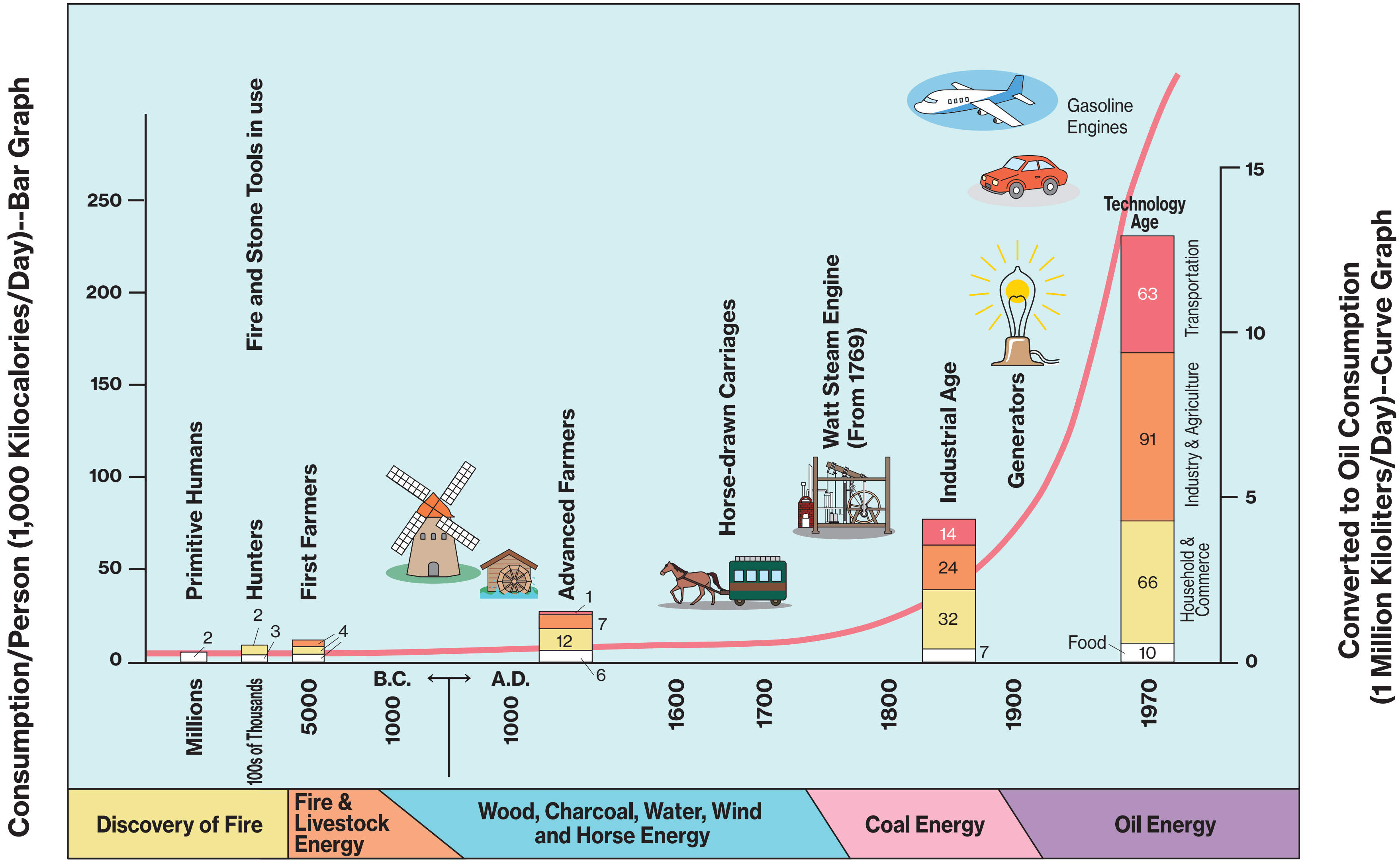
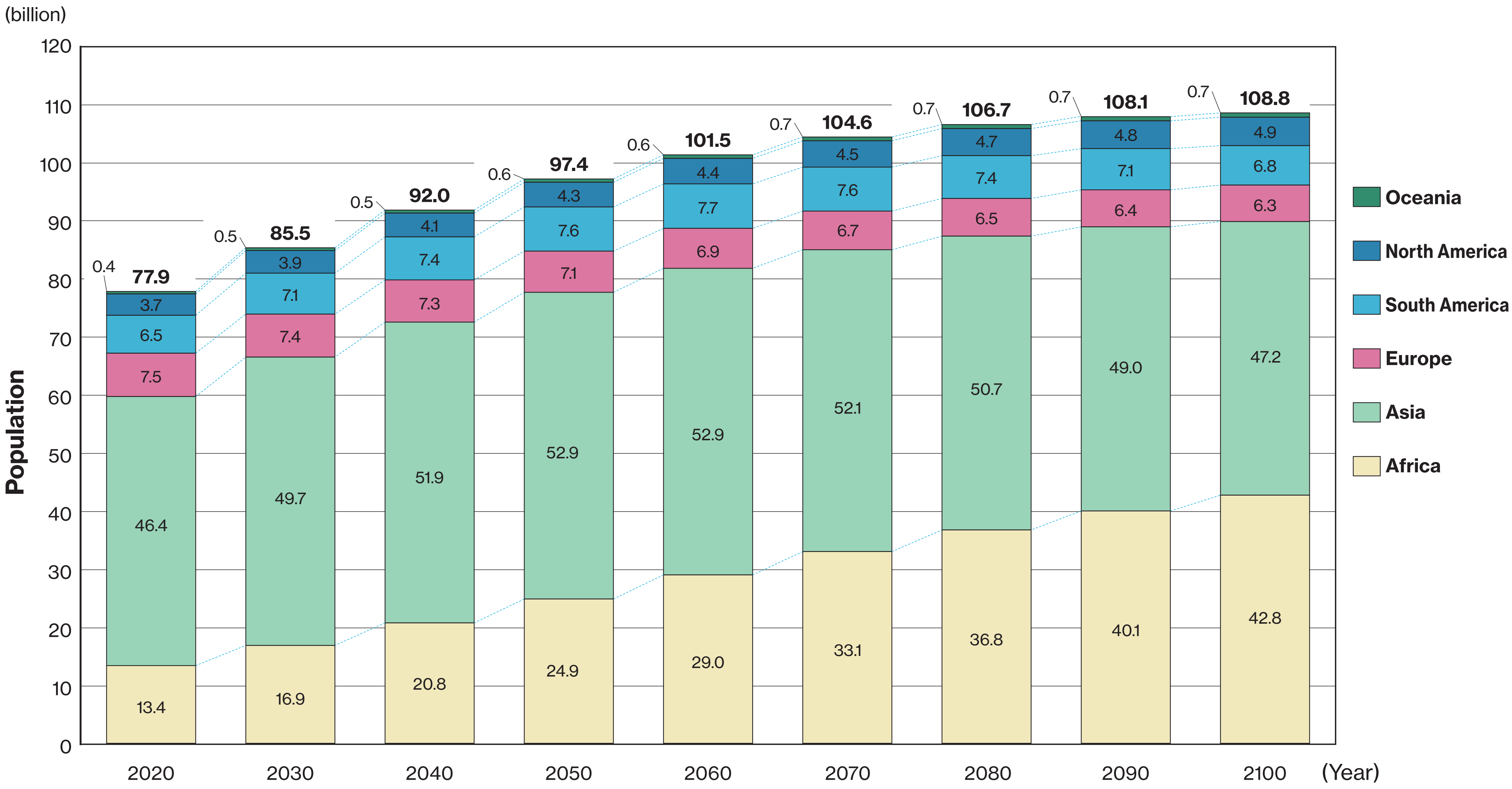
Relationship Between Humans and Energy



Primitive Humans	East Africa 1 million years ago, food only.
Hunters	Europe 100,000 years ago, burned firewood for heat and cooking.
First Farmers	Fertile delta region 5,000 years ago, used energy of livestock for cultivating crops.
Advanced Farmers	Northwest Europe 1,400 years ago, used coal for heating, wind and water power; used livestock for transportation.
Industrial Age	England in 1875, used steam engines.
Technology Age	United States in 1970, used electrical power, food includes for livestock use.

Source: National Institute for Research Advancement, Thinking about Energy

World Population Projections



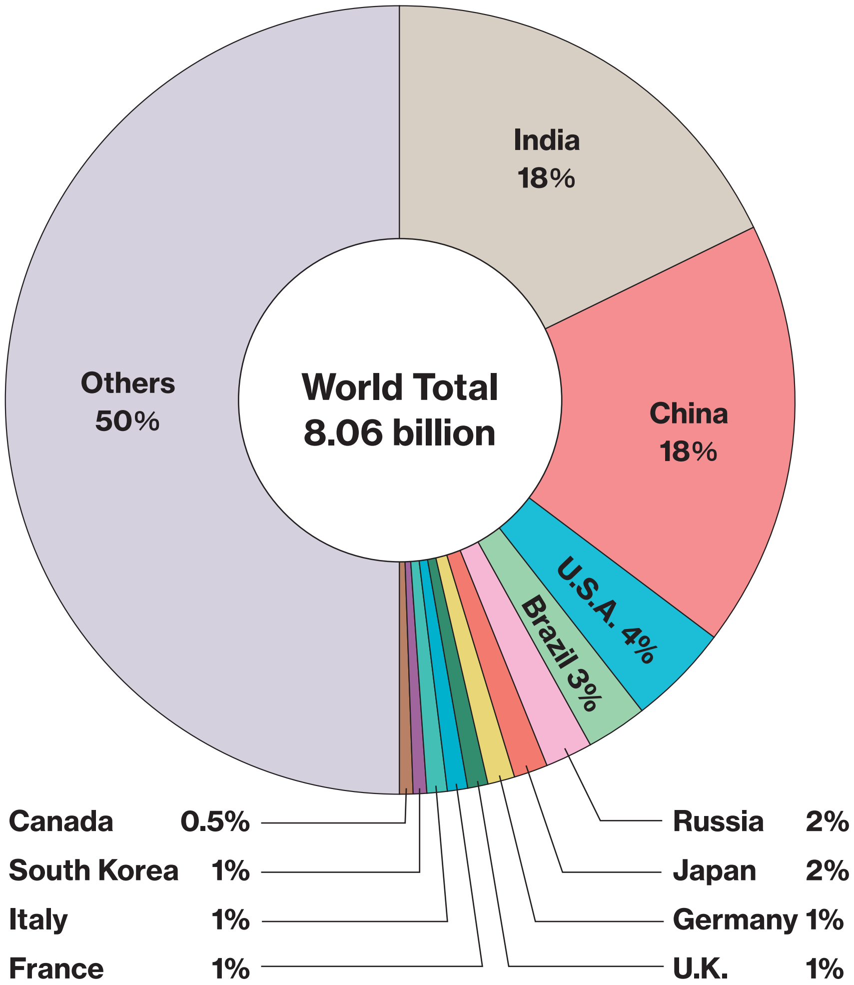
(Note) Figures may not add up to the totals due to rounding.

1-1-2

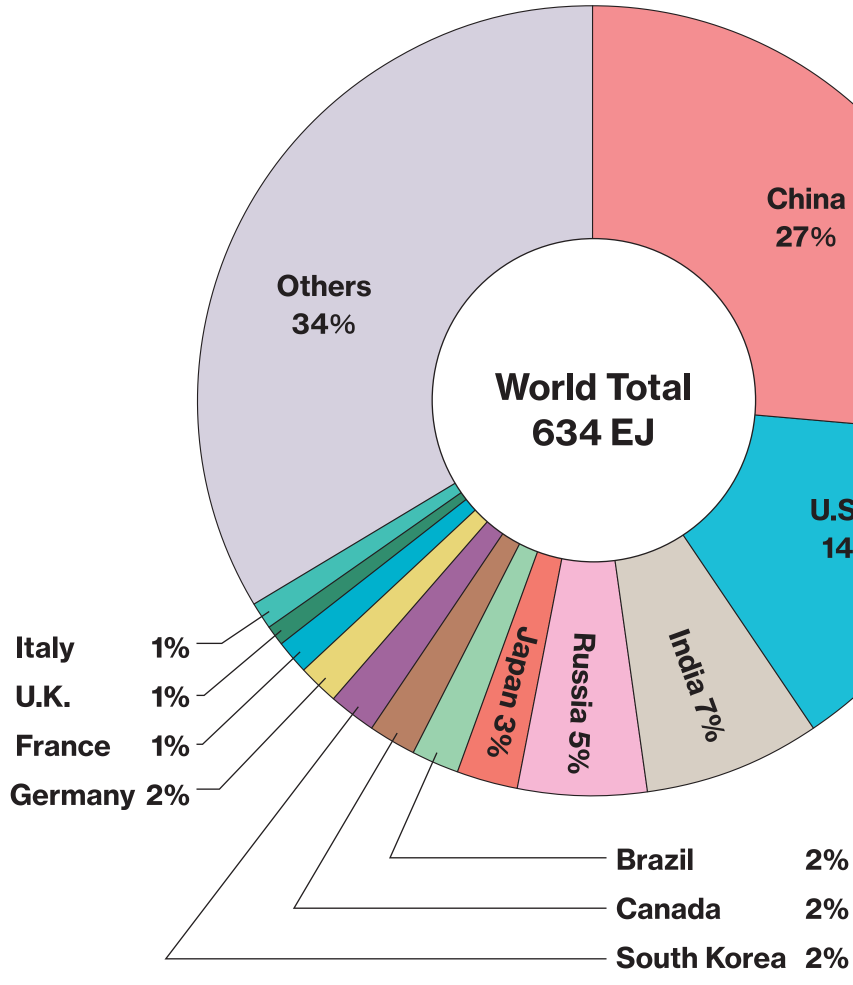
Source: UN, World Population Prospects, the 2019 Revision

World Population and Energy Supply Amount

World Population by Country (2023)



