608 157 | 6912 165 |
| Gas ³⁾ | | | | | | | | |
| Industrial | 84 | 87 | 83 | 91 | 115 | 121 | 118 | 130 |
| Transportation | — | — | — | — | — | — | — | — |
| Other ²⁾ | 155 | 205 | 284 | 295 | 349 | 361 | 372 | 383 |
| Non Energy Use ⁴⁾ | — | — | — | — | — | — | — | — |
| Total Gas (Mtoe) | 239 6 | 292 7 | 367 9 | 386 9 | 464 11 | 482 11 | 490 12 | 513 12 |
| Electricity ⁴⁾ | | | | | | | | |
| Industrial | 853 | 1078 | 1196 | 1155 | 1200 | 1220 | 1197 | 1257 |
| Transportation | 41 | 48 | 55 | 55 | 57 | 59 | 60 | 61 |
| Other ²⁾ | 340 | 482 | 754 | 761 | 962 | 1012 | 1041 | 1119 |
| Total Electricity (Mtoe) | 1234 29 | 1608 38 | 2005 48 | 1971 47 | 2219 53 | 2291 55 | 2298 55 | 2437 58 |
| Total Final Energy Demand (Mtoe) | 8445 201 | 10698 252 | 11193 267 | 10590 252 | 10715 255 | 10846 258 | 10886 259 | 11407 272 |

| 5.2 ELECTRICITY SUPPLY BY SOURCES (TWh) | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|--|------|------|------|------|------|------|------|------|
| Solid Fuels | 60 | 37 | 44 | 50 | 91 | 100 | 99 | 107 |
| Oil | 207 | 337 | 301 | 264 | 213 | 192 | 193 | 198 |
| Gas | 5 | 11 | 73 | 81 | 123 | 128 | 130 | 134 |
| Nuclear Power | 83 | 75 | 92 | 99 | 85 | 97 | 96 | 91 |
| Hydro Power ⁷⁾ | 5 | 10 | 70 | 83 | 134 | 160 | 168 | 189 |
| Other | — | — | — | — | — | — | — | — |
| Net Import | — | — | — | — | — | — | — | — |
| Total | 360 | 470 | 580 | 577 | 646 | 672 | 686 | 719 |

| 5.3 SECTOR OIL SUBSTITUTION INDICATORS (OAR and OUR) | 1970 | 1973 | 1979 | 1980 | 1984 | 1985 | 1986 | 1987 |
|---|------|------|------|------|------|------|------|------|
| Oil Application Ratio (OAR) | | | | | | | | |
| Industry | 0.32 | 0.30 | 0.28 | 0.25 | 0.24 | 0.25 | 0.25 | 0.25 |
| Transport | 0.14 | 0.14 | 0.18 | 0.20 | 0.23 | 0.25 | 0.26 | 0.25 |
| Commercial/Residential ⁸⁾ | 0.11 | 0.12 | 0.14 | 0.14 | 0.16 | 0.17 | 0.17 | 0.17 |
| Non Energy Use | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Electricity Generation | 0.20 | 0.24 | 0.23 | 0.22 | 0.19 | 0.17 | 0.17 | 0.17 |
| Oil Use Ratio (OUR) | | | | | | | | |
| Industry | 0.59 | 0.59 | 0.56 | 0.50 | 0.45 | 0.44 | 0.46 | 0.46 |
| Transport | 0.94 | 0.97 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Commercial/Residential ⁸⁾ | 0.65 | 0.67 | 0.60 | 0.58 | 0.54 | 0.53 | 0.53 | 0.53 |
| Non Energy Use | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Electricity Generation | 0.57 | 0.71 | 0.53 | 0.46 | 0.32 | 0.27 | 0.26 | 0.26 |

¹⁾ Solid fuels include coals, briquette, cokes, cokes oven gas, blast furnace, charcoal and wood.

²⁾ Refined petroleum products include LPG.

³⁾ Gas includes natural gas, liquefied natural gas and town gas.

