ELECTRICITY REVIEW JAPAN

The Federation of
Electric Power Companies of
Japan

2017

History of Japan's Electric Utility Industry

Electricity was first used in Japan on March 25, 1878 at the Institute of Technology in Toranomon, Tokyo when an arc lamp was switched on in commemoration of the opening of the Central Telegraph Office. In those days, electricity was still unfamiliar and uncommon not only in Japan but also in Europe and the United States. In 1886, Tokyo Electric Lighting, a private company, commenced operations as the nation's first electric power company, and began supplying electricity to the public in the following year.

In the early days, use of electricity grew primarily for lighting because of its safety and cleanness, and gradually found broader applications as a power source to replace the steam engine. By 1896, the number of electric utilities established throughout the nation reached a total of 33. The early 20th century marked the establishment of long-distance transmission technology. As larger thermal and hydro-power plants were introduced, generation costs fell and electricity came into wider use throughout the country. Consequently, electricity became an indispensable energy source for peoples' lives and industry.

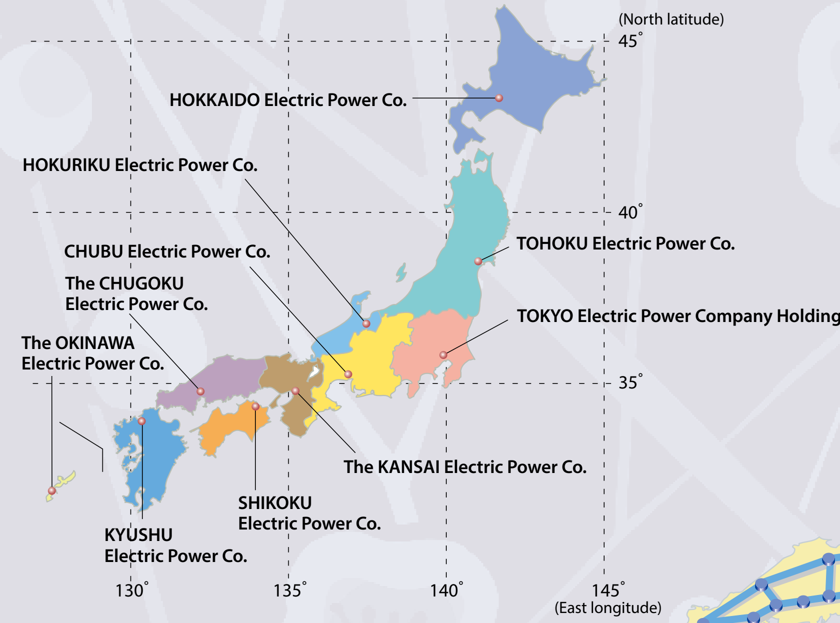
In the years that followed, the electricity utility business grew in tandem with the modernization of Japan and development of its industry. At the same time, the electric utility industry experienced a major restructuring that led to the dissolution of 700 electric utilities, which merged to create five major electric utilities after the First World War. During the Second World War, the electric utility industry was completely state-controlled and utilities were integrated into Nihon Hatsusoden Co. (a nationwide power generating and transmitting state-owned company) and nine distribution companies.

After the end of World War II in 1945, supply and demand for electricity remained very tight in Japan. A series of intense discussions were held on restructuring the electric utility industry as one of the measures for democratizing the economy. As a result, nine regional privately owned and managed General Electricity Utilities— Hokkaido, Tohoku, Tokyo, Chubu, Hokuriku, Kansai, Chugoku, Shikoku and Kyushu Electric Power Companies — were established in 1951 and assumed the responsibility of supplying electricity to each region. This fundamental structure remains to this day, and with the return of Okinawa to Japan in 1972, Okinawa Electric Power Co. joined as a tenth member.

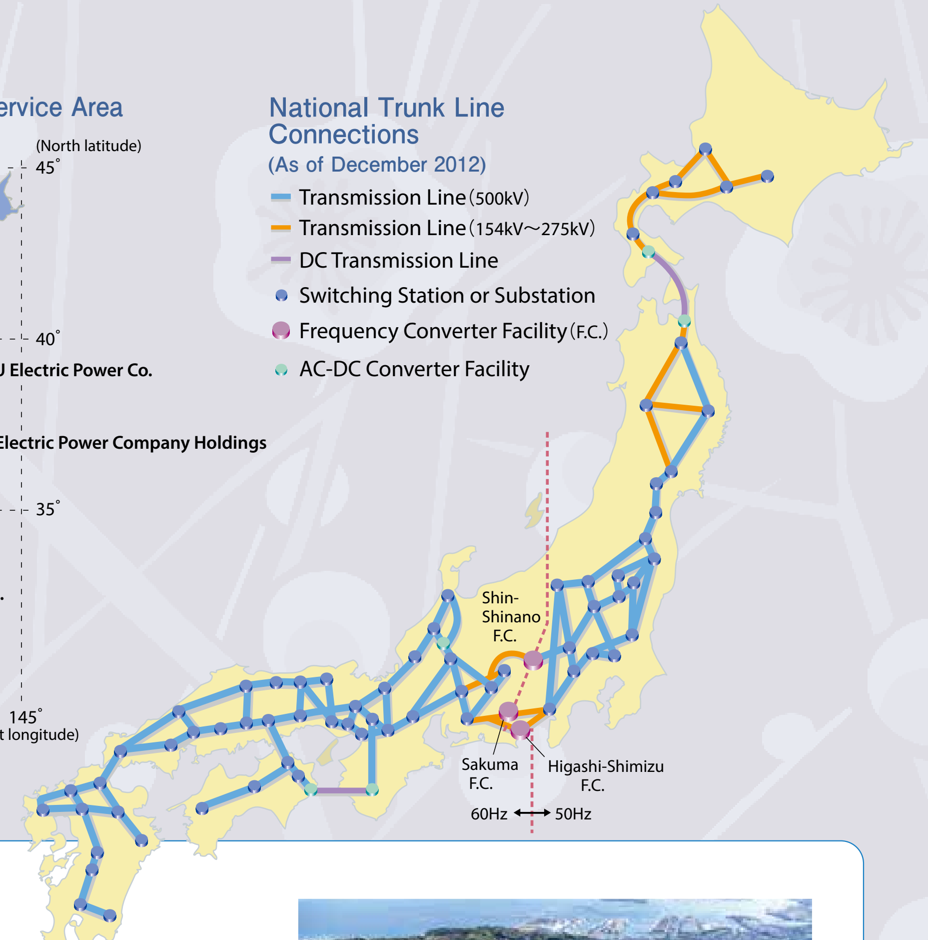
At the end of the 20th century, a trend toward deregulation and competition took hold throughout society, and the electric utility industry started to be liberalized. In December 1995, organizations such as independent power producers (IPP) were allowed to provide electricity wholesale services, and in March 2000, electricity retail supply for extra-high voltage users (demand exceeding 2MW) was liberalized. The scope of retail liberalization was then expanded in April 2004 to users of more than 500kW, and subsequently in April 2005 to users of more than 50kW. Thus, a Japanese model of liberalization based on fair competition and transparency, while maintaining the vertical integration of generation, transmission and distribution to ensure a stable supply of electricity, was established.

With the Fukushima Daiichi Nuclear Power Station accident and subsequent tight demand and supply brought about by the Great East Japan Earthquake in March 2011 as a turning point, numerous discussions were held to maintain a stable supply and reduce energy costs, and in November 2013, the policy to implement three-phase reforms of the electric power system was adopted.

The Ten Electric Power Companies by Main Service Area



National Trunk Line Connections
(As of December 2012)



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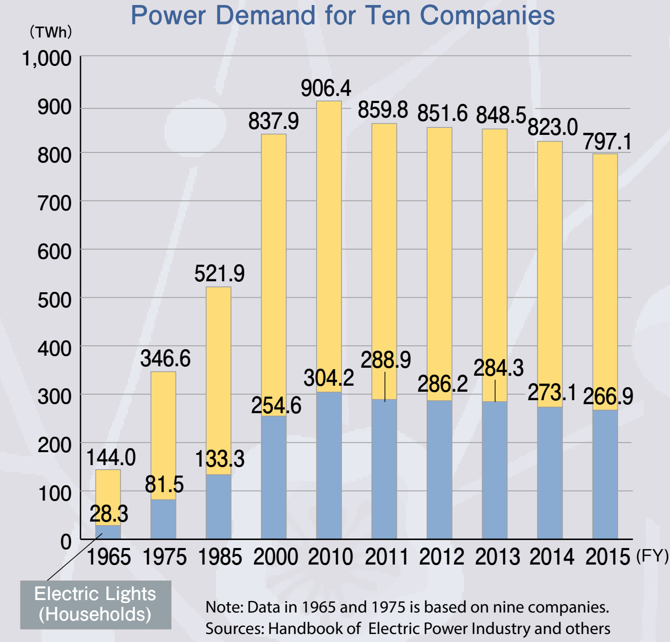
The Linchpins of East-West Grid Connection- Frequency Converter Facilities

The frequency of grid power differs between eastern and western Japan, namely 50 Hz and 60 Hz respectively. This difference has a historical root in that the Tokyo area adopted German-made generators at the beginning of the electricity business while Osaka chose US-made ones. Therefore, Frequency Converter Facilities (FCF) are necessary to connect the eastern and western power grids. Three FCFs, namely Sakuma FCF and Higashi-Shimizu FCF in Shizuoka Pref. and Shin-Shinano FCF in Nagano Pref., operate to convert the frequency.