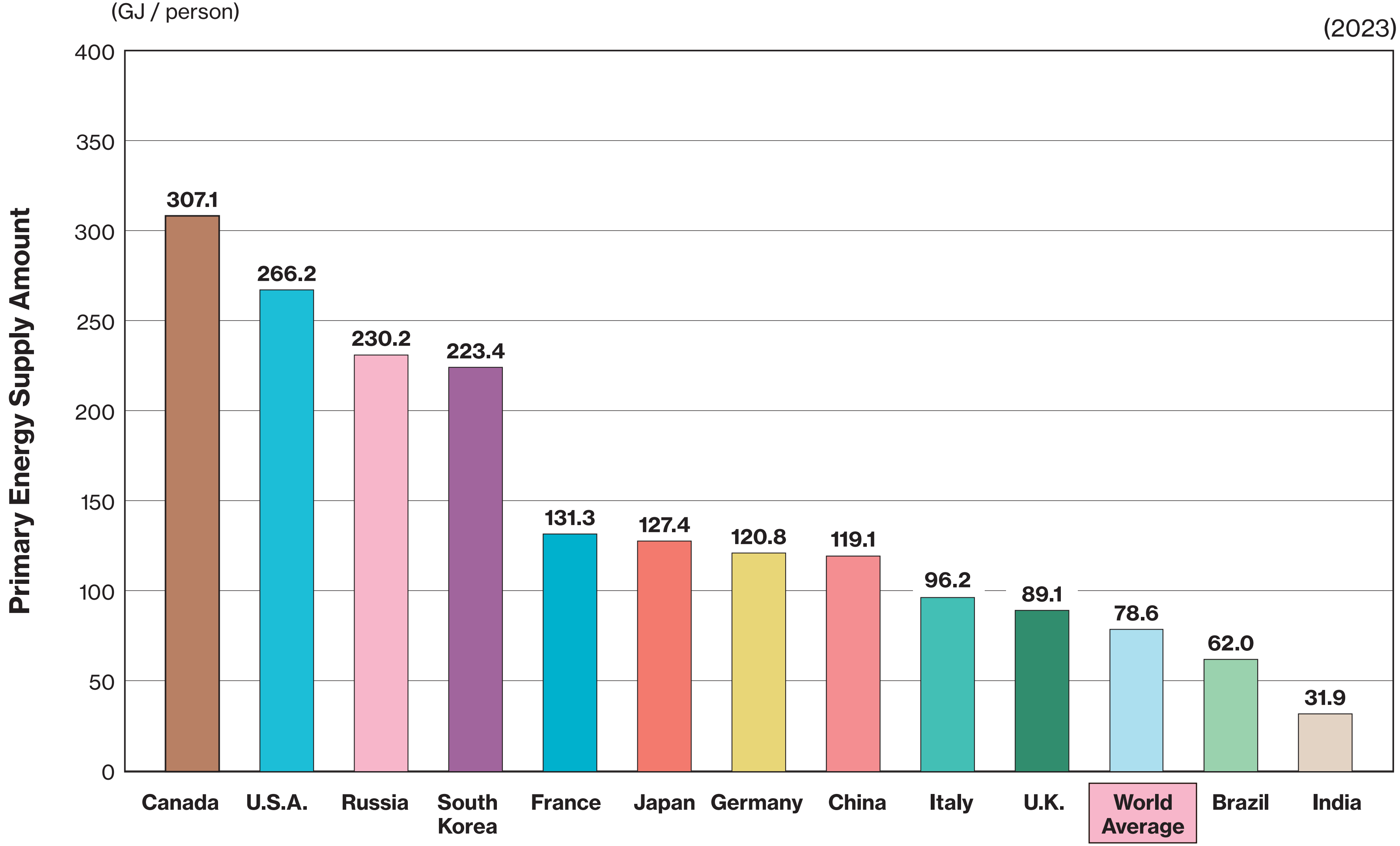
Primary Energy Supply Amount by World Population by Country (2023)



(Note) Figures may not add up to the totals due to rounding.
Btoe: billion tons of oil equivalent

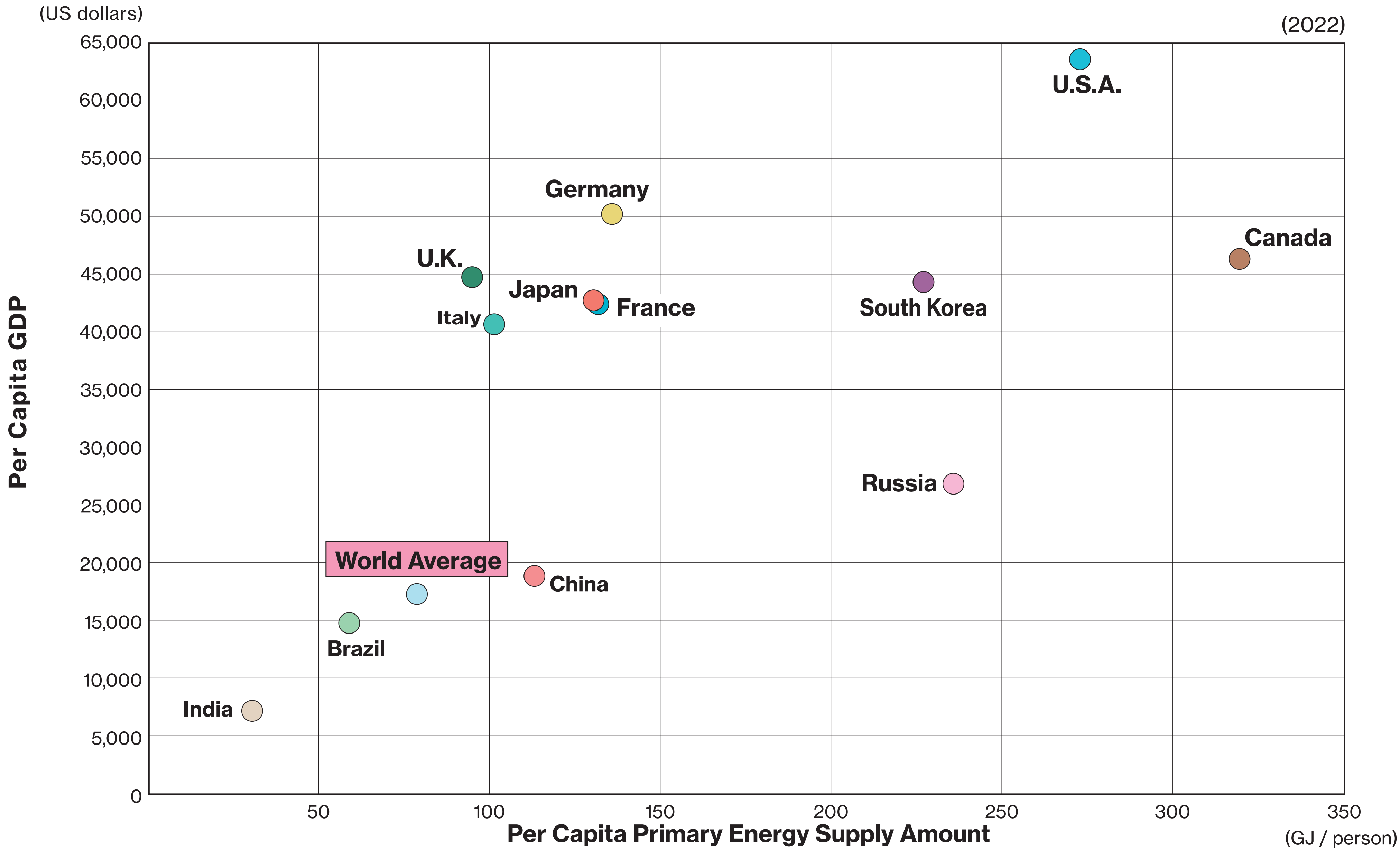
Source:IEA, World Energy Balances 2025

Primary Energy Supply Amount Per Capita in World



Source:IEA, World Energy Balances 2025

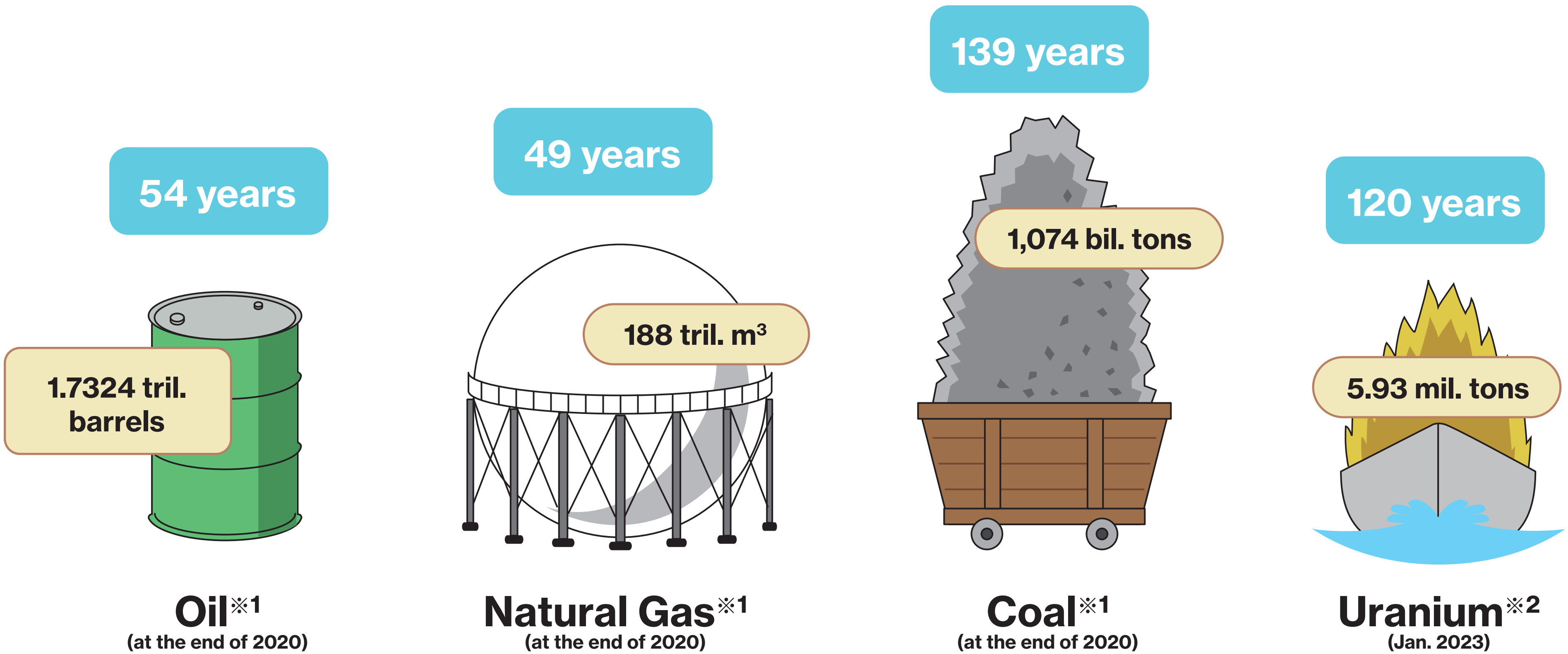
Per Capita GDP and Primary Energy Supply Amount



(Note) Total domestic production based on purchasing power parity conversion (US dollars, 2015 prices)

Source:IEA, World Energy Balances 2024

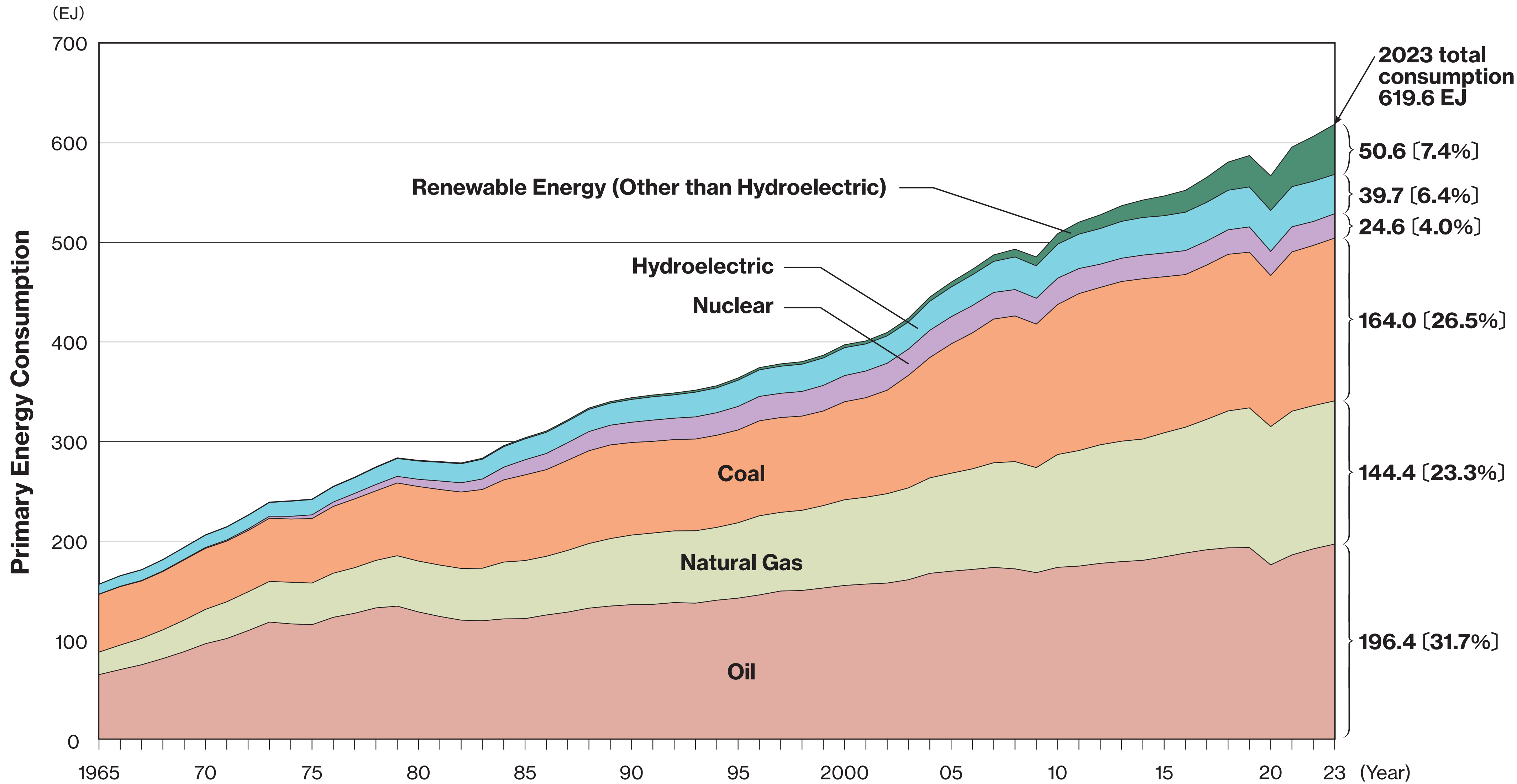
Proven Reserves of Energy Resources



(Note) Reserves-to-production (R/P) ratio = Proven Reserves / Annual Production
RAR (reasonably assured resources) of uranium is estimated at a production cost less than USD 130/kgU.