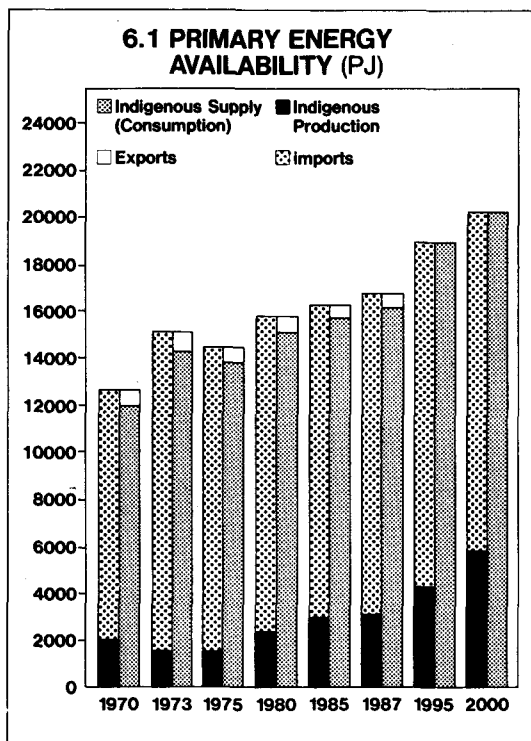
⁴⁾ Figures in electricity are for utility powers and for private power generation.

⁵⁾ Other includes agriculture, fishery, forestry, commercial, residential and public Service.

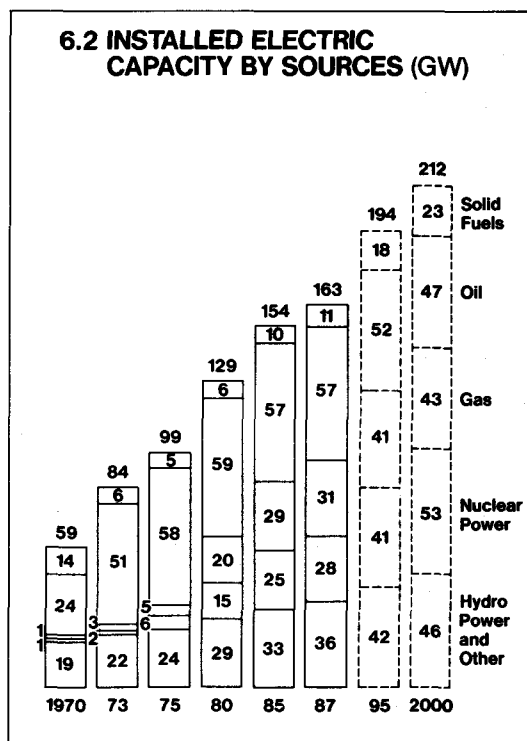
⁶⁾ Non energy use includes chemical and petrochemical feedstocks, lubricants, etc.

⁷⁾ Hydro Power includes geothermal, solar, wind and tide electricity.

⁸⁾ Commercial/residential includes, agriculture, fishery and forestry.



Exports for 1995 and 2000 is not defined.



Excludes auto generation.

6.3 EXPLANATIONS AND DEFINITIONS (according to WEC-recommendations)

SYMBOLS AND ABBREVIATIONS EMPLOYED:

- e = estimated data
- na = not available data
- = magnitude zero
- r = revised data in respect of previous issue

In rounding data, each figure has been rounded off to the nearest final digit. The sum of the parts may not therefore equal the total.

CONVERSION FACTORS

When hydro, nuclear or geothermal electricity is accounted for as primary energy in PJ or Mtoe a convention of 1 TWh of electricity = 2.6 TWh of primary energy has been used (table 4.2, diagram 3.1 and 3.3) and the conversion losses are included in table 4.3. Thus 1 TWh electricity = 2.6 TWh = 9.36 PJ of primary energy. In table 5.1 is electricity final demand given in PJ (1 TWh = 3.6 PJ). Total is also given as primary energy equivalent PJ (1 TWh = 9.36 PJ).

In table 5.2 electricity supply amounts in TWh.

S.1. MULTIPLIERS AND EQUIVALENTS

| | | | |
|-------------------------------|--------------------|-----------------------|--------------------------|
| (k) = kilo = 10 ³ | J | = 1 Joule | = 0.239 cal = 1 Ws |
| (M) = mega = 10 ⁶ | 1 kWh final demand | = 3.6 MJ or 860 kcal | |
| (G) = giga = 10 ⁹ | 1 Ton | = 1000 kg | |
| (T) = tera = 10 ¹² | 1 kg | = 2.2046 lb. | |
| (P) = peta = 10 ¹⁵ | 1 Btu | = 0.252 kcal | = 1,055 kJ |
| (E) = exa = 10 ¹⁸ | 1 Therm | = 10 ⁵ Btu | = 25200 kcal = 105506 kJ |
| | 1 Toe | = 42 GJ | |
| | 1 Toe | = 29.3 GJ | |