After the Great East Japan Earthquake, to strengthen the east-west grid connection, the capacity of FCFs is planned to be expanded to 2,100 MW by FY2020.

Higashi-Shimizu FCF

Power Demand for Ten Companies



Note: Data in 1965 and 1975 is based on nine companies.
Sources: Handbook of Electric Power Industry and others

C O N T E N T S

Note: Nine Companies include Hokkaido, Tohoku, Tokyo, Chubu, Hokuriku, Kansai, Chugoku, Shikoku and Kyushu.
Ten Companies include the above Nine Companies plus Okinawa.

Japan's Energy Supply Situation

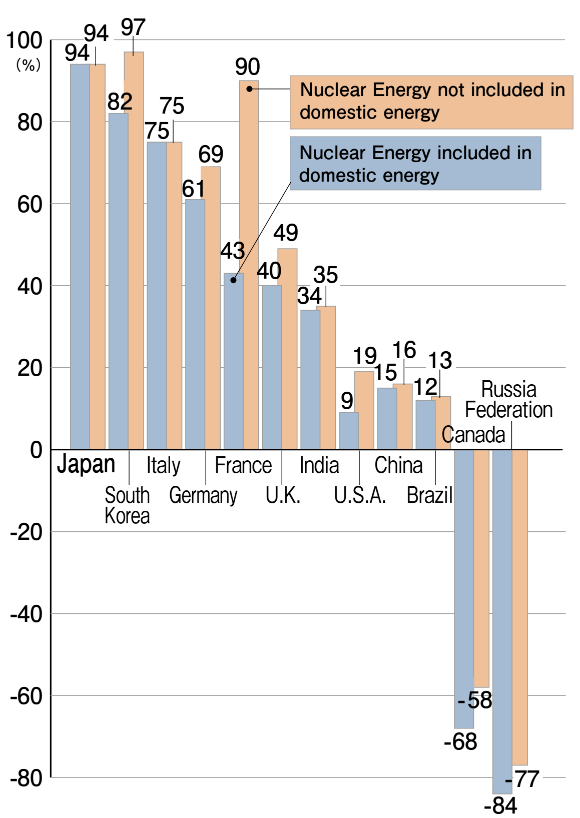
Resource-poor Japan is dependent on imports for 94% of its primary energy supply.

Thus, Japan's energy supply structure is extremely vulnerable. Following the two oil crises in the 1970s, Japan has diversified its energy sources through increased use of nuclear energy, natural gas and coal, as well as the promotion of energy efficiency and conservation. Despite these improvements, oil still accounts for about 40% of Japan's primary energy supply, and more than 80% of imported oil comes from the politically unstable Middle East. Moreover, although Japan has one of the highest proportions of electricity demand in total energy demand at over 40%, prospects for importing electricity from neighboring countries are very poor because Japan is an island nation. In addition, there is an urgent need for global warming countermeasures such as reduction of carbon dioxide emissions from the use of energy. To ensure Japan's stable electricity supply, it is crucial to establish an optimal combination of power sources that can concurrently deliver energy security, economic efficiency, and environmental conservation, while making safety the top priority.

For the future, it is important for Japan's energy mix to continue to include a certain level of nuclear energy premised on ensuring safety, while maximizing the use of renewable energy and using a reasonable proportion of thermal power considering the stability of fuel supply.

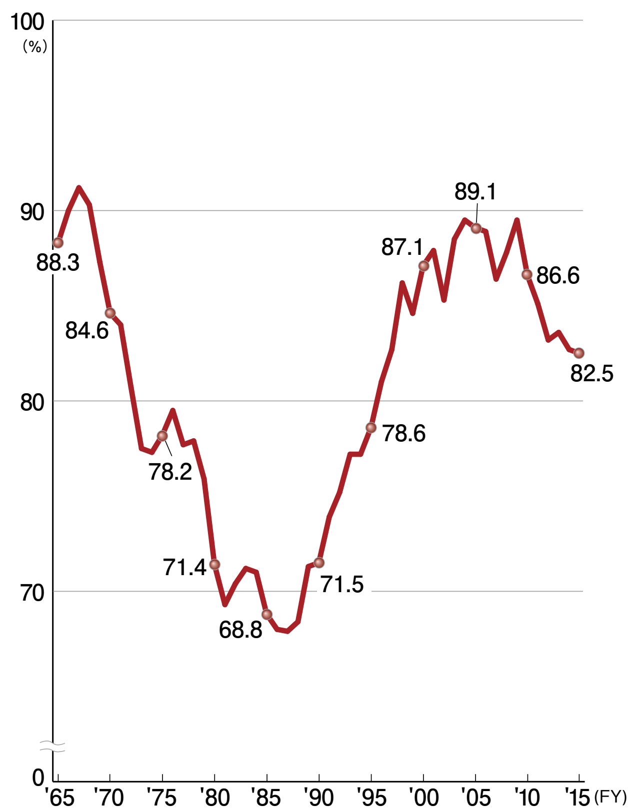
The "Strategic Energy Plan" decided by the government in April 2014 also states that nuclear power is an important base load power source that can, strictly premised on safety, contribute to the stability of the supply and demand structure of energy.

Dependence on Imported Energy Sources by Major Countries (2014)



Source: IEA "WORLD ENERGY BALANCES (2016 EDITION)"

Japan's Reliance on Middle East Crude Oil of Total Imports



Source: Petroleum Association of Japan

Development of 2030 Energy Mix

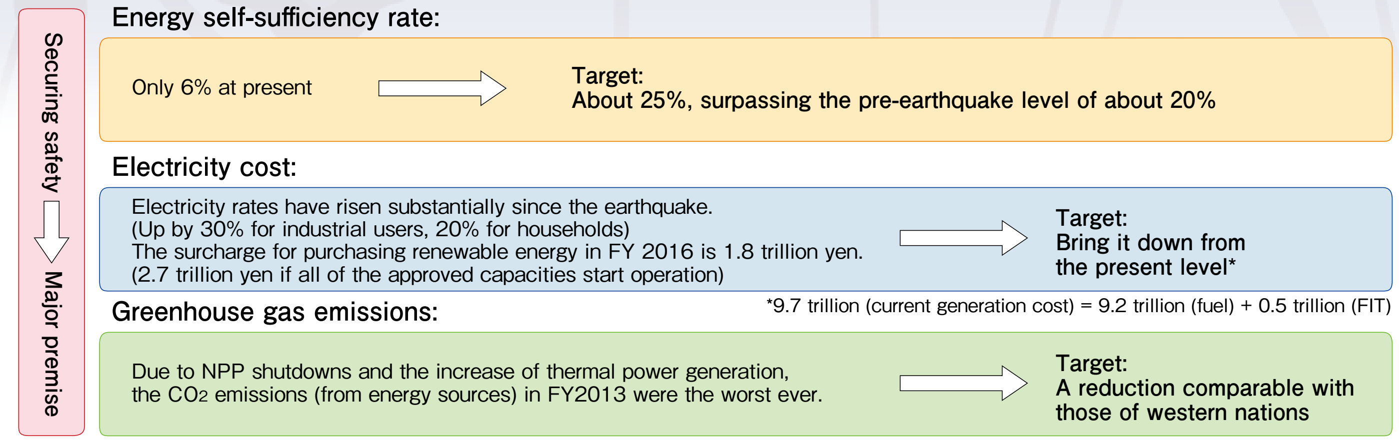
After the Great East Japan Earthquake, almost all nuclear power stations have been halted, and so thermal power generation now accounts for nearly 90% of the nation's energy mix. As a result, the nation's energy self-sufficiency ratio dropped from 20% to 6%, and the fuel cost has nearly doubled, from 3.6 trillion yen to 7.2 trillion yen in FY2014. The increase in thermal power generation has also increased CO_2 emissions.

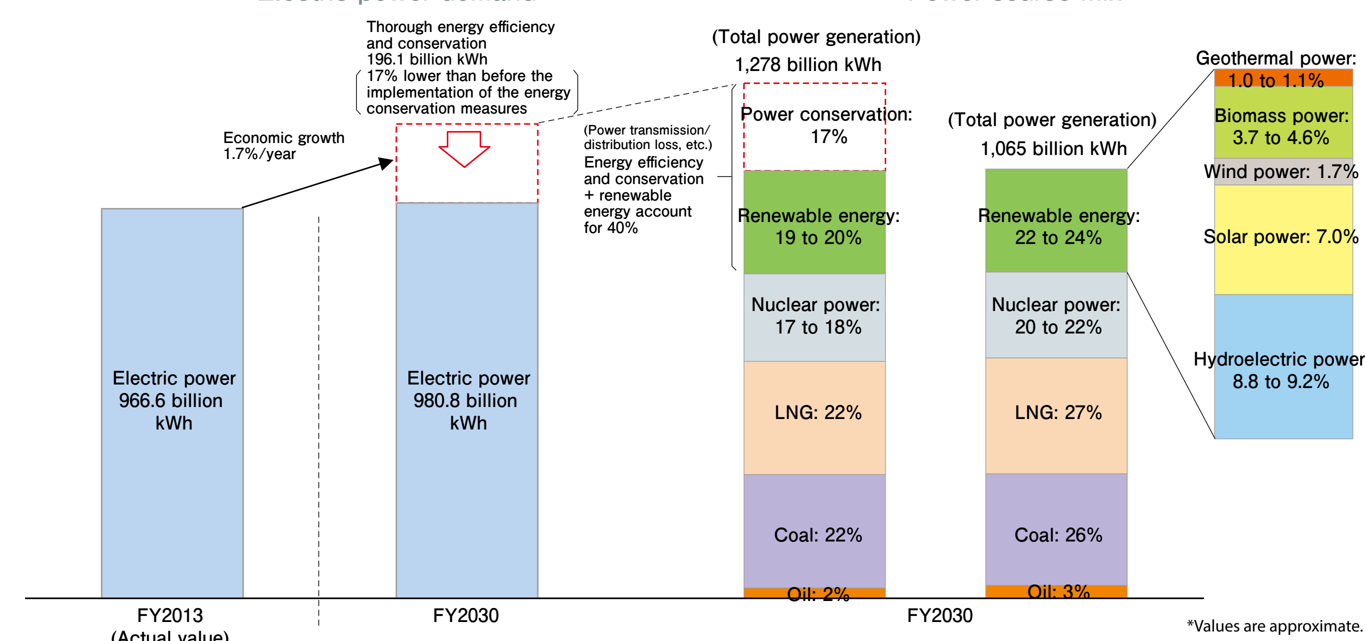
In July 2015, reflecting these observations, the Government decided the " Energy Mix " of FY2030 with the basic objectives of raising the nation's energy self-sufficiency ratio higher than that even before the earthquake, lowering the electricity cost from the current level, and setting a CO_2 emission reduction target comparable to those of western nations.