Source: ※1 2025 Energy Institute Statistical Review of World Energy ※2 OECD/NEA,IAEA, Uranium 2024

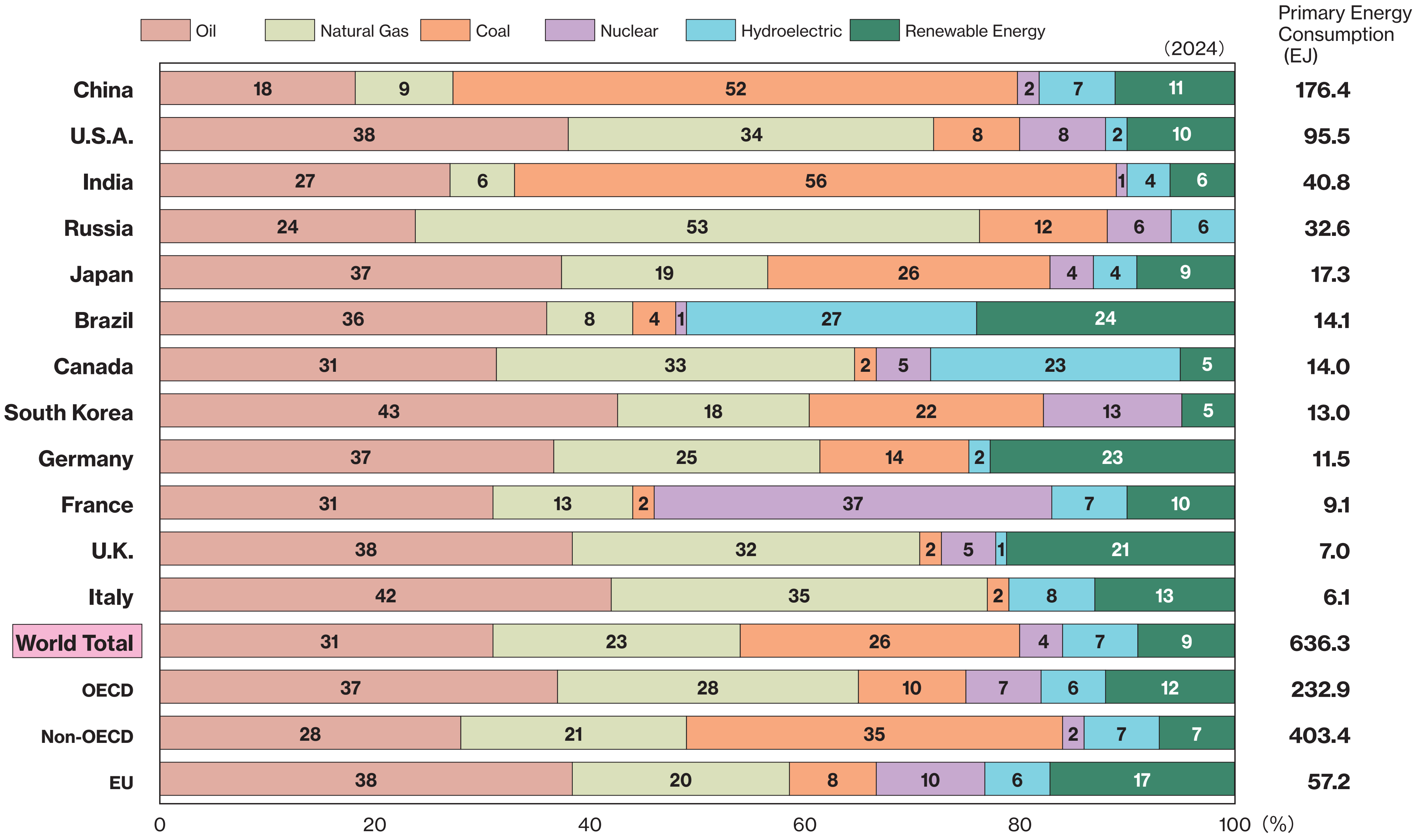
The World's Primary Energy Consumption



(Note) Figures may not add up to the totals due to rounding. The figures in parentheses are the share of the total.
1 EJ (=10^{18} Joules) is equivalent to the amount of heat from approximately 25,800,000 kℓ of crude oil (EJ: exajoule).

Source: 2024 Energy Institute Statistical Review of World Energy

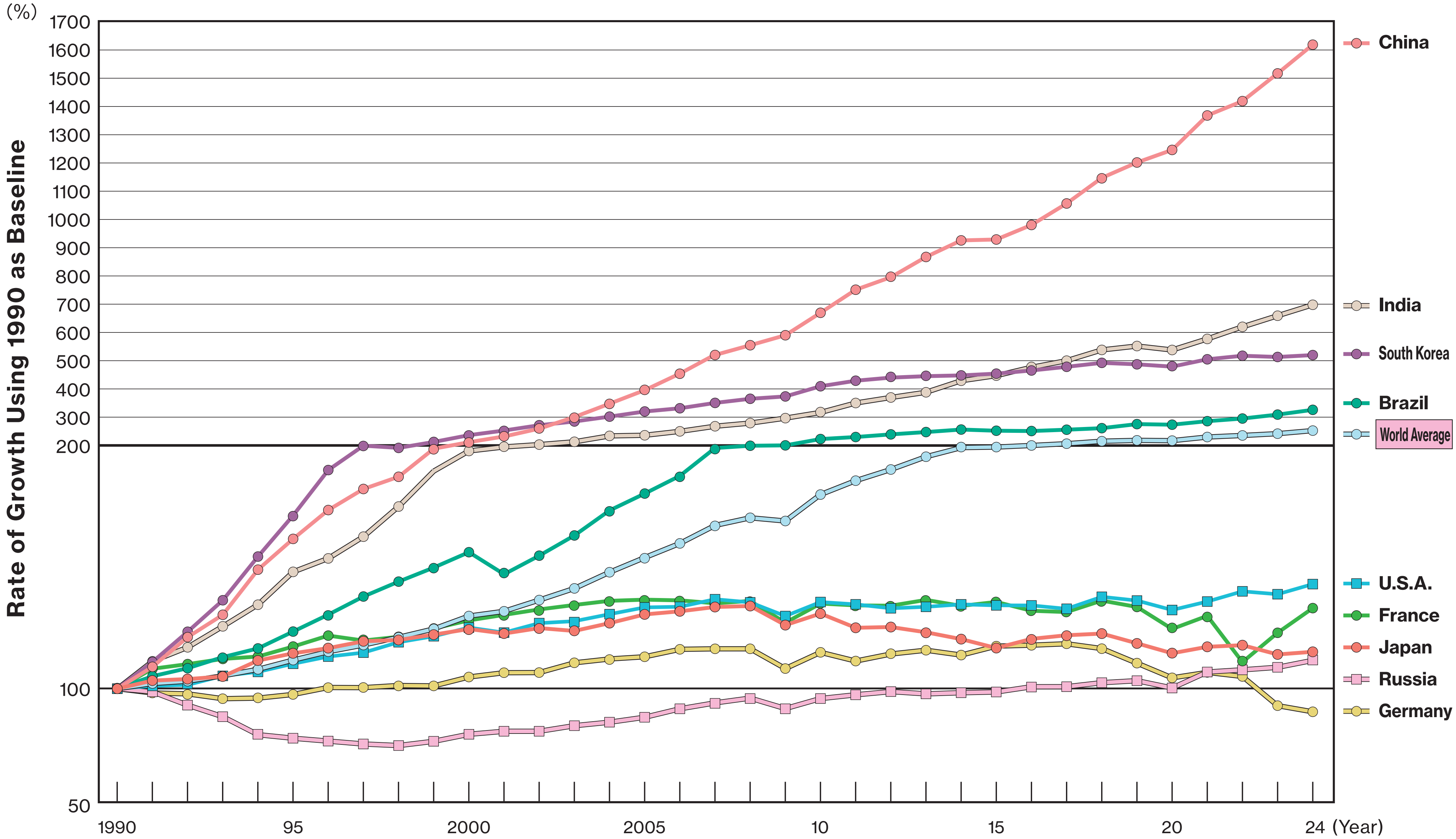
Primary Energy Consumption in Major Countries



(Note) Figures may not add up to the totals due to rounding.
1 EJ (=10^{18} Joules) is equivalent to the amount of heat from approximately 25,800,000 kℓ of crude oil (EJ: exajoule).

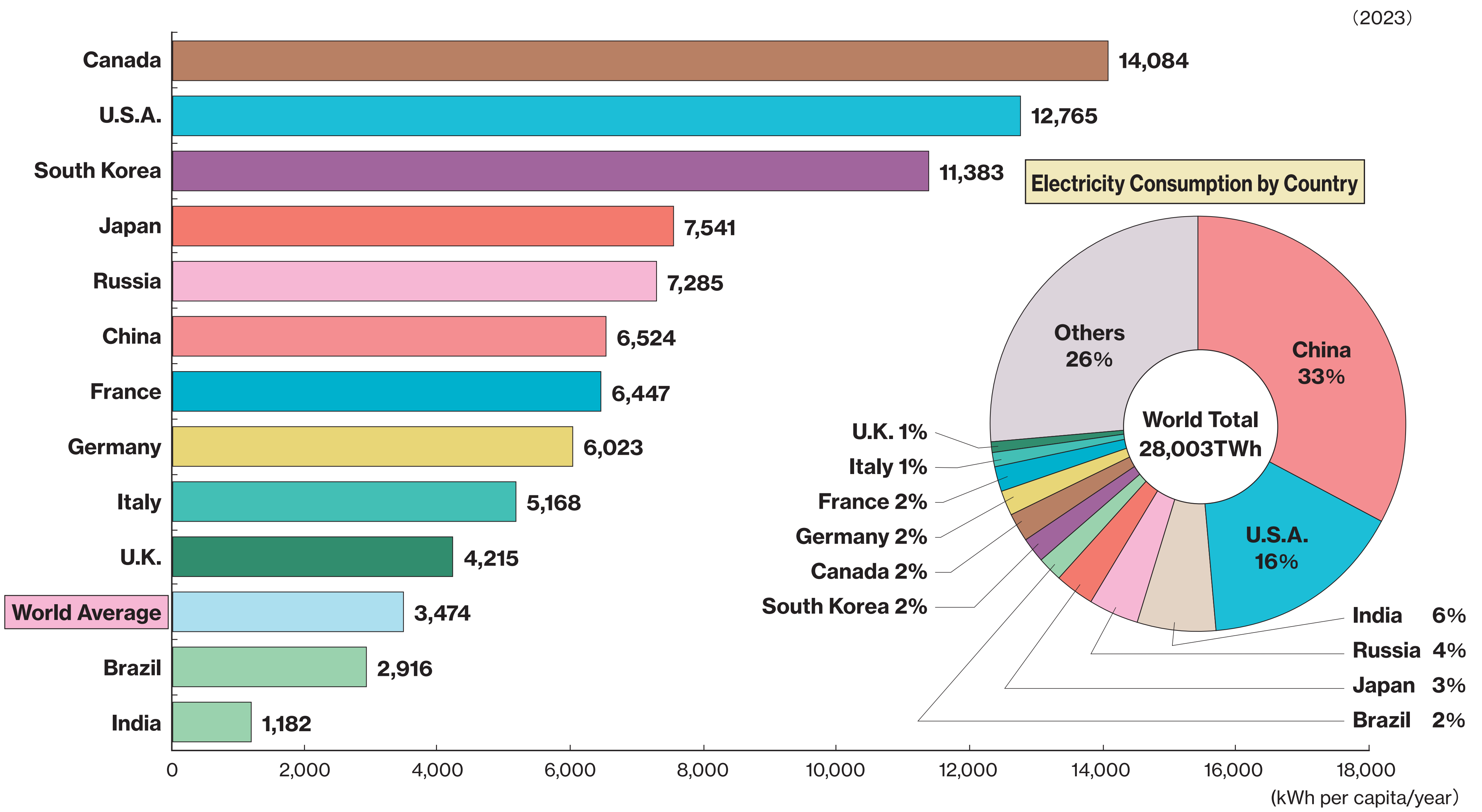
Source: 2025 Energy Institute Statistical Review of World Energy

Electricity Generated by Major Countries (Growth Rate)



Source: 2025 Energy Institute Statistical Review of World Energy

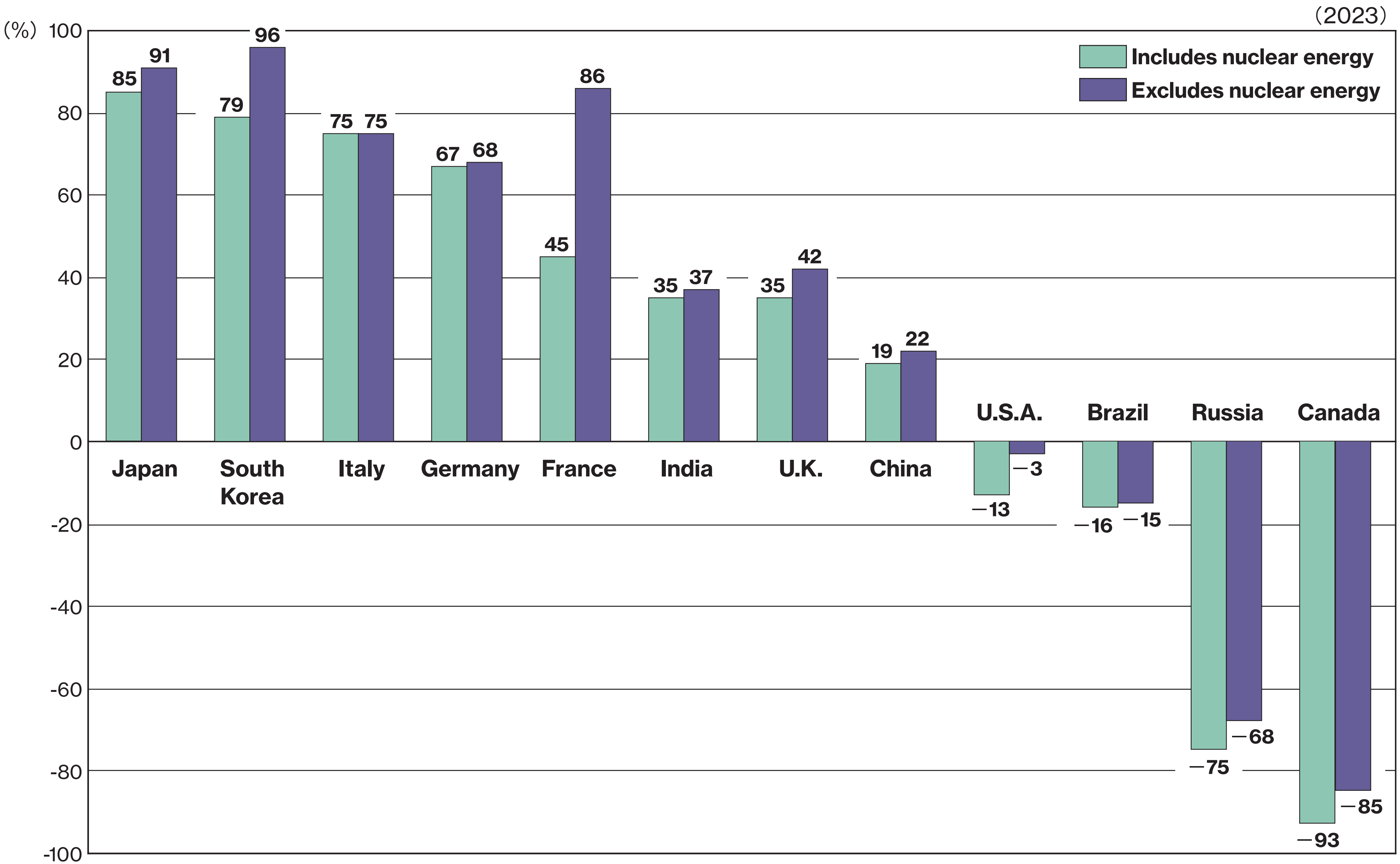
Electricity Consumption Per Capita in Major Countries



(Note) Figures may not add up to the totals due to rounding.