OIL SUBSTITUTION INDICATORS

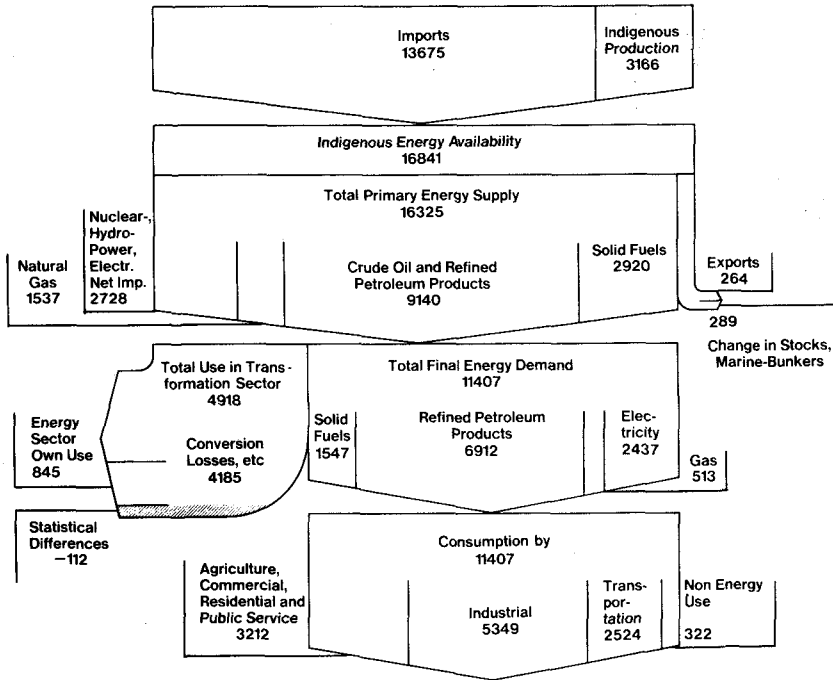
$$OAR = \frac{\text{Oil Consumption in Sector}}{\text{Total Oil Consumption in Country}}$$

$$OUR = \frac{\text{Oil Consumption in Sector}}{\text{Total Energy Consumption in Sector}}$$

CURRENCY CONVERSION

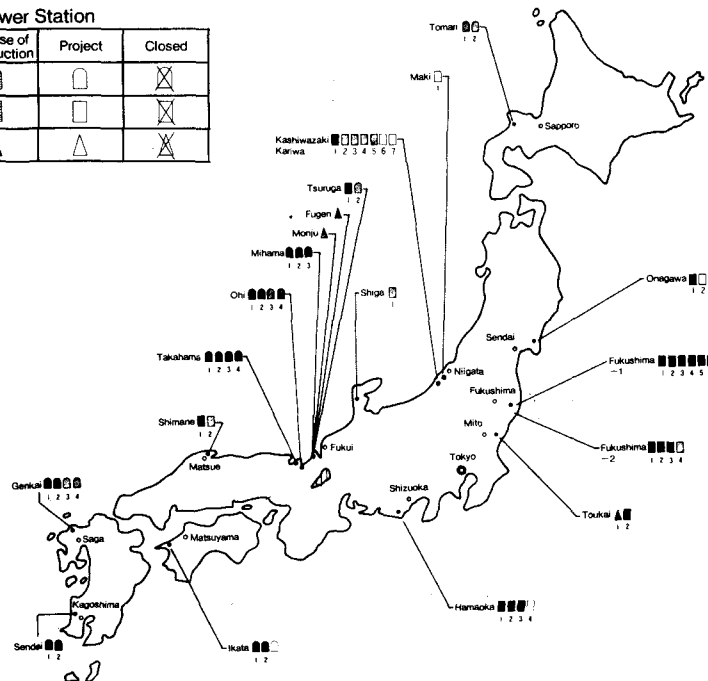
Local currency is converted to 1980 US \$ by deflating local currency values to 1980 values and using the 1980 US Dollar exchange rate (1 US \$ = 227 YEN) (Average exchange rate for 1987 was about 140 yen to the U.S. dollar)

DIAGRAM OF ENERGY FLOW 1987 (PJ)