The Energy Mix proposes, in addition to a firm commitment to reduce overall energy consumption, that nuclear should account for 20-22%, thermal power for 56% (27% LNG, 26% coal, and 3% oil), and renewable energy for 22-24%.

In view of the Energy Mix decided by the Government, the electric power companies will strive to achieve energy security, economic efficiency, and environmental conservation, while putting top priority on safety.

Three Viewpoints Concerning Development of the Energy Mix





*Values are approximate.

Source: METI "Long-term Energy Supply and Demand Outlook"

Electric Power Companies' Commitment to Safety Measures at Nuclear Power Plants

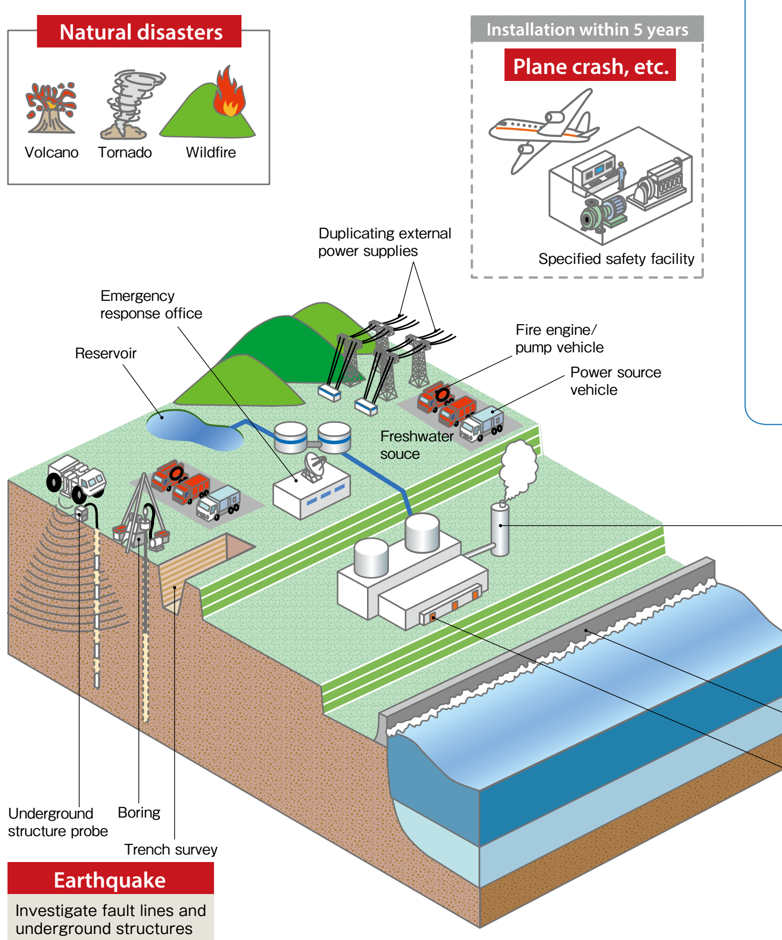
The Great East Japan Earthquake on March 11, 2011 led to a nuclear accident at the Fukushima Daiichi Nuclear Power Station, resulting in the release of radioactive materials into the environment.

Determined to avoid a repeat of this accident, the electric power companies have been taking both tangible and intangible measures since immediately after the accident, starting with emergency safety measures including the installation of additional emergency power source vehicles and fire engines, as well as upgrading procedure manuals and conducting drills.

Even after implementing the emergency safety measures, the electric power companies are making further efforts to improve safety, including installing air-cooled emergency power generators, filtered ventilation systems and earthquake-isolated emergency response centers.

To enable these efforts to be constantly and objectively evaluated, the Japan Nuclear Safety Institute(JANSI), which evaluates the safety improvement activities of electric power companies and gives them technical advice, and the Nuclear Risk Research Center(NRRC), which uses Probabilistic Risk Assessment(PRA) and proposes solutions based on R&D, were established. The electric power companies take to heart the evaluations and recommendations and are striving to achieve the highest safety level in the world.

In July 2013, the new regulatory requirements set forth by the Nuclear Regulation Authority (NRA) were put into effect. As of July 2017, the electric power companies have applied for a review of compliance with the new regulatory requirements for 26 units of their 16 power stations. 12 of these 26 units have been passed the review, and 5 of these 12 units have restarted commercial operation.



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Start of full operation of Mihama Nuclear Emergency Assistance Center in December 2016

- When an nuclear accident occurs, the center swiftly assembles an emergency dispatch team, transports personnel and equipment to the operator struck by disaster, and cooperates with the operator to deal with the nuclear accident at high radiation dose.
- During normal times, the center intensively deploys and manages radio controlled robots, etc., and implements operating training for nuclear operator personnel.

Fair Competition and Transparency

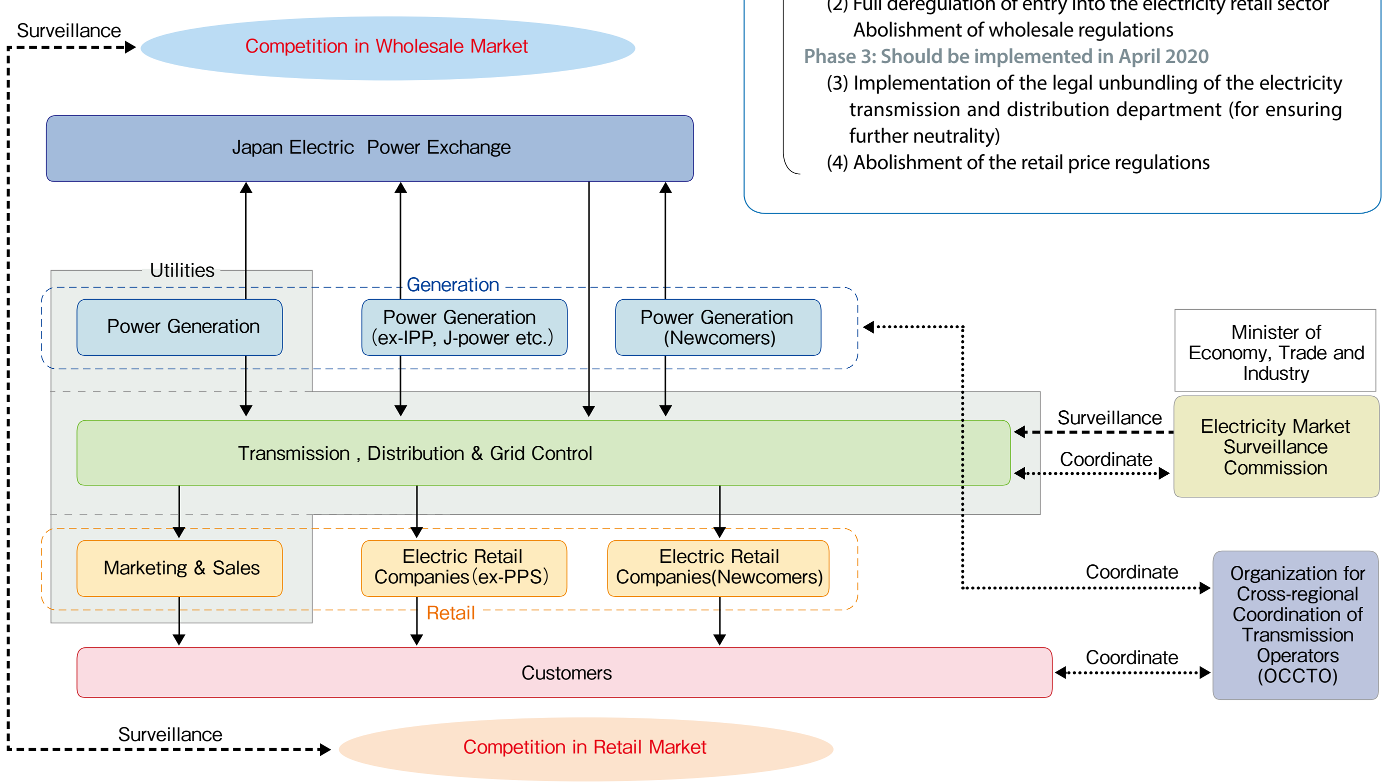
The electric power market in Japan has been progressively liberalized to ensure competitive neutrality on the basis of a stable power supply by the former ten General Electricity Utilities, which consistently handle all functions from power generation to distribution.