Source:IEA, World Energy Balances 2025

Dependence on Imported Energy Sources in Major Countries



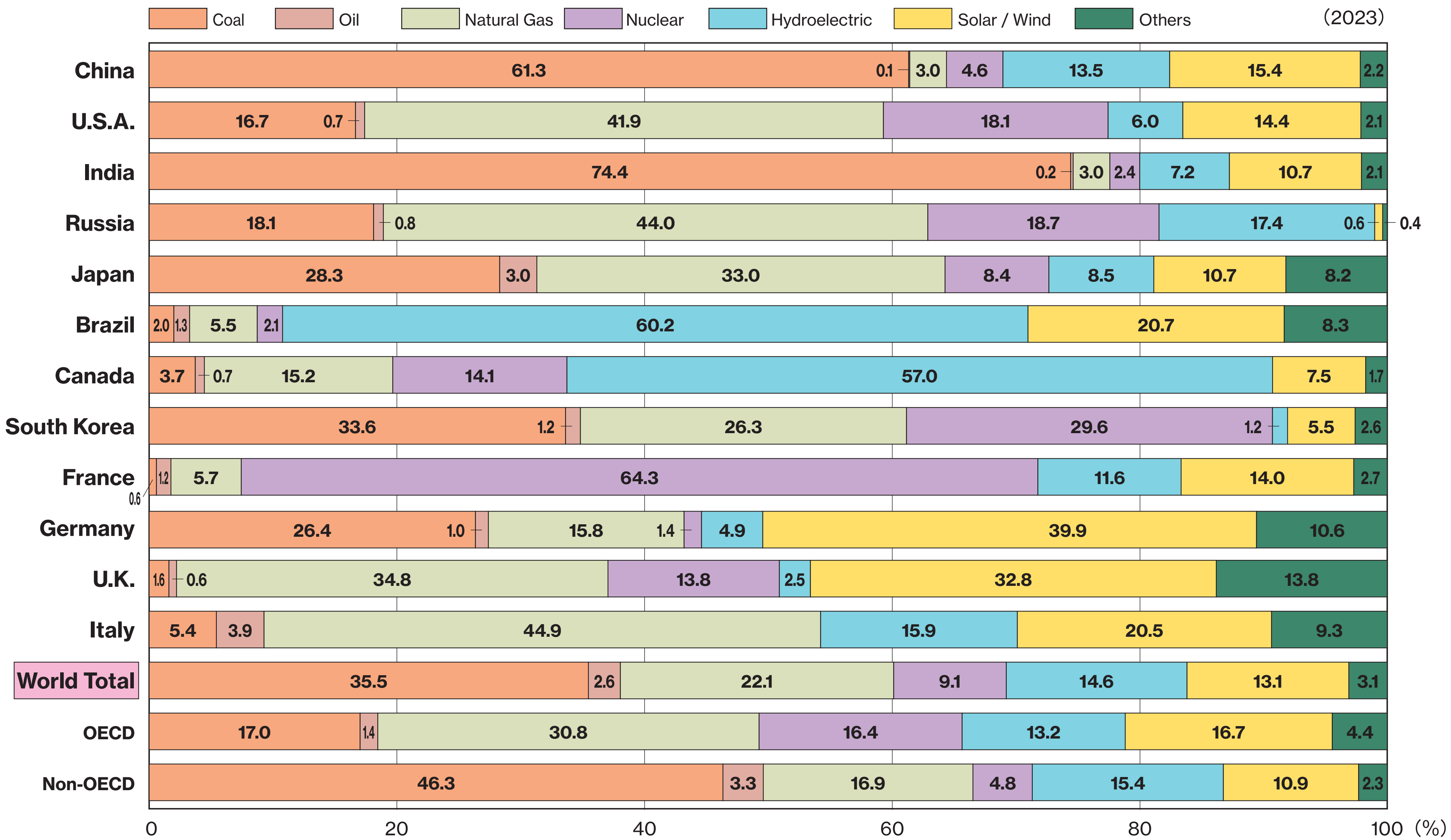
(Note) Canada and Russia are net-exporting countries.

Source: IEA, World Energy Balances 2025

National Gas Pipeline Network in Europe

Source: eurogas, Statistical Report 2015

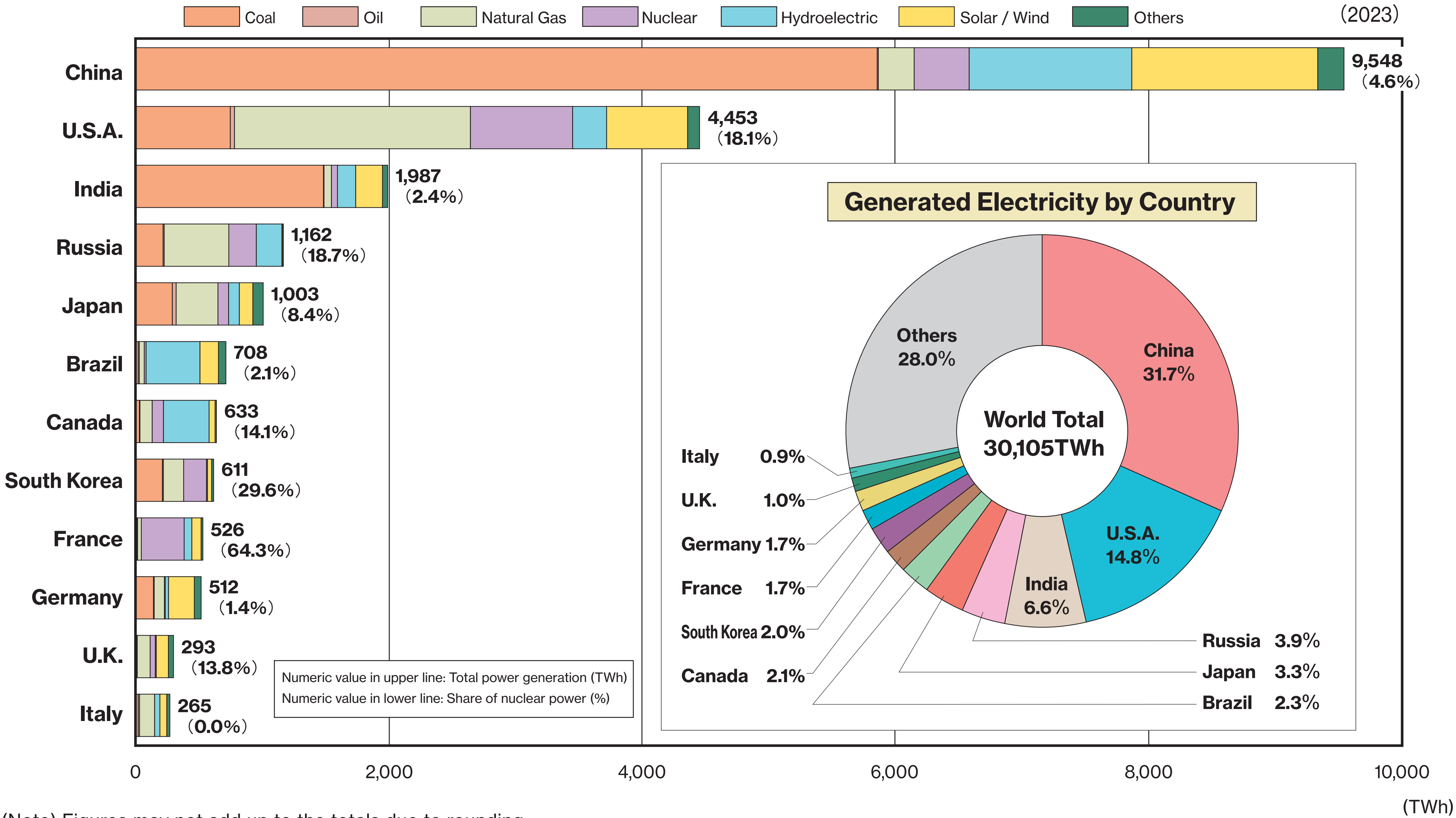
Power Generation Composition by Source in Major Countries



(Note) Figures may not add up to the totals due to rounding.

Source: IEA, World Energy Balances 2025

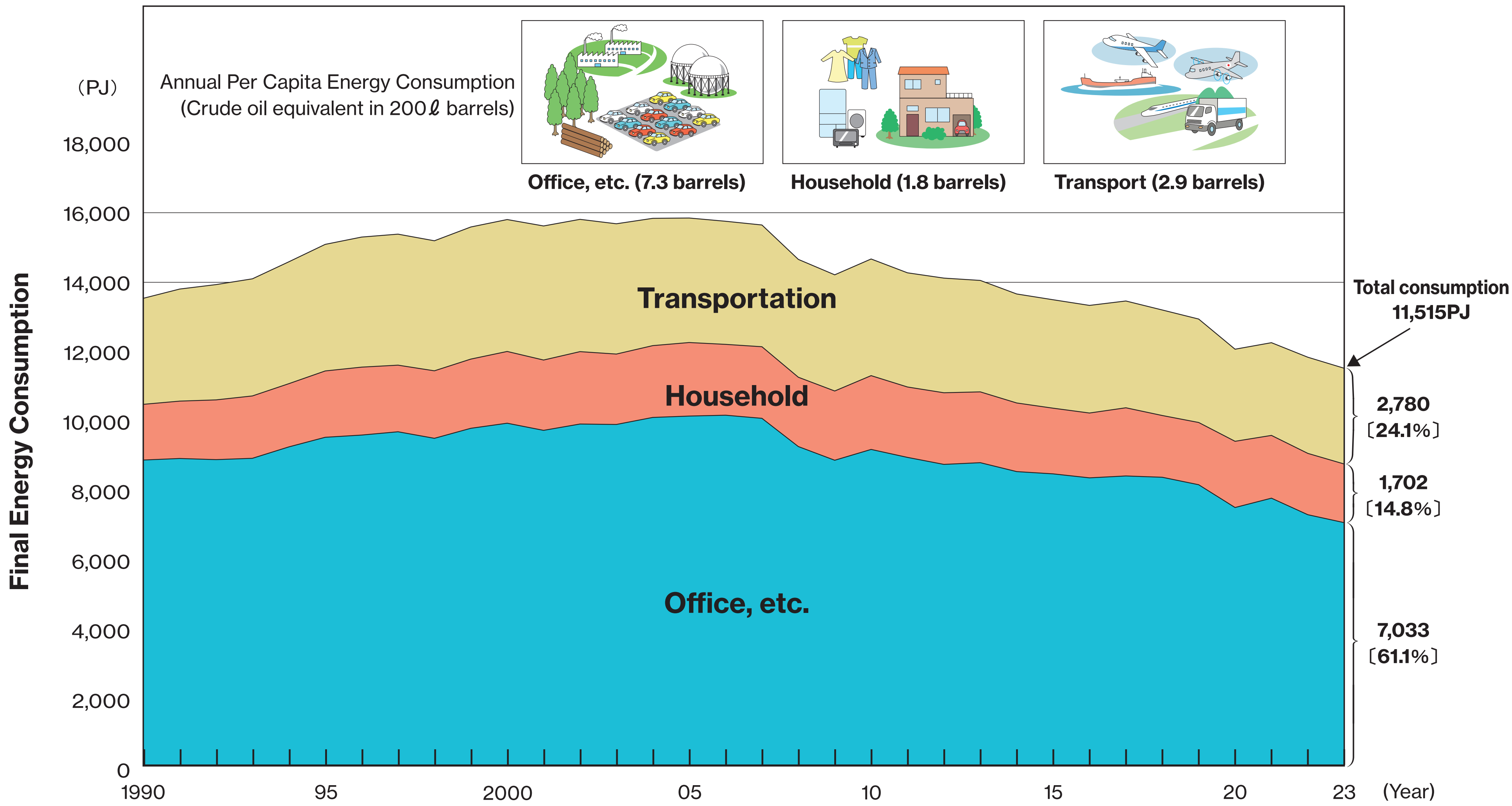
Electricity Generated and Share of Nuclear Power in Major Countries



(Note) Figures may not add up to the totals due to rounding.

Source: IEA, World Energy Balances 2025

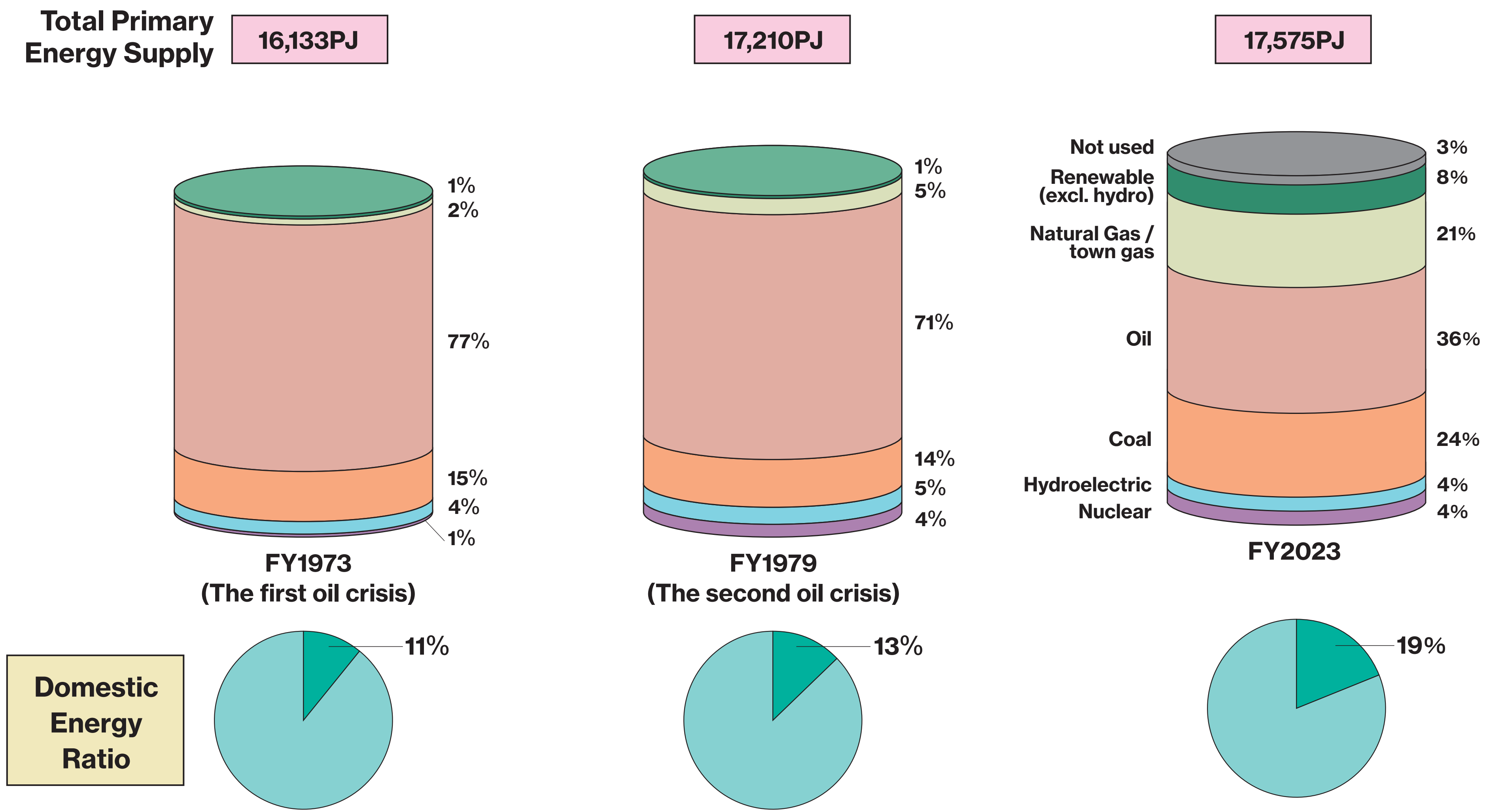
How Energy is Used in Japan



(Note) Figures may not add up to the totals due to rounding.
1 PJ (=10^{15} Joules) is equivalent to the amount of heat from approximately 25,800 kℓ of crude oil (PJ: petajoule).
Content of parentheses is the percentage of the total.
The calculation method of Total Energy Statistics has been changed since FY1990.