Nuclear Power Station

| Reactor Type | In Operation | In course of construction | Project | Closed |
|--------------|--------------|---------------------------|---------|--------|
| PWR | ■ | ▨ | □ | ⊗ |
| BWR | ■ | ▨ | □ | ⊗ |
| Other Types | ▲ | ▴ | △ | ⊗ |



| Nuclear Power Units | | DECEMBER 1988 | | |
|-------------------------------------|-----|--------------------|-----------------|--------------------------------|
| Power Plant | | Net Power (MW) | Type Of Reactor | Placed in Commercial Operation |
| 1. IN OPERATION | | | | |
| FUGEN | | 165 ¹⁾ | ATR | 1979 |
| TOUKAI | | 159 | GCR | 1966 |
| TOUKAI-2 | | 1080 | BWR | 1978 |
| TSURUGA | NO1 | 341 | BWR | 1970 |
| TSURUGA | NO2 | 1115 | PWR | 1987 |
| ONAGAWA | | 497 | BWR | 1984 |
| FUKUSHIMA-1 | NO1 | 439 | BWR | 1971 |
| FUKUSHIMA-1 | NO2 | 760 | BWR | 1974 |
| FUKUSHIMA-1 | NO3 | 760 | BWR | 1976 |
| FUKUSHIMA-1 | NO4 | 760 | BWR | 1978 |
| FUKUSHIMA-1 | NO5 | 760 | BWR | 1978 |
| FUKUSHIMA-1 | NO6 | 1067 | BWR | 1979 |
| FUKUSHIMA-2 | NO1 | 1067 | BWR | 1982 |
| FUKUSHIMA-2 | NO2 | 1067 | BWR | 1984 |
| FUKUSHIMA-2 | NO3 | 1067 | BWR | 1985 |
| FUKUSHIMA-2 | NO4 | 1067 | BWR | 1987 |
| KASHIWAZAKI | NO1 | 1067 | BWR | 1985 |
| HAMAOKA | NO1 | 515 | BWR | 1976 |
| HAMAOKA | NO2 | 815 | BWR | 1978 |
| HAMAOKA | NO3 | 1066 | BWR | 1987 |
| MIHAMA | NO1 | 320 | PWR | 1970 |
| MIHAMA | NO2 | 470 | PWR | 1972 |
| MIHAMA | NO3 | 780 | PWR | 1976 |
| TAKAHAMA | NO1 | 780 | PWR | 1974 |
| TAKAHAMA | NO2 | 780 | PWR | 1975 |
| TAKAHAMA | NO3 | 830 | PWR | 1985 |
| TAKAHAMA | NO4 | 830 | PWR | 1985 |
| OHI | NO1 | 1120 | PWR | 1979 |
| OHI | NO2 | 1120 | PWR | 1979 |
| SHIMANE | NO1 | 439 | BWR | 1974 |
| IKATA | NO1 | 538 | PWR | 1977 |
| IKATA | NO2 | 538 | PWR | 1982 |
| GENKAI | NO1 | 529 | PWR | 1975 |
| GENKAI | NO2 | 529 | PWR | 1981 |
| SENDAI | NO1 | 846 | PWR | 1984 |
| SENDAI | NO2 | 846 | PWR | 1985 |
| 2. IN COURSE OF CONSTRUCTION | | | | |
| TOMARI | NO1 | 550 | PWR | 1989 |
| TOMARI | NO2 | 550 | PWR | 1991 |
| KASHIWAZAKI | NO2 | 1067 | BWR | 1990 |
| KASHIWAZAKI | NO3 | 1067 | BWR | 1993 |
| KASHIWAZAKI | NO4 | 1067 | BWR | 1994 |
| KASHIWAZAKI | NO5 | 1067 | BWR | 1990 |
| SHIGA | NO1 | 540 ¹⁾ | BWR | 1993 |
| OHI | NO3 | 1127 | PWR | 1991 |
| OHI | NO4 | 1127 | PWR | 1992 |
| SHIMANE | NO2 | 787 | BWR | 1989 |
| IKATA | NO3 | 846 | PWR | 1995 |
| GENNKAI | NO3 | 1127 | PWR | 1993 |
| GENKAI | NO4 | 1127 | PWR | 1997 |
| MONJU | | 280 ¹⁾ | FBR | - |
| 3. PROJECT | | | | |
| MAKI | NO1 | 796 | BWR | 1998 |
| ONAGAWA | NO2 | 796 | BWR | 1996 |
| KASHIWAZAKI | NO6 | 1356 ¹⁾ | BWR | 1996 |
| KASHIWAZAKI | NO7 | 1356 ¹⁾ | BWR | 1998 |
| HAMAOKA | NO4 | 1092 | BWR | 1993 |

¹⁾ Gross Power