In 1995, a law was revised to enable IPPs to participate in the electricity wholesale market in addition to the conventional Wholesale Electricity Utilities. Then, in March 2000, use of the transmission/distribution network owned by the electric power companies was liberalized, and the retail market was partially liberalized to allow power producers and suppliers (PPSs) to sell electricity to extra-high voltage users requiring more than 2MW. The scope of liberalization was then expanded in April 2004 to users requiring more than 500kW, and subsequently in April 2005 to users requiring more than 50kW. Then, in April 2016, all users including individual households and retail stores were included in the scope of this liberalization so that everyone is free to choose an electric power company and price menu. Electric power companies have responded to this trend of liberalization by increasing their business efficiency while lowering electricity prices and offering a variety of pricing plans.

With the three goals of ensuring supply stability, suppressing electricity rates to the maximum extent possible, and expanding the options for consumers and the business opportunities for operators, the government is planning to advance the reforms in three phases through the three key measures of enhancing nationwide grid operation, full deregulation of the electricity retail and generation sectors, and futher ensuring neutrality in the transmission / distribution sector through the legal unbundling while thoroughly inspecting each phase to solve any issues and taking necessary measures based on the results of the inspections.

As practitioners, the electric power companies would like to continue taking an active role in the deliberation so the markets will be organized to secure the stable supply of electricity, including the market transactions that are already active, and so that the electric power system reform will truly bring benefits to the customers.

The New Electricity Supply System (from April 2016)



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Overview of the Reforms of the Electric Power System

The following revisions to the Electricity Business Act related to the reforms of the electric power system were passed into law in November 2013.

Phase 1: Enforced in April 2015
(1) Establishment of the "Organization for Cross-regional Nationwide Coordination of Transmission Operators" (Enhancement of nationwide grid operation)

Phase 2: Enforced in April 2016
(2) Full deregulation of entry into the electricity retail sector
Abolishment of wholesale regulations

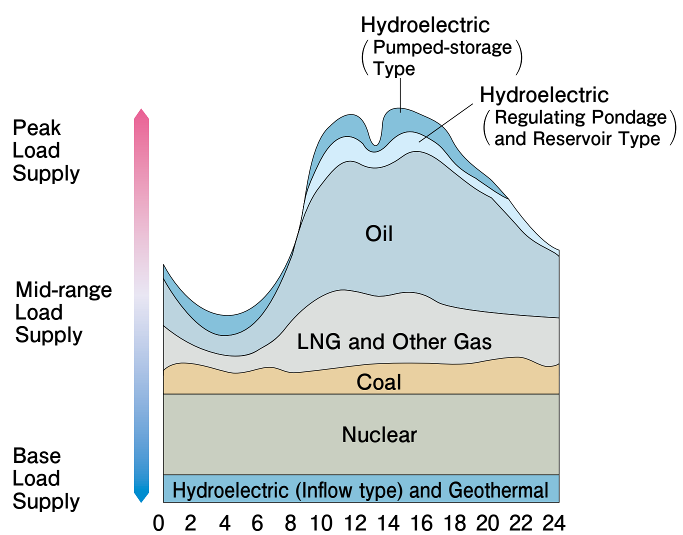
Phase 3: Should be implemented in April 2020
(3) Implementation of the legal unbundling of the electricity transmission and distribution department (for ensuring further neutrality)
(4) Abolishment of the retail price regulations

Optimal Combination of Power Sources

Electric power companies in resource-poor Japan are committed to developing an optimal combination of power sources including hydro, thermal and nuclear power in order to provide electricity, which is essential for modern living, in a stable manner at the lowest prices.

As electricity is nearly impossible to store in large quantities, electric power companies generate electricity by combining various power sources, considering optimal operational and economic performance, to ensure that fluctuating demand, such as during the daytime in the height of summer, can always be met.

(Example) Combination of Power Sources



Hydroelectric and nuclear power provides base load supply, while coal and LNG are major power sources for mid-range load supply. Oil-fired and pumped-storage hydroelectric power respond to peak demand fluctuation and contribute to the consistent, stable supply of electricity.

Hydroelectric Power

Hydroelectric power has been one of the few self-sufficient energy resources in resource-poor Japan for more than 100 years. Hydroelectric power is an excellent source in terms of stable supply and generation cost over the long term. Though it used to compare unfavorably with thermal power for some time, hydroelectric power saw a renaissance following the oil crisis.

Although the steady development of hydroelectric power plants is desired, Japan has used nearly all potential sites for constructing large-scale hydroelectric facilities, and so recent developments have been on a smaller scale. As the gap in demand between daytime and nighttime continues to widen, electric power companies are also developing pumped-storage power generation plants to meet peak demand. The share of pumped-storage generation facilities of the total hydroelectric power capacity in Japan is growing year by year.

Okumino Hydroelectric Power Station (Pumped-storage)

Takami Hydroelectric Power Station

Thermal Power

Initially, coal was the dominant fuel for thermal power generation in Japan, but it later lost that place to oil. Today, a diverse range of fuels including coal, oil, and LNG are used for the important generating role that thermal power plants play. In particular, electric power companies are promoting the introduction of LNG fired plants in response to global environmental concerns, as they emit less CO_2 and other pollutants.

To enhance thermal efficiency further, combined-cycle power plants with both gas and steam turbines have been installed. As a result, gross thermal efficiency (maximum designed value) has exceeded 60%. In the future, we will continue to research and develop new technologies in order to increase thermal efficiency as well as the use of integrated coal gasification combined cycle (IGCC) power generation.

Kawasaki Thermal Power Station (LNG Combined-cycle)

Yoshinoura Thermal Power Station (LNG-fired)

Nuclear Power

Japan's first commercial nuclear power plant started operation in Ibaraki Prefecture in 1966. The electric utility industry believes that nuclear power generation will retain an important position in the optimal combination of power sources from the viewpoint of assuring energy security and mitigating global warming.

Electric utilities are firmly committed to implementing extensive voluntary safety measures by adopting best practice from both Japan and overseas, while also complying with the new regulatory requirements following the accident at the Fukushima-daiichi Nuclear Power Station.

We will also continue to publish the latest information to contribute to the safety of nuclear power generation throughout the world.

Ohi Nuclear Power Station (PWR)

Ohma Nuclear Power Station (ABWR, Under Construction)

Japan's Nuclear Fuel Cycle

The nuclear fuel cycle is a series of processes consisting of reprocessing spent fuel that has been used at nuclear power plants and recovering and recycling plutonium and residual uranium as nuclear fuel.

Japan has chosen a closed nuclear fuel cycle policy since the dawn of its nuclear power generation development. Having few resources, Japan decided to recycle spent nuclear fuel domestically in order to establish nuclear power as a homegrown energy source. The benefits of a closed nuclear fuel cycle for Japan are significant: it adds to long-term energy security by reducing dependence on imported fuels; it conserves uranium resources; and it reduces the amount of high-level radioactive waste that must be disposed of. Reprocessing is a chemical process that recovers plutonium and reusable uranium from spent fuel and separates radioactive wastes into more manageable forms.

Once recovered, the plutonium is ready to be re-introduced into the nuclear power plants in the form known as uranium-plutonium mixed oxide (MOX) fuel. Under the policy of possessing no plutonium reserves without specified purposes, Japan's electric power companies have sincerely committed to a plan to utilize recovered plutonium – in the form of MOX fuel – as soon as possible.

In the past, Japan has relied on countries such as the U.K. and France to reprocess most of the spent fuel it produced. However, to place Japan's domestic nuclear fuel cycle on a firmer footing, Japan Nuclear Fuel Limited (JNFL) is preparing for completion of construction of a reprocessing plant at a site in Rokkasho-mura in the northern prefecture of Aomori. JNFL has applied for a review of compliance with the new regulatory requirements, which came into effect in December 2013, and the plants are currently undergoing reviews by the Nuclear Regulation Authority. JNFL expects to be ready for operation in the first half of FY 2018. In addition, JNFL engages in uranium enrichment, temporary storage of vitrified waste, and disposal of low-level radioactive waste. JNFL has also begun construction of a MOX fuel fabrication plant.

Electric utilities regard nuclear power as an important power source for Japan from viewpoints such as assuring energy security and mitigating global warming. We will make the utmost effort to establish the nuclear fuel cycle on the premise of securing thorough safety.