Source: Agency for Natural Resources and Energy, Total Energy Statistics

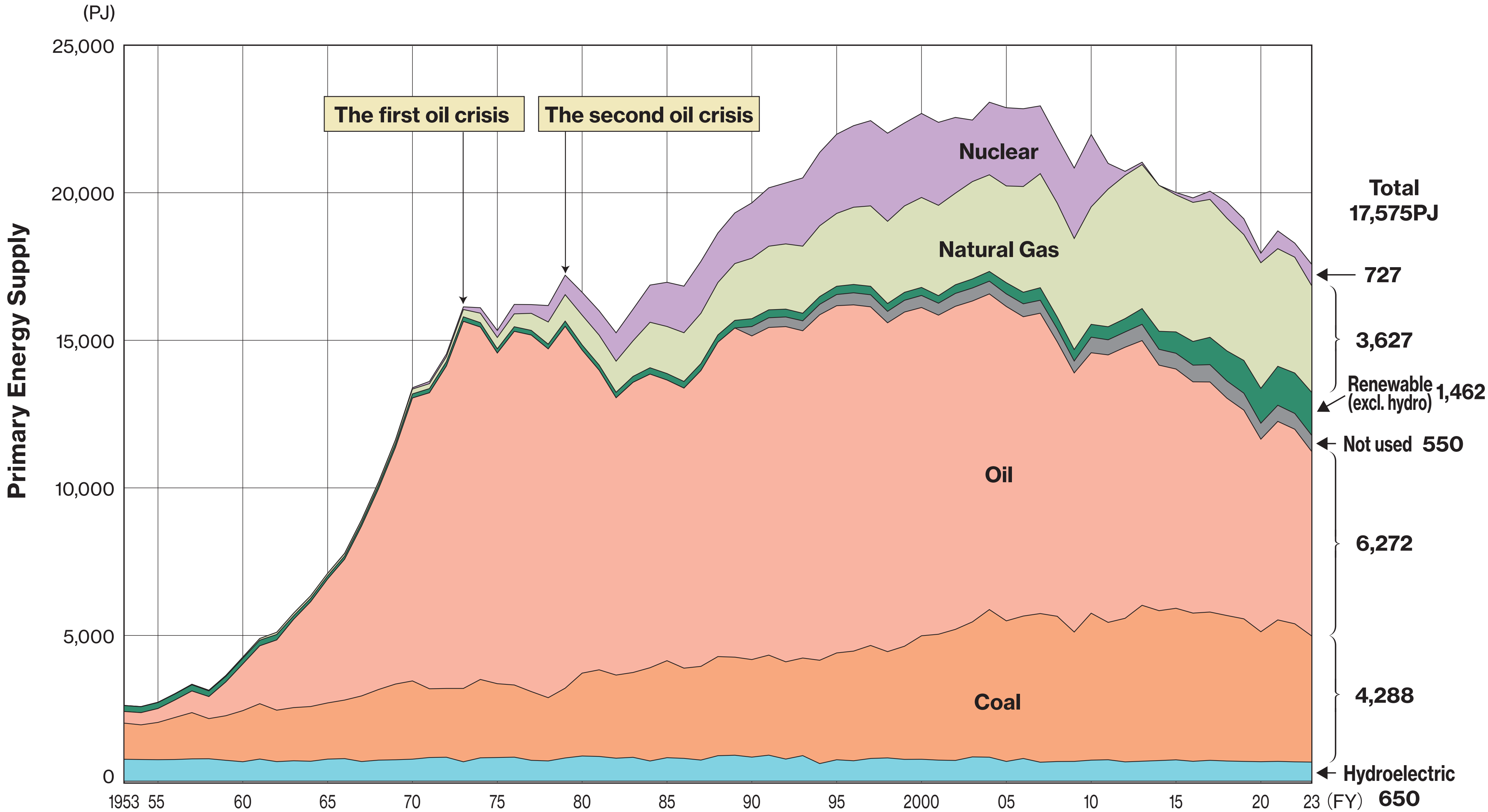
Changes in Japan's Primary Energy Supply Structure



(Note) Figures may not add up to the totals due to rounding.
1 PJ (=10^{15} Joules) is equivalent to the amount of heat from approximately 25,800 kℓ of crude oil (PJ: petajoule).
Nuclear energy is classified into semi-domestic energy due to its characteristics.
The calculation method of Total Energy Statistics has been changed since FY1990.

Source: Agency for Natural Resources and Energy, Total Energy Statistics

Historical Trends in Japan's Primary Energy Supply



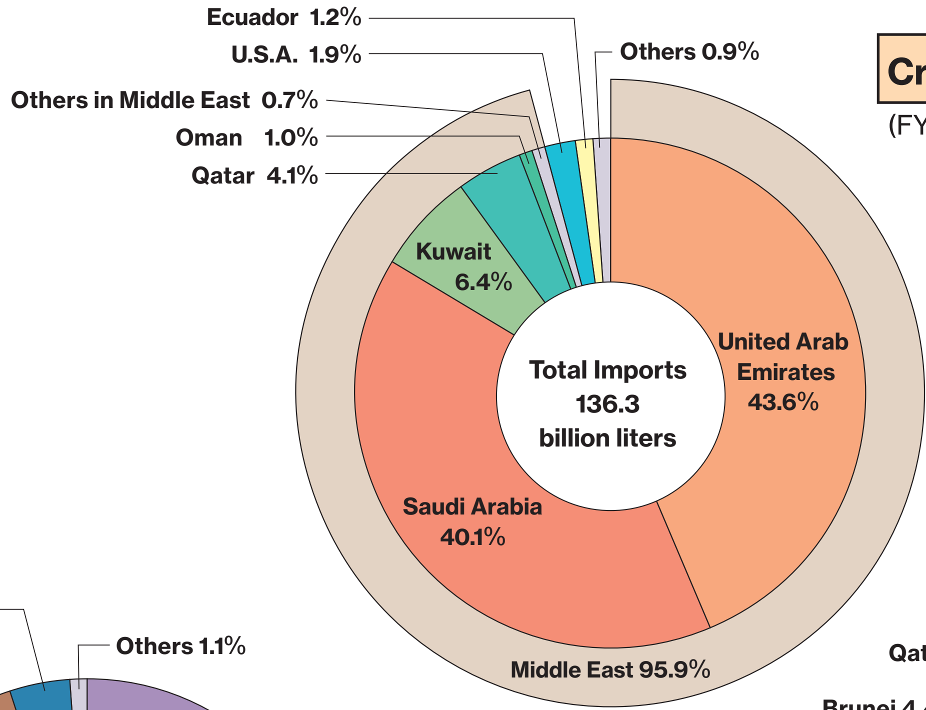
(Note) 1 PJ (=10^{15} Joules) is equivalent to the amount of heat from approximately 25,800 kℓ of crude oil (PJ: petajoule).
The calculation method of Total Energy Statistics has been changed since FY1990.

Source: Agency for Natural Resources and Energy, Total Energy Statistics

Japan's Fossil Fuel Imports by Country of Origin

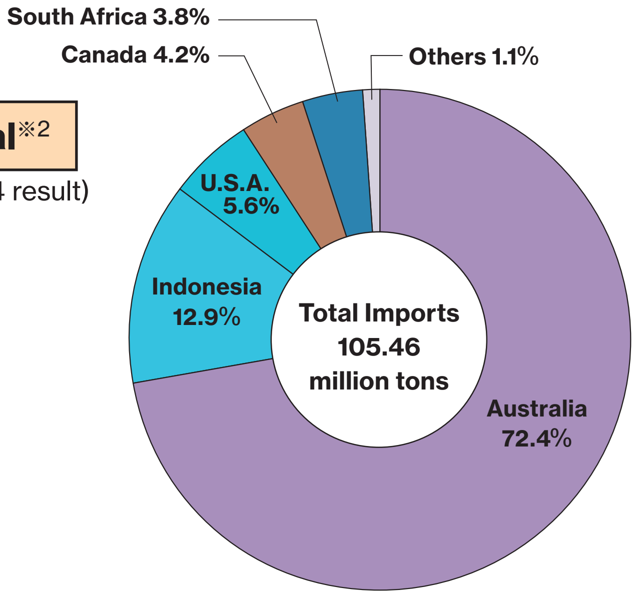
Crude Oil※1

(FY2024 result)



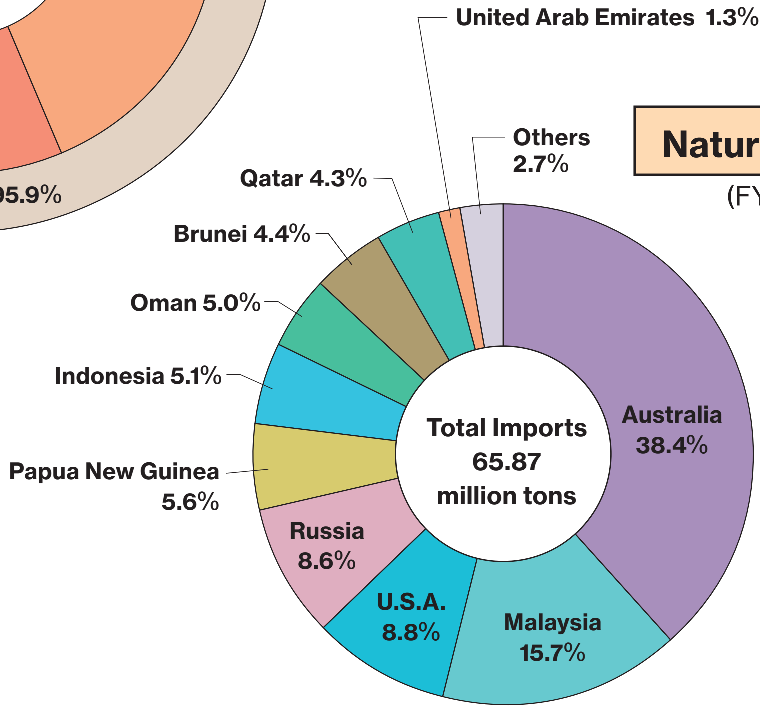
Coal※2

(FY2024 result)



Natural Gas※2

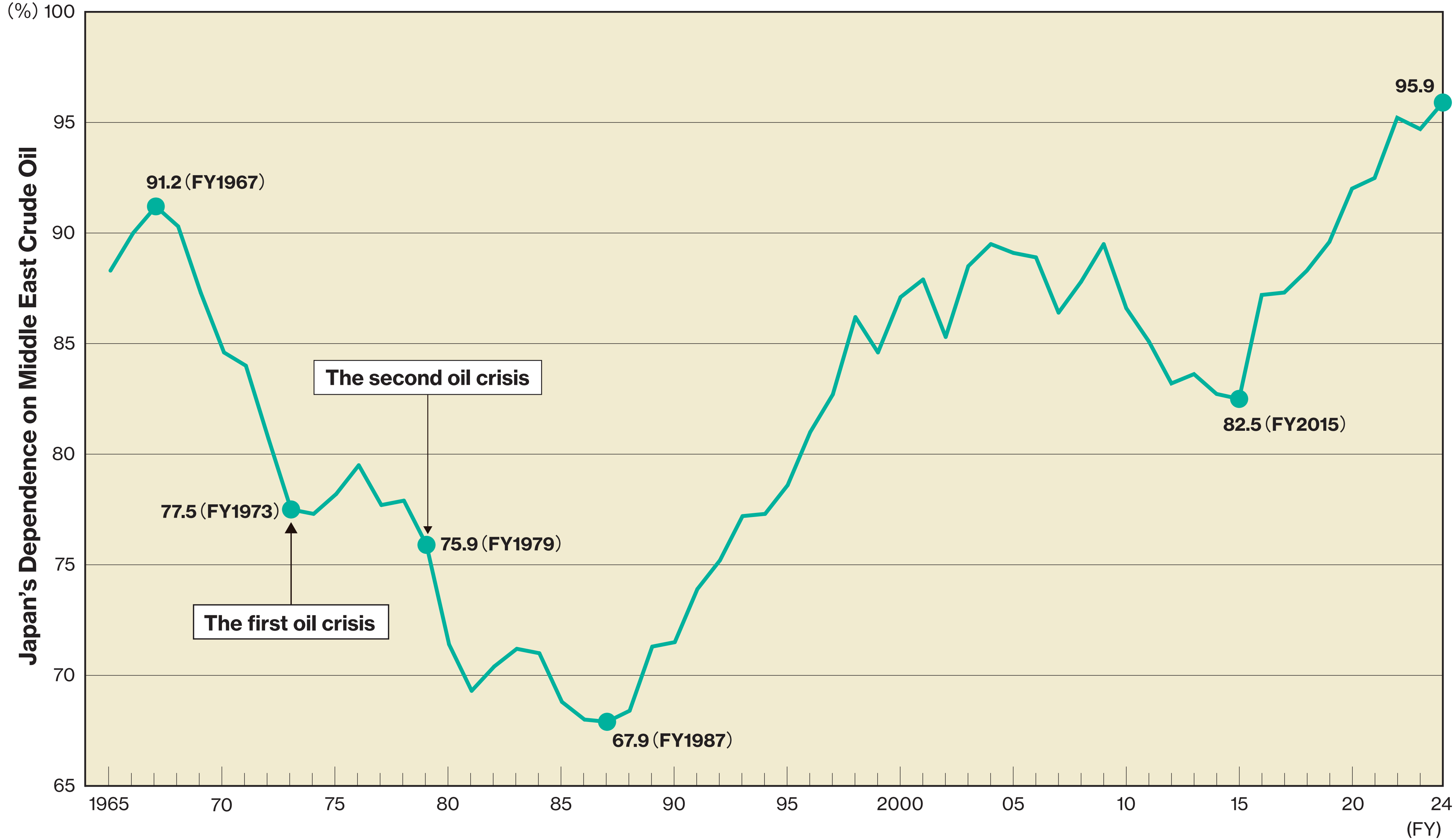
(FY2024 result)



(Note) Figures may not add up to the totals due to rounding.