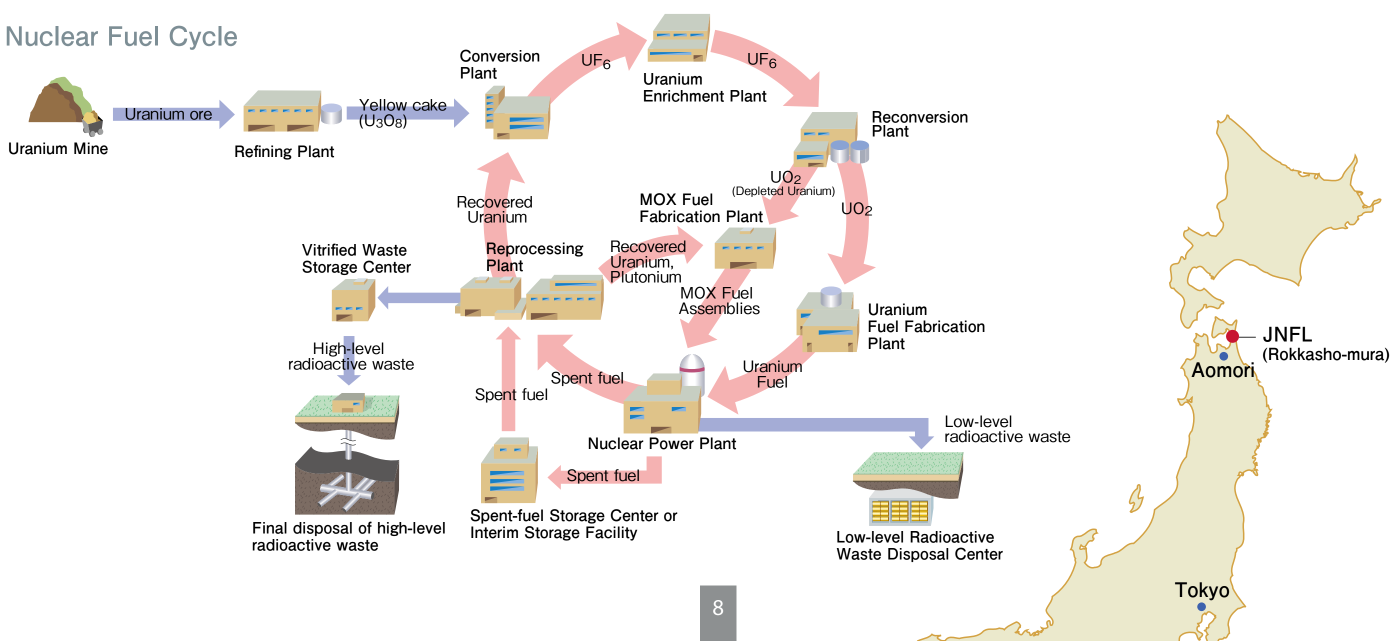
Outline of JNFL's Nuclear Fuel Cycle Facilities (as of October 2016)

Facility	Reprocessing Plant	MOX fuel fabrication plant	Vitrified waste storage center	Uranium enrichment plant	Low-level radioactive waste disposal center
Site	Iyasakatai, Rokkasho-mura, Kamikita-gun, Aomori Prefecture			Oishitai, Rokkasho-mura, Kamikita-gun, Aomori Prefecture	
Capacity	Maximum capacity: 800 ton-U/year Storage capacity for spent fuel: 3,000 ton-U	Maximum capacity: 130 ton-HM/year (*)	Storage capacity for wastes returned from overseas plants: 2,880 canisters of vitrified waste	Design capacity 1,500 ton-SWU/year (*)	Planned to be expanded to 600,000m³ (equivalent to 3 million 200 liter drums)
Current Status	Under construction	Under construction	Cumulative number of received canisters: 1,830	Running capacity: 1,050 ton-SWU/year	Cumulative number of received drums: 292,051
Schedule	Start of construction: 1993 Completion of construction: 2018(planned)	Start of construction: 2010 Completion of construction: 2019(planned)	Start of construction: 1992 Start of storage: 1995	Start of construction: 1988 Start of operation: 1992	Start of construction: 1990 Start of operation: 1992

(*) "ton-HM" stands for "tons of heavy metal" which indicates the weight of plutonium and uranium metallic content in MOX.
"SWU" stands for "Separative Work Unit" which is a measure of the work expended during an enrichment process of uranium

Sources: JNFL's website and others

Nuclear Fuel Cycle



The Peaceful Use of Nuclear Energy

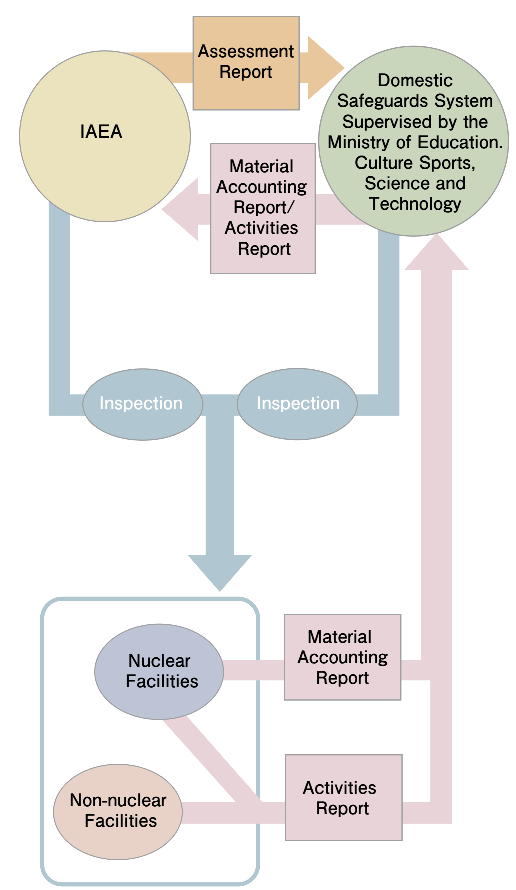
Japan's electric power companies are fully committed to implementing the closed nuclear fuel cycle and plutonium utilization consistent with all domestic laws and international nonproliferation standards. Since 1955, the domestic laws of Japan require that all nuclear activities, including commercial activities, be conducted only for peaceful purposes. Also, since 1968, Japan has embraced the "Three Non-Nuclear Principles," which state that Japan will not possess, produce, or permit the entry of nuclear weapons into its territory.

In addition, in 1976, the Government of Japan ratified the Nuclear Non-Proliferation Treaty (NPT) and thereby obligated itself to a national policy not to produce or acquire nuclear weapons. In order to ensure the application of more extensive safeguards, Japan signed the IAEA Additional Protocol in 1998, which allows the IAEA to carry out a range of additional inspection measures. In accordance with national laws, Japan's electric power companies currently submit reports on material accounting and safeguards activities to the Nuclear Regulation Authority (previously, the reports were submitted to the Minister of Education, Culture, Sports, Science ahd Technology), and accept joint inspections by the IAEA and Japanese regulatory authorities to check the reports.

The results of each of these Japanese initiatives were reflected in the IAEA's conclusion in June 2004, which stated that all the nuclear materials in Japan are protected under IAEA safeguards and are not being diverted to the manufacture of nuclear weapons. As a result, more effective and efficient IAEA safeguards known as integrated safeguards came into effect in Japan in September 2004.

Furthermore, concerning the handling of plutonium, the Strategic Energy Plan states that Japan will firmly maintain the policy of possessing no plutonium reserves without specified purposes and using it only for peaceful purposes, in order to steadily advance the use of plutonium while contributing to nuclear non-proliferation and gaining the understanding of the international community. To substantiate these efforts, Japan will manage and use plutonium appropriately by promoting MOX fuel power generation, while paying due consideration to the balance of plutonium collected and utilized, and advance R&D on fast breeder reactors (FBR) by strengthening ties with the US and France.

The Safeguards Program



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Enactment of the Spent Nuclear Fuel Reprocessing Fund Act

In May 11, 2016, the Spent Nuclear Fuel Reprocessing Fund Act was passed in the Diet. The objective of the legislation is to provide a framework for pursuing the national policy of reprocessing spent fuel in a most reliable and efficient manner even under a new business environment characterized by the liberalized electricity market and reduced dependence on nuclear energy.

The new bill is to implement a series of institutional measures, which include creating a new funding system aimed at securing adequate funds, organizing a government-authorized corporation (the spent fuel reprocessing organization) which, as a principal business entity, conducts the reprocessing business both appropriately and efficiently, and establishing an authorized corporation acting as a decision-making organization (a management committee) from a proper governance viewpoint. The law also ensures a certain level of involvement of the National Government.

Furthermore, the supplemental resolution to the legislation reaffirms the policy of possessing no plutonium reserves without specified purposes. Also, according to the bill, the Governmental instructs the nuclear operators to conduct reprocessing business while upholding this policy, and if an implementing body should make reprocessing plans that go against this policy, the Minister of Economy, Trade and Industry can withhold approval of such plans.

Status of MOX Fuel Utilization

The electric power industry in Japan intends to introduce MOX fuel in 16 to 18 nuclear reactors. So far, 10 reactors have received the permission of a reactor installation license to use MOX fuel power generation, 4* of which (expect Unit 3 of Fukushima Daiichi Station) have started operation with MOX fuel. The electric power companies recognize the importance of improving the transparency of the MOX fuel project. Based on the outlook of individual companies toward restarting nuclear power plants and considering the schedule and other details of the plan to start up the reprocessing plant, we shall compile and announce the MOX fuel project before restarting plutonium recovery operations.

*As of July 31, 2017

Measures by the Electric Utility Industry to Suppress CO_2 Emissions

Efforts for environmental conservation including countermeasures against global warming, creating a recycling-based society and managing chemical substances, are key challenges for the electric utility industry. Regarding global warming measures, the "Paris Agreement" was adopted in December 2015 at the 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21), and it entered into force in November 2016, building a framework that all countries and regions of the world participate for global warming measures. In July 2015, the Japanese Government announced its "Intended Nationally Determined Contributions(INDC)", with the objective of reducing greenhouse gas emissions in 2030 by 26% from 2013 levels. In May 2016, in accordance with INDC, the plan for Global Warming Countermeasures was adopted. Emissions of carbon dioxide(CO_2), a major cause of global warming, are closely related to energy utilization in economic activities and daily life, and so the reduction of CO_2 emissions is a major challenge for the industry.

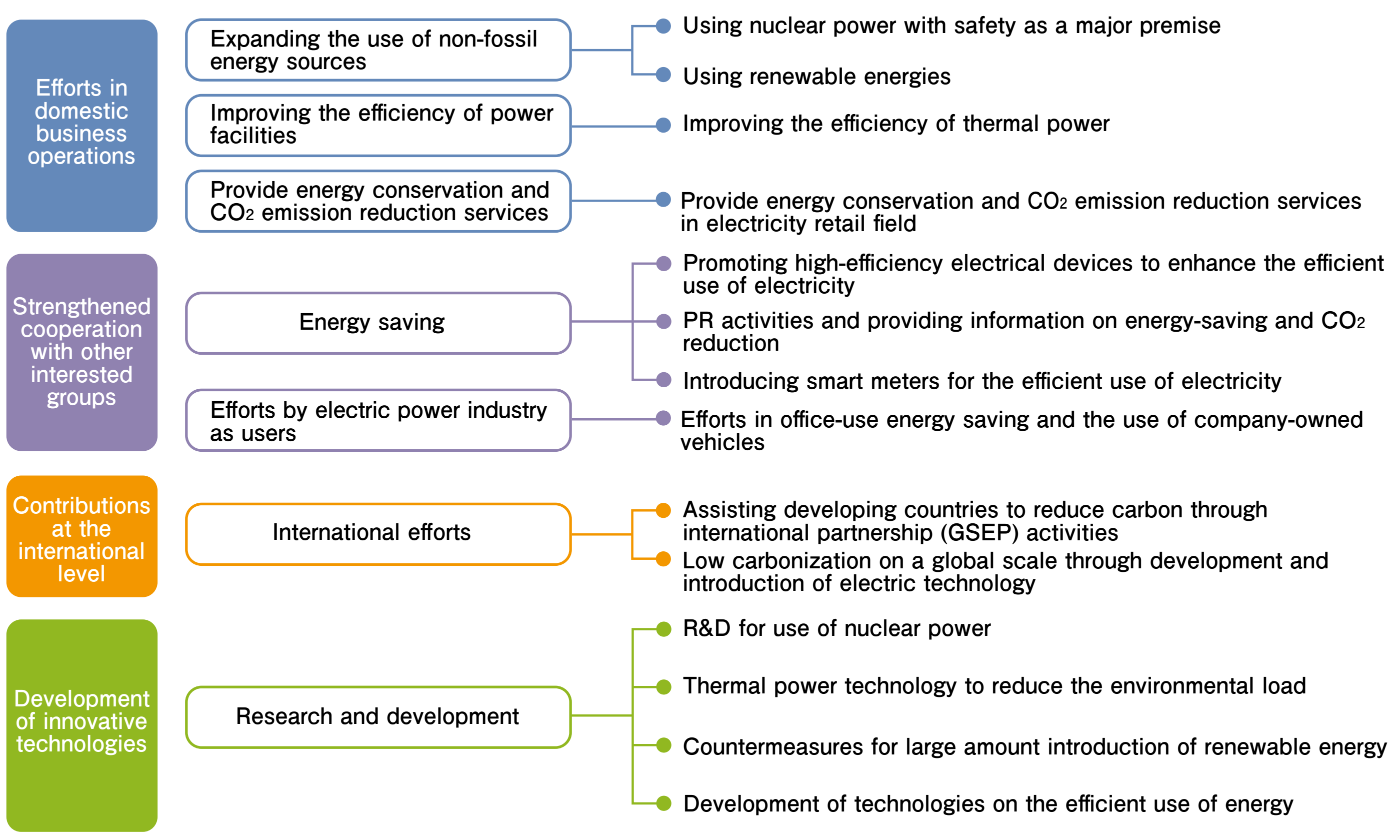
The electric power companies are trying to reduce CO_2 emissions mainly through attaining the optimal energy mix, seeking to simultaneously achieve Energy security, Economic efficiency and Environmental conservation, under the major premises of Safety (S+3Es).

In July 2015, 35 electricity utility companies jointly constructed a voluntary framework for a low carbon society and prepared an "Action Plan for a Low-Carbon Society" that laid out specific efforts to be made. In February 2016, "the Electric Power Council for a Low-Carbon Society (ELCS)" was founded to facilitate efforts toward this goal (a membership of 42 utility companies as of June 2017).

According to the Action Plan, an end-user CO_2 emission factor of about 0.37kg- CO_2/kWh will be targeted in light of the Government's 2030 energy supply and demand outlook. Moreover, as the maximum reduction potential, a reduction of about 11 million t- CO_2 will be expected by using economically achievable best available technologies(BATs) in light of the construction of new thermal power plants, etc.

The member companies will make efforts towards a low carbon society by utilizing nuclear power generation premised on ensuring safety or renewable energy, raising the efficiency of thermal power plants and optimizing their appropriate maintenance and control, and promoting energy-conservation or CO_2 reduction services on both the supply and demand sides.

Overview of the Action Plan for a Low Carbon Society of ELCS



Decarbonization of Energy on the Supply-side

Promoting nuclear power generation while assuring safety, and improving the thermal efficiency of thermal power plants further

Nuclear power emits no carbon dioxide (CO_2) in the process of power generation, and even considering CO_2 emissions over the entire life cycle of various energy sources, those from nuclear power are lower than those from thermal power, and are even lower than those from solar or wind power. However, because of the extended shutdown of nuclear power plants following the Great East Japan Earthquake, and subsequent increase in thermal power generation, the CO_2 emission factor has remained higher than that before the earthquake.

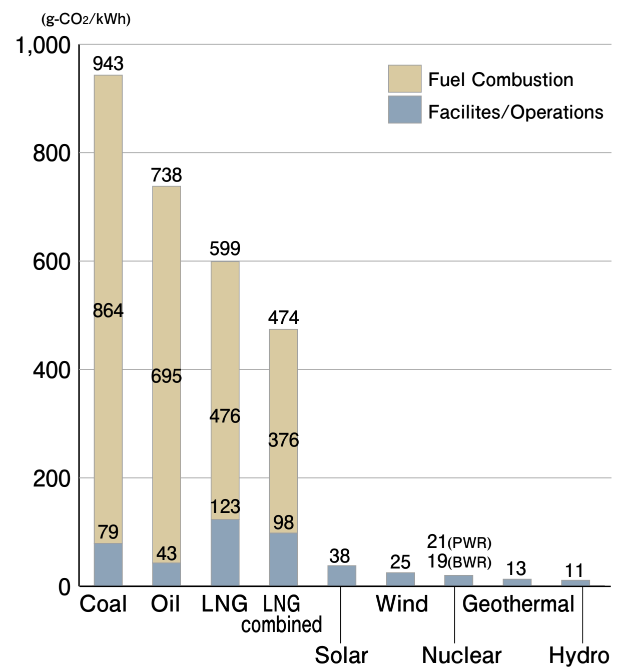
Considering that nuclear power generation will continuously play a key role in combating global warming, the industry is committed to making the utmost effort to improve the safety of nuclear power generation and to restore the trust of citizens.

The electric power companies are also striving to maintain and improve the efficiency of thermal power plants through the introduction of highly efficient plants of the latest design or through appropriate operation and maintenance of the existing plants.

Currently operating state-of-the-art gas turbine combined cycle power plants have achieved the world's highest level of 61% in thermal efficiency, by, for example, raising the combustion temperature at the gas turbines.

As to the conventional coal-fired power plants, the adoption of enhanced steam conditions (temperature and pressure) is being promoted to improve thermal efficiency. Presently, ultra-supercritical (USC) thermal power generation with the main steam temperature of 600°C is commercially available. Moreover, research and development of the Integrated coal Gasification Combined Cycle (IGCC) are being conducted, in which gasified coal will be used in combination with gas turbines and steam turbines to generate electricity.

CO_2 Emissions Intensity over the Entire Lifecycle by Source

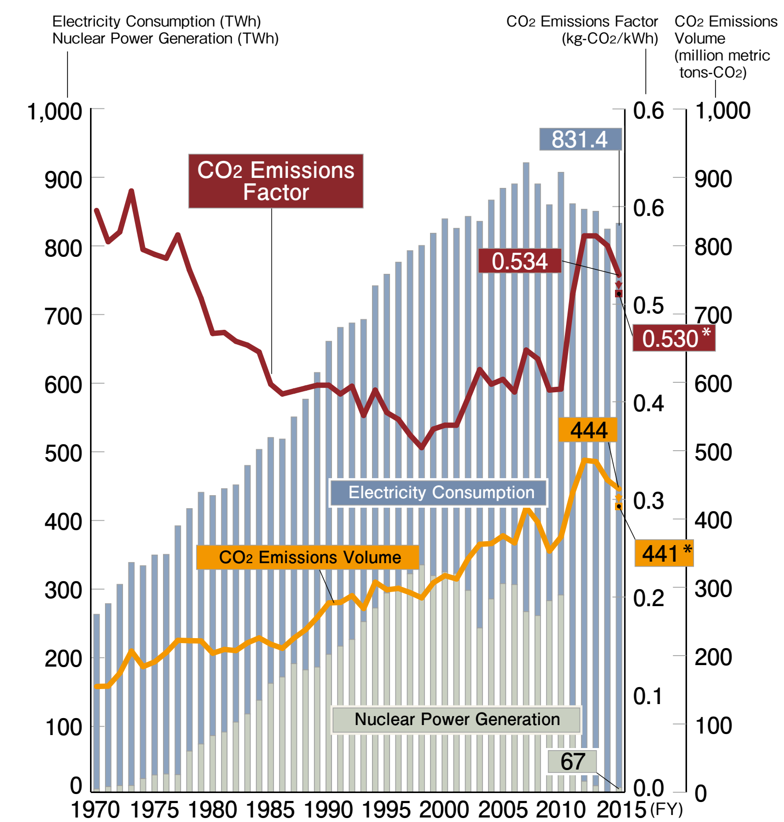


Note: (1) Based on total CO_2 emissions from all energy consumed in energy extraction, transportation, refining, plant operation and maintenance, etc. in addition to burning of the fuel.
(2) Data for nuclear power: 1) includes spent fuel reprocessing in Japan (under development), MOX fuel use in thermal reactors (assuming recycling once) and disposal of high level radioactive waste, and 2) is based on the capacity-weighted average of CO_2 emissions intensities of existing BWR and PWR plants in Japan, which are 19g-CO_2/kWh and 21g-CO_2/kWh respectively.