Source: ※1 Agency for Natural Resources and Energy, YEARBOOK OF MINERAL RESOURCES AND PETROLEUM PRODUCTS STATISTICS ※2 Trade Statistics of Japan

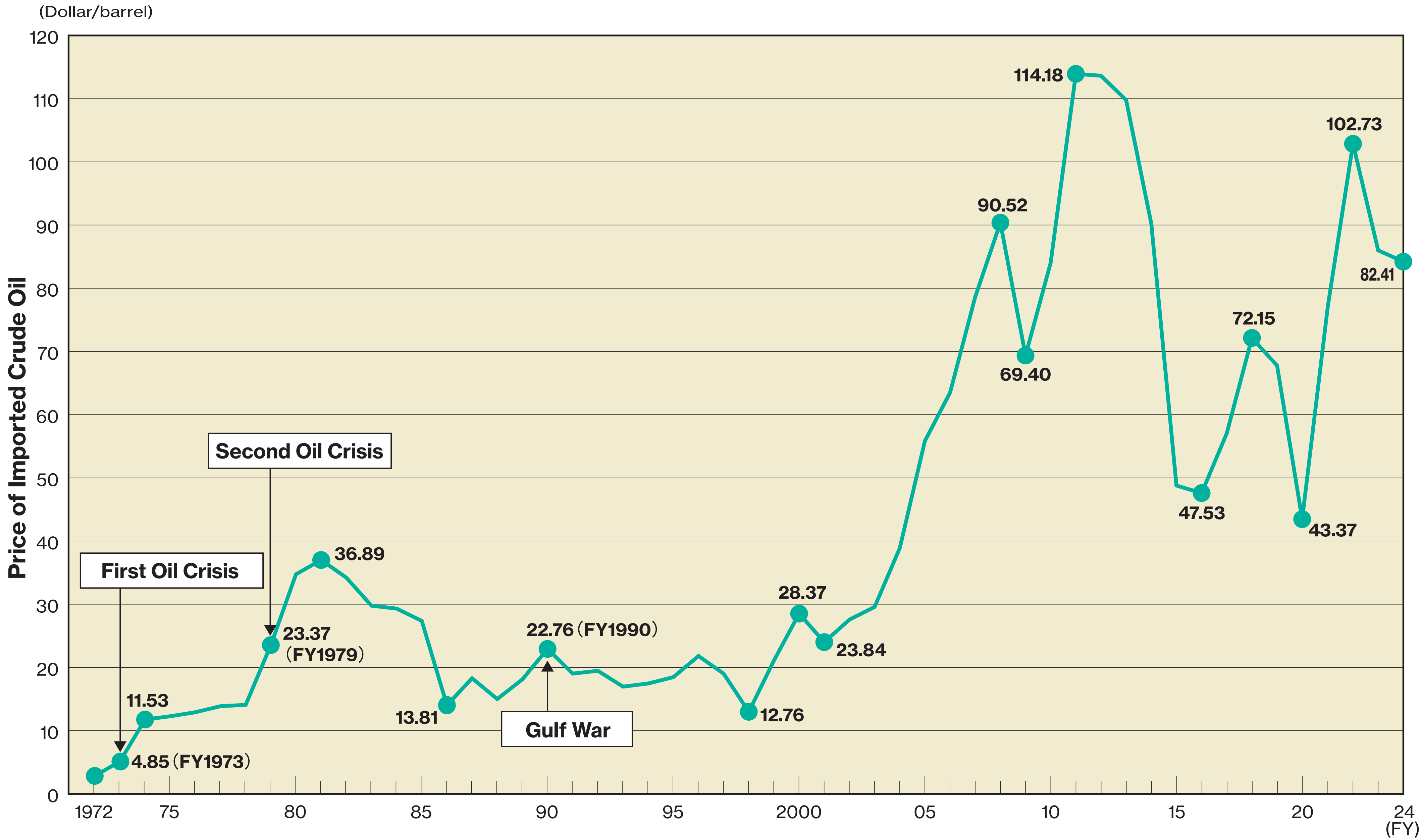
Japan's Dependence on Middle East Crude Oil Imports



1-2-5

Source: Agency for Natural Resources and Energy, YEARBOOK OF MINERAL RESOURCES AND PETROLEUM PRODUCTS STATISTICS

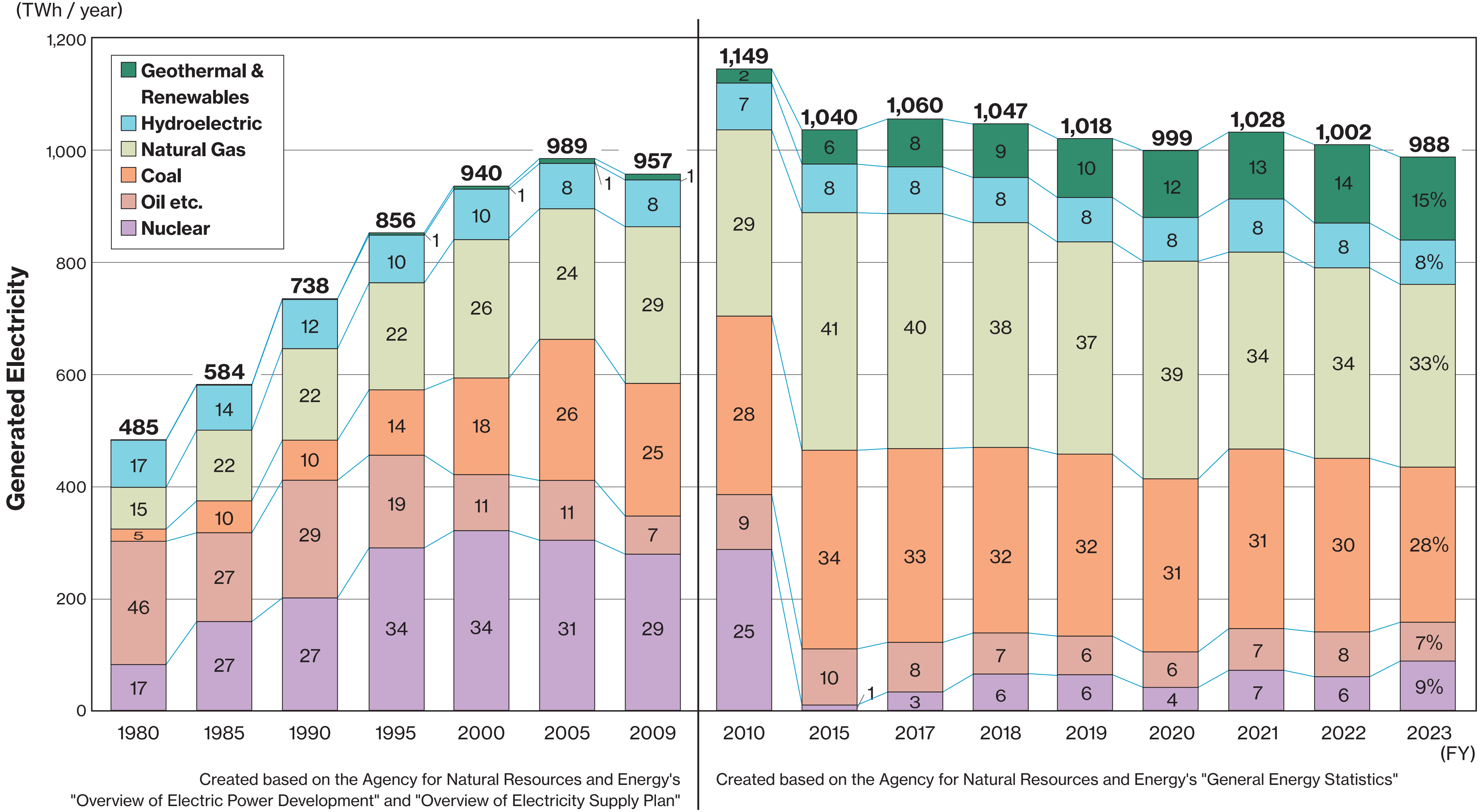
Changes in the Price of Imported Crude Oil



1-2-6

Source: Petroleum Association of Japan

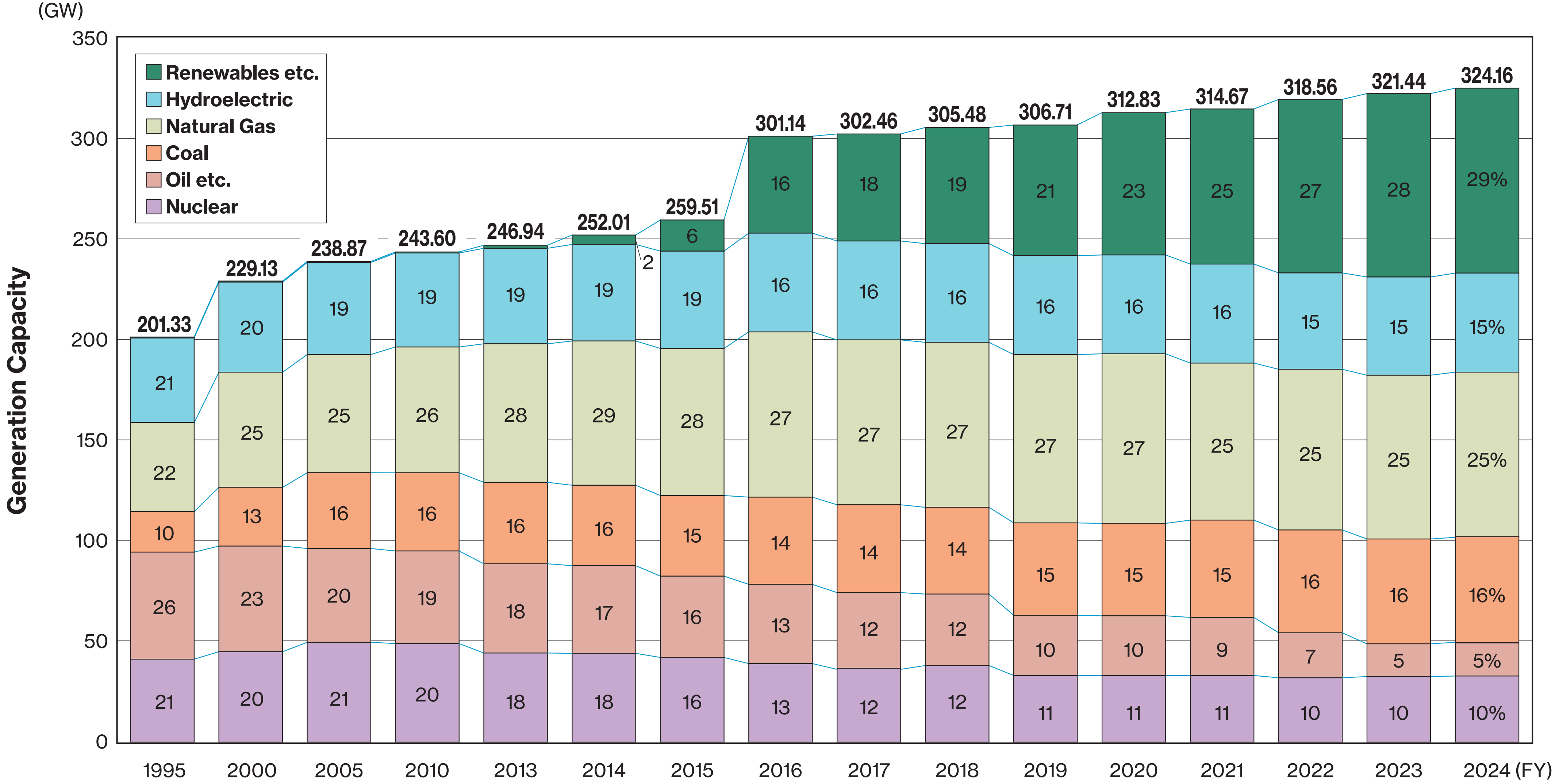
Japan Power Generation and Purchase Volume by Source



(Note) Oil etc. includes LPG, other gases and bituminous mixtures. Figures may not add up to the totals due to rounding. Numerical values depicted in this graph are composition ratios (%).

Source: Agency for Natural Resources and Energy, Total Energy Statistics

Historical Trends in Japan Power Generation Capacity by Source

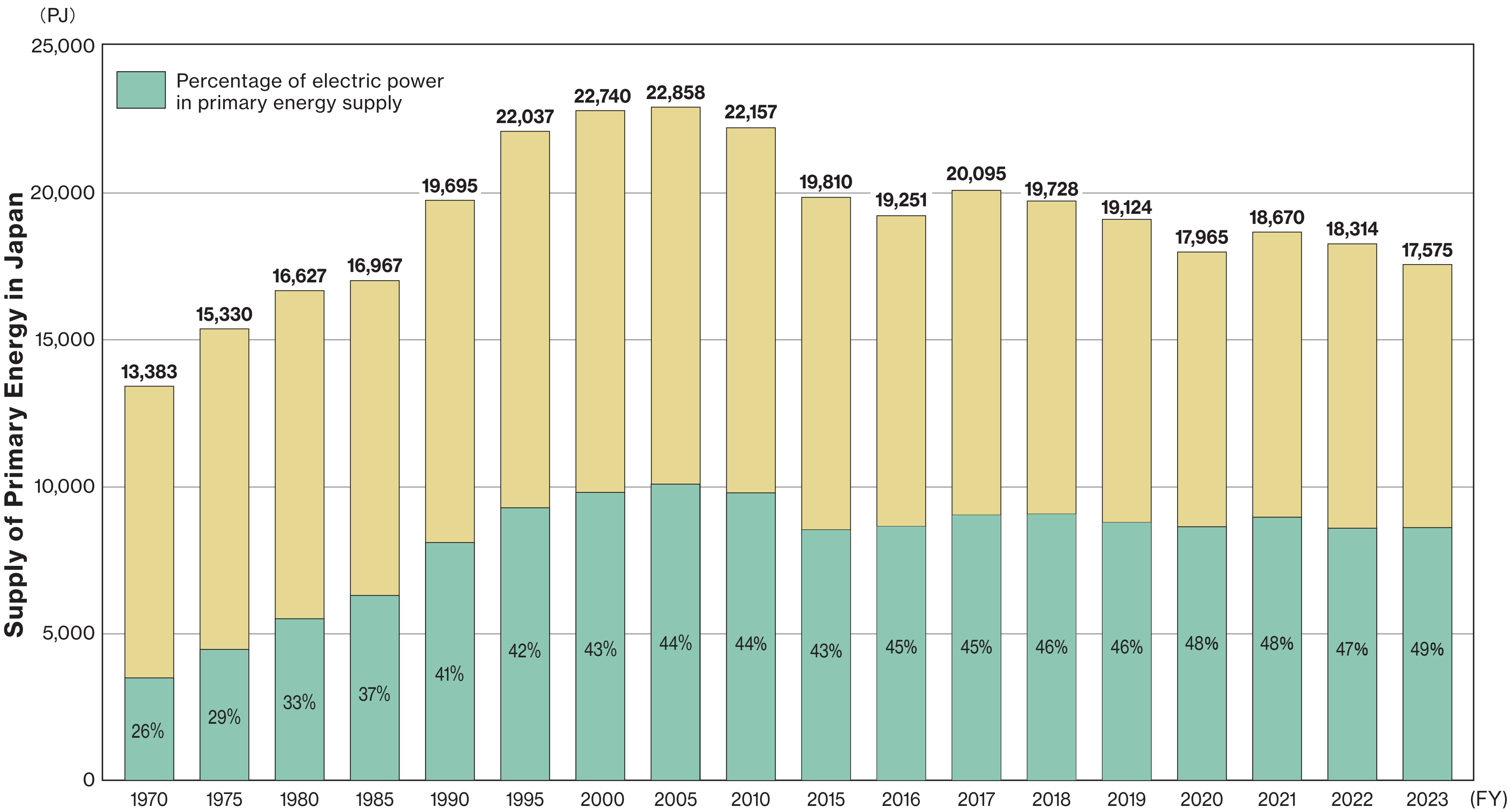


Source	1995	2000	2005	2010	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Renewables etc.						2	6	16	18	19	21	23	25	27	28	29%
Hydroelectric	21	20	19	19	19	19	19	16	16	16	16	16	16	15	15	15%
Natural Gas	22	25	25	26	28	29	28	27	27	27	27	27	25	25	25	25%
Coal	10	13	16	16	16	16	15	14	14	14	15	15	15	16	16	16%
Oil etc.	26	23	20	19	18	17	16	13	12	12	10	10	9	7	5	5%
Nuclear	21	20	21	20	18	18	16	13	12	12	11	11	11	10	10	10%
Total (GW)	201.33	229.13	238.87	243.60	246.94	252.01	259.51	301.14	302.46	305.48	306.71	312.83	314.67	318.56	321.44	324.16

(Note) Oil etc. include LPG, other gases and bituminous mixtures.
Figures may not add up to the totals due to rounding.
Numerical values depicted in this graph are composition ratios (%).

Source: Before FY 2015, Agency for Natural Resources and Energy, Energy White Paper.
After FY 2016, Organization for Cross-Regional Coordination of Transmission Operators (OCCTO), Aggregation of Electricity Supply Plans.

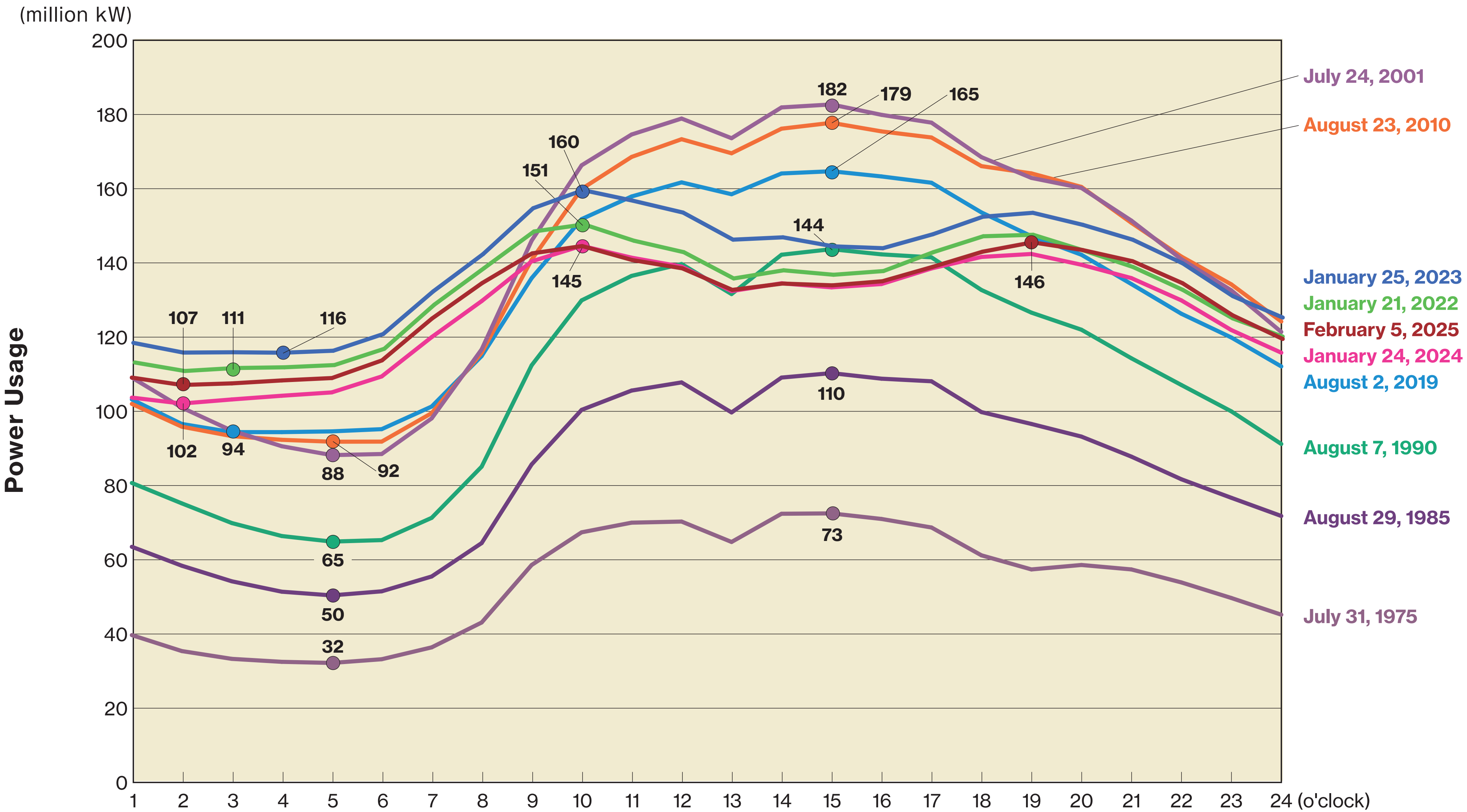
Percentage of Electric Power in Primary Energy (Electrification Ratio)



(Note) 1 PJ (=10^{15} Joules) is equivalent to the amount of heat from approximately 25,800 kℓ of crude oil (PJ: petajoule).

Source: Agency for Natural Resources and Energy, Total Energy Statistics

Hourly Power Usage on Peak Power Days



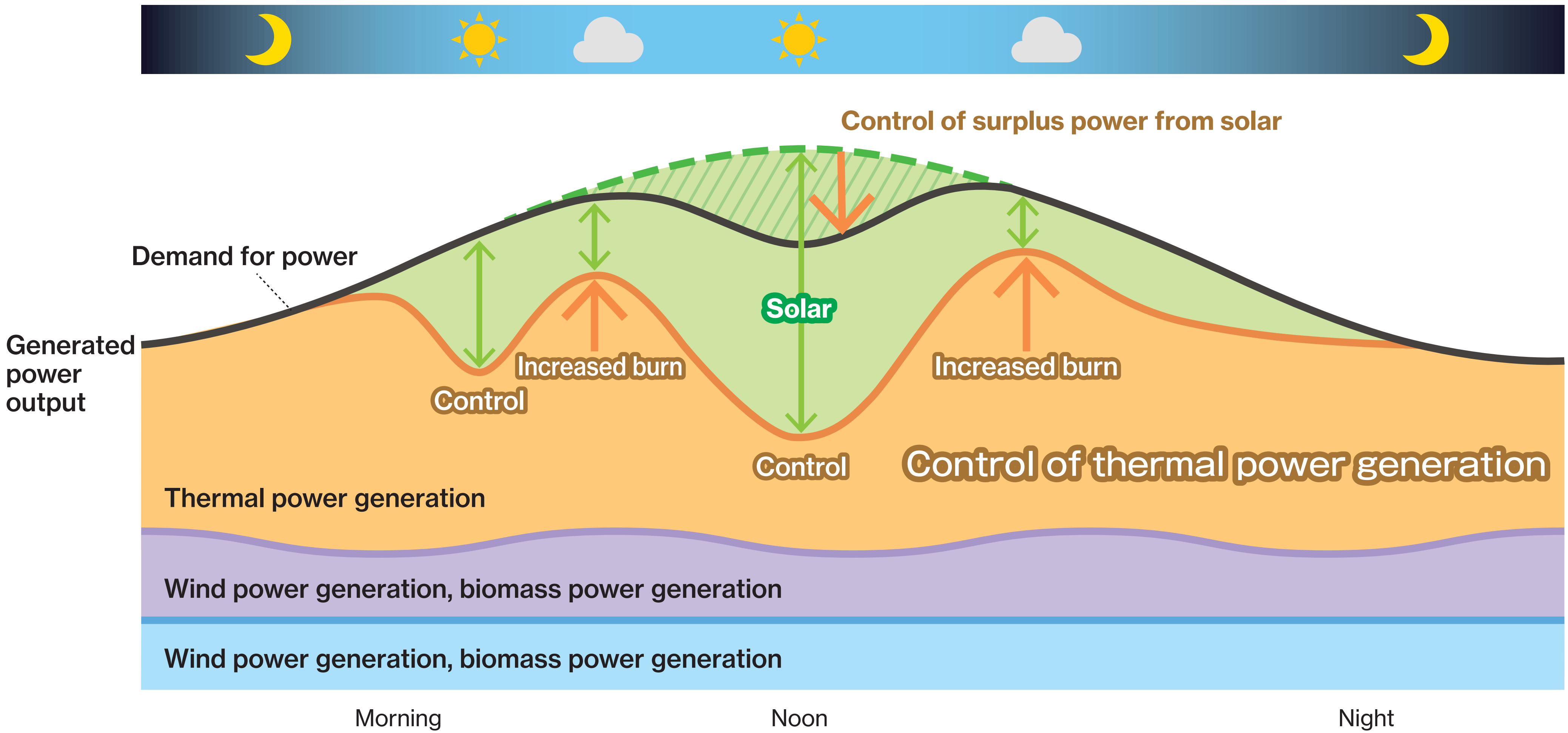
Note: 1975 only is total of 9 power companies (generating end), 1985–2015 is total of 10 power companies (generating end), and 2016 onward is total of 10 areas (sending end).

1-2-10

Source: The Federation of Electric Power Companies

Combinations of Power Generation Methods to Correspond to Power Supply and Demand

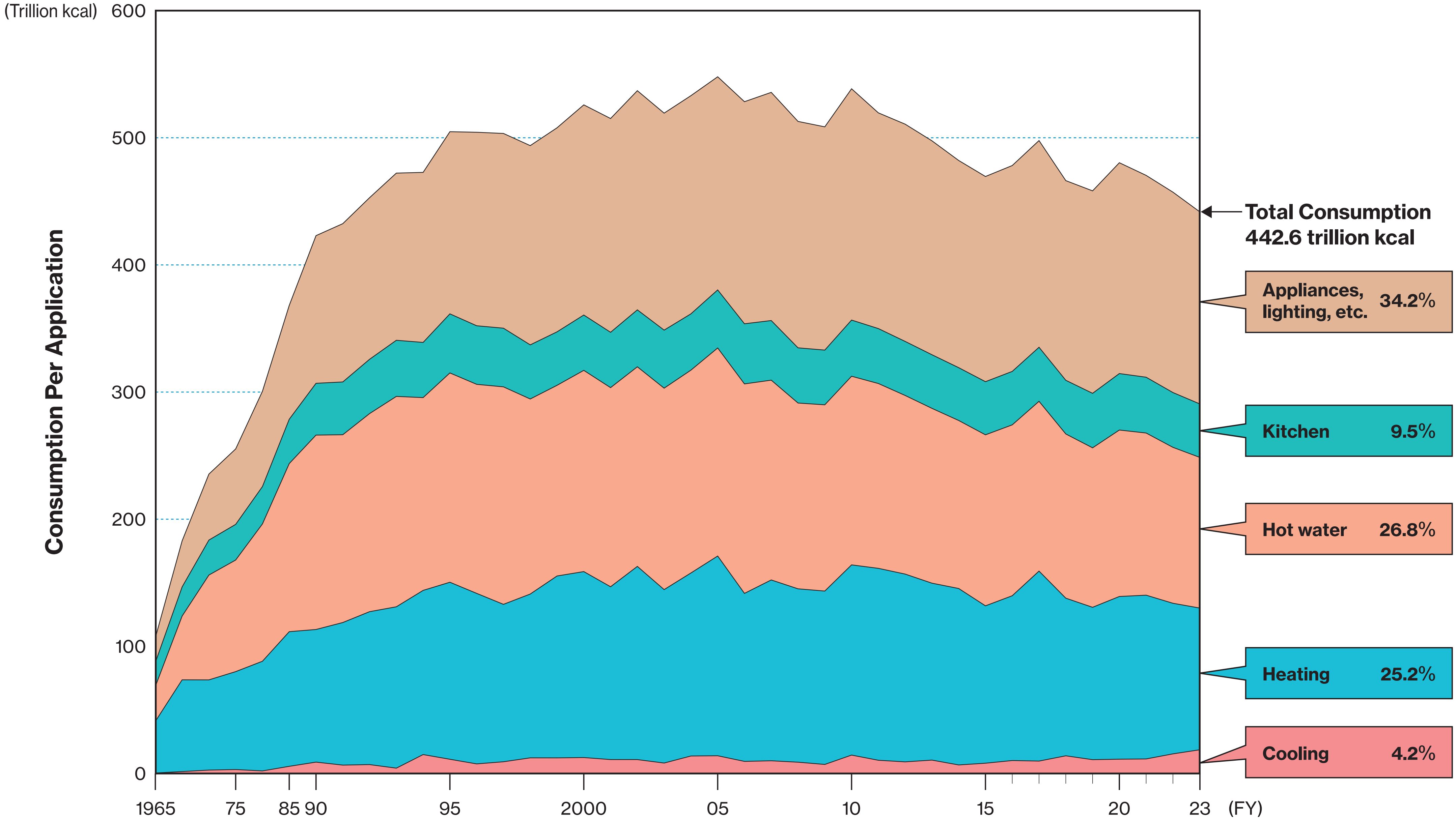
Concept image of supply and demand on day of lowest demand (sunny day in May, etc.)