Source: Report of the Central Research Institute of Electric Power Industry, etc.

Historical Trends in CO_2 Emissions from Power Generation

(excluding self-generators)



Note: Data in 1970 and 2013 is based on ten companies.
Data in 2014 and 2015 is based on ELCS members.
The numerical value of "0.530*" and "441*" reflected Kyoto Mechanism credit.

Source: FEPC

Decarbonization of Energy on the Supply-side

Development and expansion of the use of renewable energy sources

Hydroelectric, geothermal, solar, wind, and biomass energy are all clean and renewable, and the electric utilities are striving to develop them.

For example, the electric utilities are developing mega-solar power generation (large-scale photovoltaic power generation plants) in addition to the efforts such as utilizing woody biomass fuel at their existing coal-fired power plants. We are planning to build megasolar power plants with a total capacity of about 140 MW at around 30 sites throughout the country, and in fiscal 2015, the total capacity of megasolar power plants which had started commercial operation reached 140 MW.

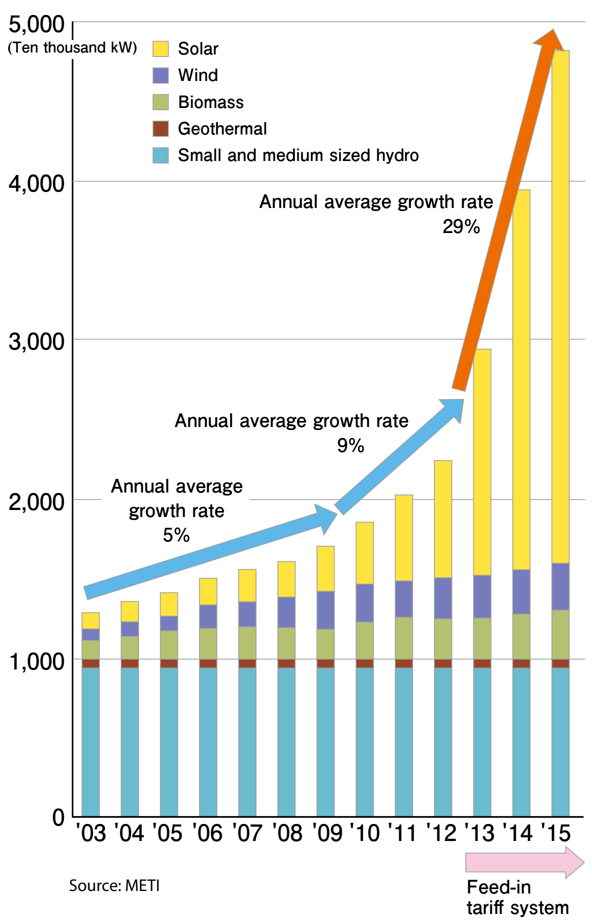
Japanese electric power companies have been purchasing electricity generated from the solar and wind power systems of our customers, and thus renewable energy sources account for about 10% of total electricity.

The feed-in tariff system for renewable energy began in July 2012, whereupon the electric power companies are obliged to buy such electricity at a fixed price for a certain period. The cost of purchasing this electricity is finally borne by customers in the form of a surcharge, which in principle is proportional to the amount of electricity consumed.

Renewable energy such as solar power has problems involving efficiency, cost of power generation and stability of output. R&D on the latest power system control technologies for combining existing power plants and storage batteries will be actively conducted to help stabilize the system, when introducing large amounts of wind and photovoltaic power, which are susceptible to the weather.

Electric utilities will keep striving to develop and improve renewable energy sources.

Introduction amount of Generating Capacity (Renewable energy)



Source: METI

Mikuni Solar Power Station

Wind Power

Sharing Japan's Top-level Environmental Technologies with the World

As a result of taking various environmental measures at thermal power plants, Japan has achieved the world's top-level energy efficiency. Based on this achievement, the electric utility industry in Japan has been making efforts to establish a mechanism for sharing such advanced technologies with electric power industries in other countries (see the column).

With high-efficiency plants to be introduced and the improvement of operation and maintenance technologies, coal-fired plants' CO_2 reduction potential in OECD countries and developing countries in Asia in FY 2030 is estimated to be a maximum of 900 million t- CO_2/year. The electric utility industry of Japan will contribute to the reduction of global CO_2 emissions with Japan's expertise and advanced technologies.

Column

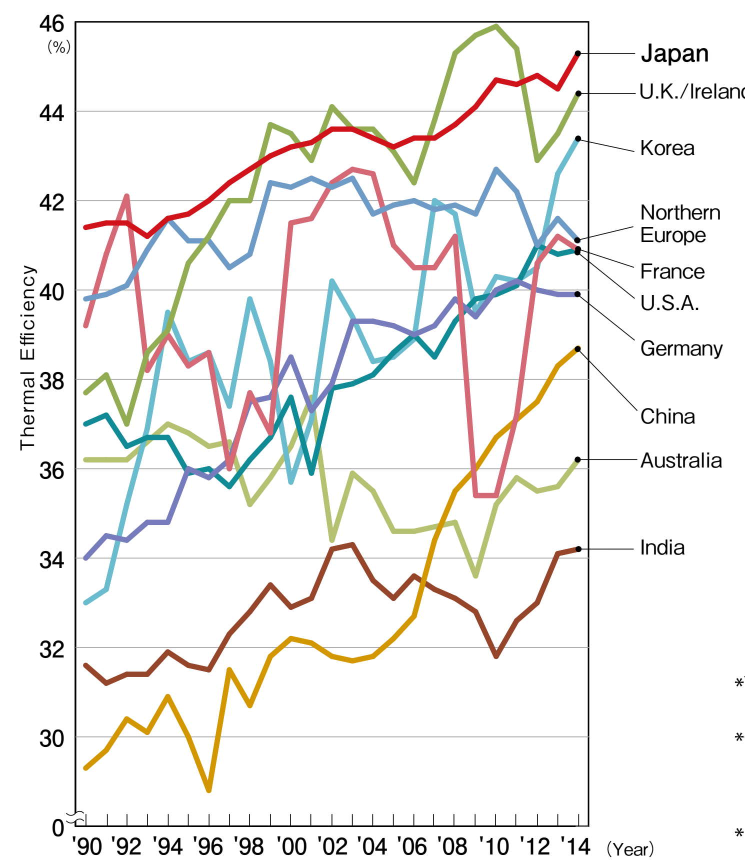
Peer Review Activities by the GSEP

In July 2015, the fourth workshop (WS) was held in Turkey to share the best practices in electricity generation technologies. About 60 participants from Japan, Indonesia, Saudi Arabia and Turkey, etc. joined the meeting for a seminar on electricity generation, distribution and demand management technologies, as well as a Peer Review at a coal-fired thermal power plant (Cayirhan Thermal Power Plant), and actively exchanged views on operation and maintenance (O&M).

<Result of the review>

- As a result of check the operating data in detail, the review acknowledged that the temperature of the main steam at the rated output was lower than that of Japanese units of similar specifications.
- Representatives from Japan reported on the reduction of fuel consumption and CO_2 emissions by improving the main steam temperature.

Comparison of Thermal Power Plant Efficiency in Japan and Other Countries



*Thermal efficiency is the gross generating efficiency based on the weighted averages of efficiencies for coal, petroleum and gas (low heat value standard).

*Comparisons are made after converting Japanese data (higher heating value standard) to lower heating value standard, which is generally used overseas. The figures based on lower heating value are around 5-10% higher than the figures based on higher heating value.

*Private power generation facilities, etc. not covered.

Source: ECOFYS 「INTERNATIONAL COMPARISON OF FOSSIL POWER EFFICIENCY AND CO_2 INTENSITY 2016」

Demand-side Efforts for CO_2 Reduction

In Japan, the energy demand for water heating constitutes about 30% of the total energy demand in the household sector, and so energy-saving and CO_2 reduction measures in this area are very important. Electric power companies have been working hard to develop and promote electric appliances and systems to reduce CO_2 emissions. One example is EcoCute, a water heating system with a heat pump that uses CO_2 as refrigerant.

EcoCute heats water by transferring the thermal energy in air, which is freely available, to water by means of refrigerants. With a single unit of electric energy for heat pump operation and two units of thermal energy from air, it produces three units of thermal energy.

Thanks to this principle, CO_2 emissions are cut by over 66% compared with conventional combustion type water heaters. Because of this advantage, the government and industry are jointly promoting the use of heat pump systems as a key means of preventing global warming in the consumer sector (household and commercial sectors).

If boilers fulfilling thermal demand in the consumer and industrial sectors are replaced with these heat pump systems, CO_2 emissions in 2030 are estimated to be 48.3 million t- CO_2/year less than the 2012 level, which is about 3.5% of the total CO_2 emissions in fiscal 2012.