In order to achieve stable usage of power, the amount of power generated (supply) and amount of power consumed (demand) must be made always equal.
For that purpose, the amount of power generated and the amount of power consumed must be balanced using methods
such as thermal power generation that can compensate for the fluctuations in output from renewable energy.

Source: Agency for Natural Resources and Energy, Japan's Energy

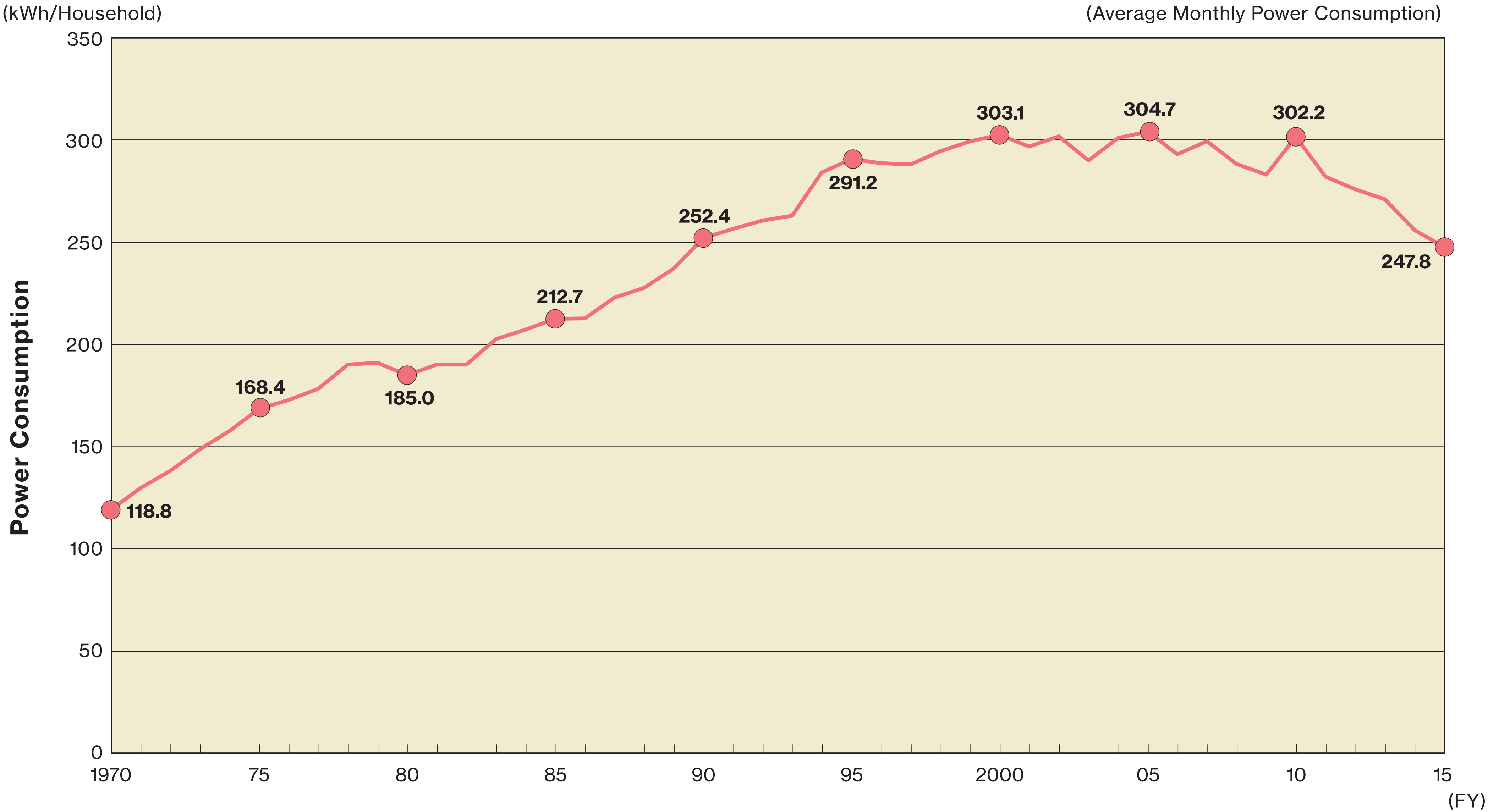
Household Energy Consumption Per Application



(Note) The category "Appliances, lightning, etc." includes washing machines, clothes dryers, futon dryers, TVs, VCRs, stereos, CD players, DVD players, record players, vacuum cleaners, PCs and electric bidet toilets.

Source: The Institute of Energy Economics, Japan, 2025 EDMC Handbook of Energy and Economic Statistics in Japan

Power Consumption Per Household



(Note) The values are the average across nine power companies.

Source: The Federation of Electric Power Companies

[Power Generation Costs of Model Plant Method] Estimated Results for 2040

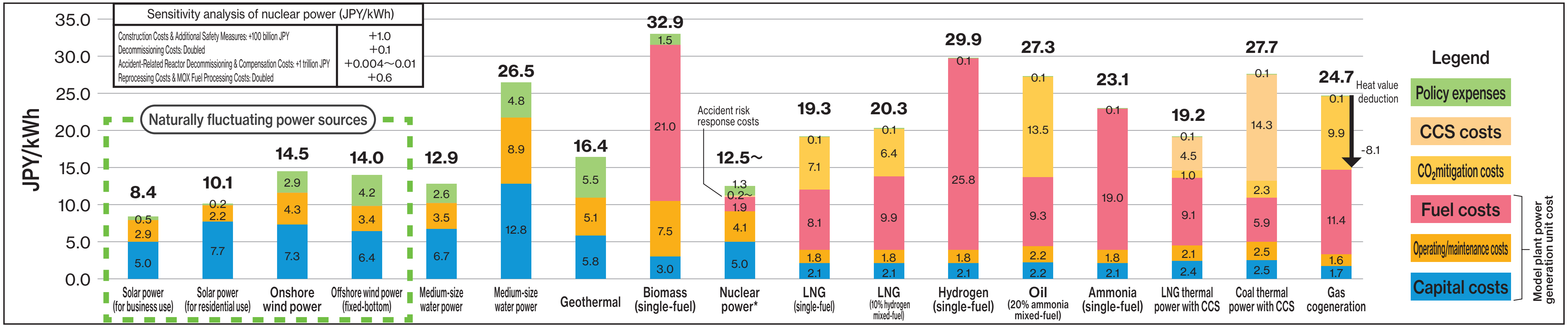
		Naturally fluctuating power sources				Water power		Geothermal	Biomass	Nuclear power	LNG	Decarbonized thermal power						Cogeneration
Power source		Solar power (for business use)	Solar power (for residential use)	Onshore wind power	Offshore wind power (fixed-bottom)	Medium-size water power	Small-size water power	Geothermal	Biomass (single-fuel)	Nuclear power	LNG (single-fuel)	LNG (10% hydrogen mixed-fuel)	Hydrogen (single-fuel)	Oil (20% ammonia mixed-fuel)	Ammonia (single-fuel)	LNG thermal power with CCS	Coal thermal power with CCS	Gas cogeneration
LCOE (JPY/kWh)	With policy expenses	6.9 – 8.8	7.8 – 10.6	12.6 – 14.5	13.5 – 14.3	12.9	26.5	16.1 – 16.8	32.9	12.5〜	16.0 – 21.0	16.9 – 22.3	24.4 – 33.1	21.1 – 32.0	21.0 – 27.9	17.1 – 21.1	26.6 – 32.3	16.5 – 17.5
	Without policy expenses	6.6 – 8.4	7.6 – 10.4	10.1 – 11.6	9.5 – 10.1	10.3	21.7	10.9	31.4	11.2〜	15.9 – 20.9	16.8 – 22.2	24.3 – 33.0	21.0 – 31.9	20.9 – 27.8	17.0 – 21.0	26.5 – 32.2	16.4 – 17.4
Capacity utilization rate and years of operation		18.3% 25 years	15.8% 25 years	29.6% 25 years	40.2% 25 years	54.7% 40 years	54.4% 40 years	83% 40 years	87% 40 years	70% 40 years	70% 40 years	70% 40 years	70% 40 years	70% 40 years	70% 40 years	70% 40 years	70% 40 years	72.3% 30 years

Note 1: Values in the table are estimates with ranges that depend on the estimation method of future fuel prices, CO_2 mitigation costs, and equipment-price decreases due to the expansion of solar and wind power adoption. For example, the range for CO_2 mitigation costs is based on South Korea's Stated Policies Scenario (STEPS) and the EU's Announced Pledges Scenario (APS) in the IEA's "World Energy Outlook 2024" (WEO2024).

Note 2: Values in the graph are based on the WEO2024 STEPS case. CO_2 prices are based on the WEO2024 EU STEPS case, hydrogen and ammonia are based on the case where blue hydrogen and blue ammonia are imported from overseas, CCS is based on pipeline transport, and cogeneration is based on costs calculated using CIF prices. Other assumptions are as shown in the "Breakdown of power generation costs" (graph) for each power source, listed below.

Note 3: The policy expenses considered by the Power Generation Cost Verification Working Group are generally not included in the calculations under internationally-established methods, so we have also included cases where policy expenses are not included. *Policy expenses: These are not costs that power generation companies bear for power generation, but are social costs that are considered necessary for power generation for each power source, among policy expenses that are covered by taxes, etc.

Note 4: Sums of values may not match totals due to rounding. Note 5: Hydrogen and ammonia mixed fuels are based on heat quantity. Note 6: "CO_2 mitigation costs" are a portion of environmental externality costs that have been approximated using the carbon price indicated in the WEO for convenience.

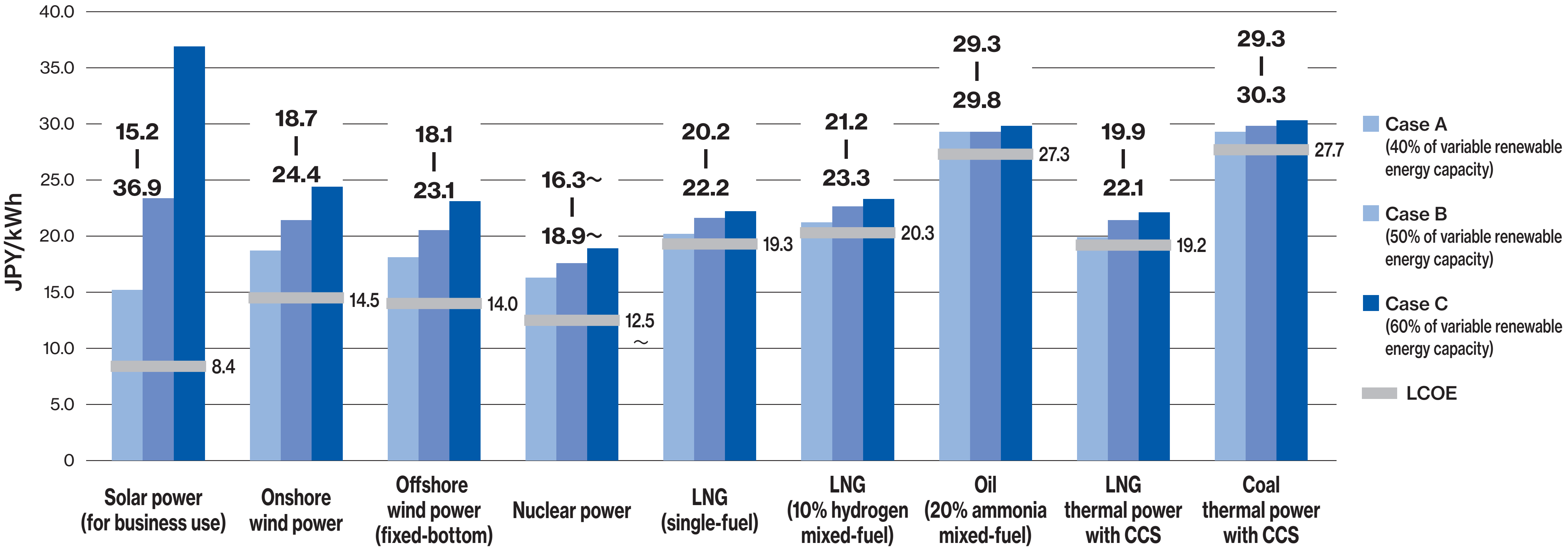


* At present, the technologies for perovskite solar cells and floating offshore wind power are still in the development stage, and the predictability of their costs is not necessarily high. However, when power generation costs were estimated under certain assumptions based on cost calculation models created from cost data from other countries and estimates from businesses, the results were: 16.4 JPY/kWh for perovskite solar cells with policy expenses and 15.3 JPY/kWh without policy expenses, and 21.6 to 21.7 JPY/kWh for floating offshore wind power with policy expenses and 14.9 JPY/kWh without policy expenses. (Reference values)

* For nuclear power, estimates take into account not only costs directly related to power generation, but also future costs such as decommissioning costs, nuclear fuel cycle costs (including final disposal of radioactive waste), accident response costs (including compensation and decontamination), and policy expenses (power plant location subsidies, research and development costs, etc.).

Source: Created from materials from the Ministry of Economy, Trade and Industry Power Generation Cost Verification Working Group

[Power Generation Costs Considering a Portion of Integration Costs] Estimated Results for 2040



* [Power Generation Costs Considering a Portion of Integration Costs] are calculated with the additional costs incurred in the power system when a specific power source is added while existing power generation facilities are in operation. Specifically, it takes into account adjustments by other power sources such as LNG thermal power, storage and discharge losses from pumped storage and grid batteries, grid stabilization costs associated with deployment of renewable energy, operational changes to existing thermal power due to fluctuations and unpredictability of amounts of renewable energy power generation, reduced efficiency of power generation, and costs associated with adjusting amounts of power generation and securing reserve capacity.
* Future costs will vary if the assumptions for the calculations are changed, such as the outlook for fuel costs, the number of years of operation and the capacity utilization rates of the facilities, and the power source that is expected to be replaced in the power system when a specific power source is added (which in these circumstances is coal thermal power, the most expensive). Three cases were used for these calculations. It is also important to keep in mind the possibility of further technological innovations.
* The power supply system in 2040 is assumed to have a certain degree of strengthening of inter-regional transmission lines and installation of grid storage batteries, and the reduction of integration costs that these will bring has been taken into account in the above results. Furthermore, if demand response is taken into account to a certain extent, power generation costs considering a portion of integration costs will be lower than the above.
* The costs of strengthening inter-regional transmission lines and installing storage batteries are not included in the calculation, as these are not additional costs that arise in the entire power system when a specific power source is added.
* Hydrogen and ammonia are based on heat quantity.

Source: Created from materials from the Ministry of Economy, Trade and Industry Power Generation Cost Verification Working Group