Column

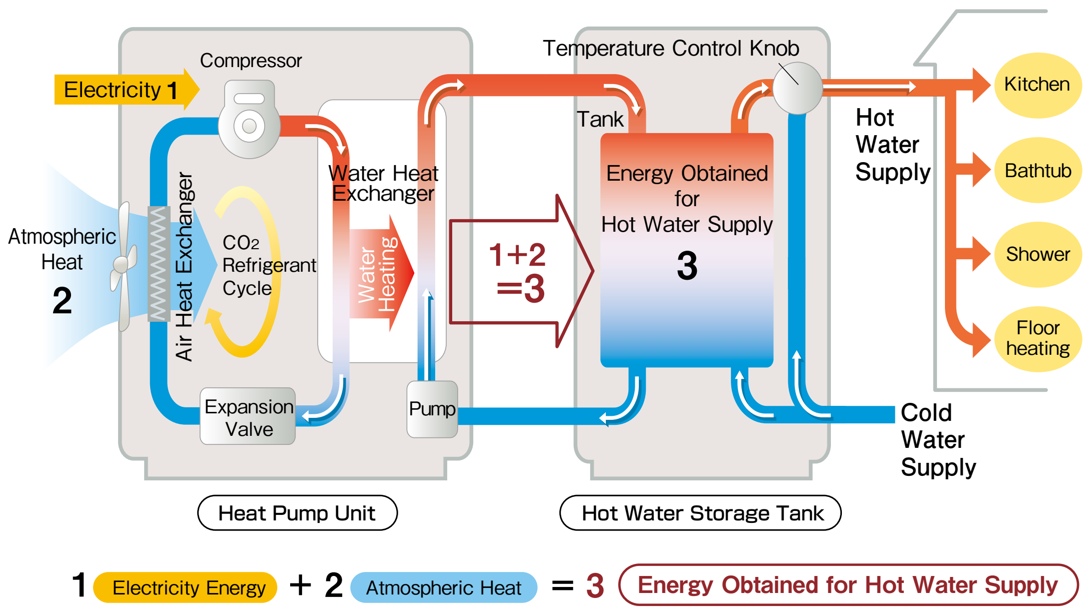
Deployment of Electric Vehicle

The electric power companies of Japan have been working hard to achieve full-scale commercialization of environmentally-efficient electric vehicles, such as conducting driving tests and jointly developing new fast battery chargers with automobile manufacturers. Also, efforts are being made to increase the use of electric vehicles and plug-in hybrid vehicles as commercial vehicles.

Electric Vehicle
(Mitsubishi Motors Corporation, i MiEV)

Fast Battery Charger

EcoCute Hot Water Supply Structure: CO_2 Refrigerant Heat Pump Hot Water Heater



EcoCute Heat Pump Unit (left) and Hot Water Storage Tank

Strengthening International Communication and Cooperation

Japan's electric power companies remain active on a worldwide basis. In order to cope with global warming and to ensure the safety of nuclear power generation, international cooperation is indispensable. Each of the electric power companies in Japan has individual agreements with overseas utilities in order to facilitate exchanges on a wide range of information such as power generation, customer relations, distribution and quality control. The industry's top executives actively participate in international meetings such as the International Electricity Summit and the World Association of Nuclear Operators (WANO) to exchange views, while we also accept trainees from overseas. We import most of our fuel such as oil and coal from overseas countries and also keep our doors open to foreign companies for the purchase of equipment such as generators.

Overseas Offices

Please feel free to contact your nearest office.

WASHINGTON, D.C.

The Federation of Electric Power Companies of Japan, Washington Office

The Federation's Washington Office was established in January 1994. Its principal objectives are to study U.S. energy policies and to exchange information with U.S. energy opinion leaders in order to promote a greater understanding of the Japanese electric power industry.

1707 L Street, N.W., Suite 670, Washington, D.C. 20036, U.S.A.
Tel: (202) 466-6781 Fax: (202) 466-6758
Established in 1994

Tokyo Electric Power Company Holdings, Inc., Washington Office
2121 K Street, NW Suite 910, Washington, DC 20037
Tel: (202) 457-0790 Fax: (202) 457-0810
Established in 1978

Chubu Electric Power Co., Inc., Washington Office
900 17th Street, N.W., Suite 1220, Washington, D.C. 20006, U.S.A.
Tel: (202) 775-1960 Fax: (202) 331-9256
Established in 1982

LONDON

Tokyo Electric Power Co., Inc., London Office
Berkeley Square House, Berkeley Square, London W1J 6BR, U.K.
Tel: (020) 7629-5271 Fax: (020) 7629-5282
Established in 1982

Chubu Electric Power Co., Inc., London Office
Nightingale House, 65 Curzon Street, London W1J8PE, U.K.
Tel: (020) 7409-0142 Fax: (020) 7408-0801
Established in 1985

PARIS

The Kansai Electric Power Co., Inc., Paris Office
3, rue Scribe, Paris 75009, FRANCE
Tel: (01) 43 12 81 40 Fax: (01) 43 12 81 44
Established in 2008

DOHA

Chubu Elecric Power Co., Inc., Doha Office
4th Floor, Salam Tower, Al Corniche P.O.Box 22470, Doha-QATAR
Tel: (974) 4836-830 Fax: (974) 4834-841
Established in 2007

BEIJING

Tokyo Electric Power Co., Inc., Beijing Office
Unit 4, Level 8, Tower E3, Oriental Plaza,
No.1 East Chang An Avenue, Dong Cheng District, Beijing 100738, China
Tel: (10) 8518-7771
Established in 2011

Major Power Plants

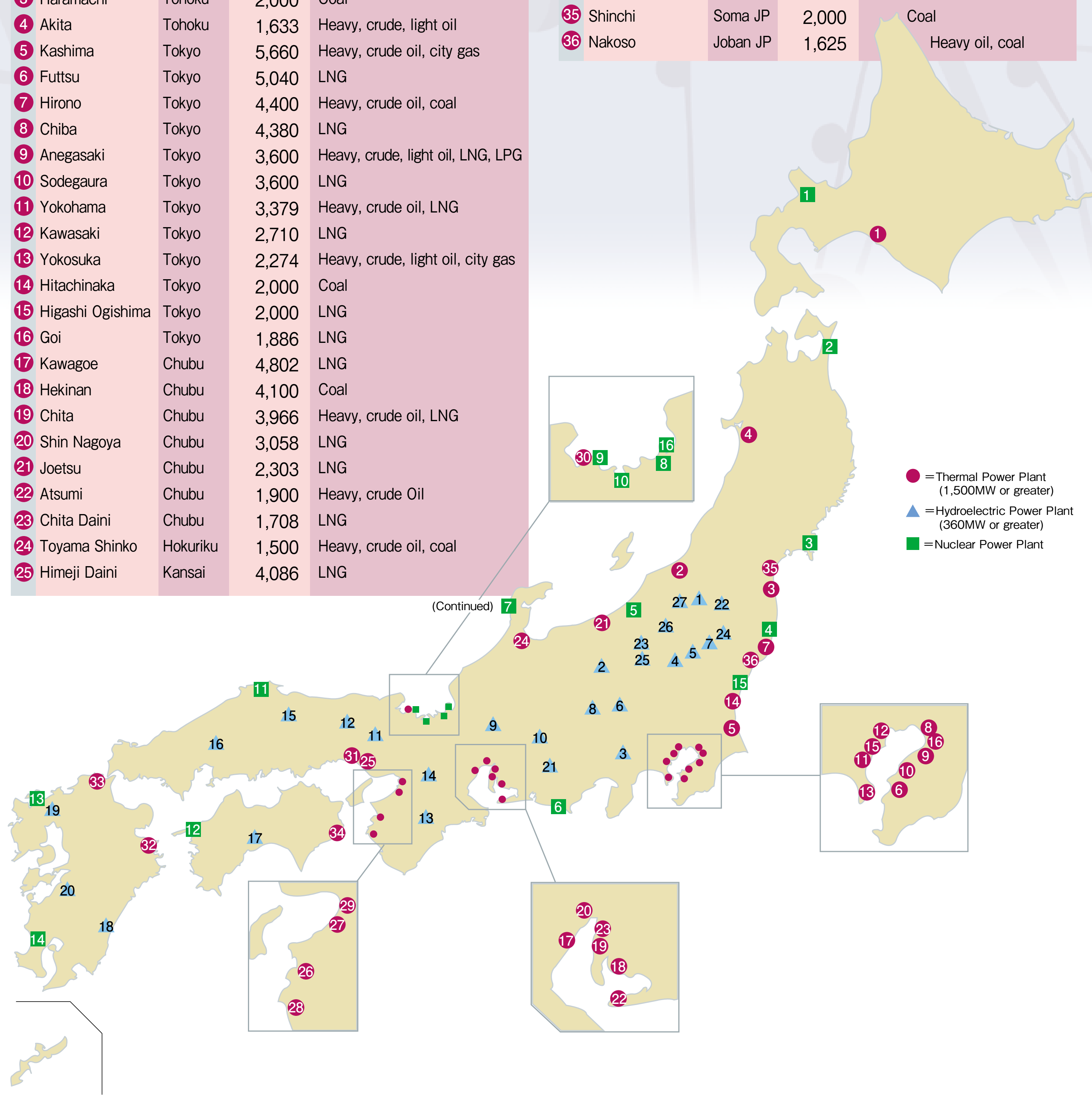
Japan's electric power industry operates some 1,800 hydroelectric, thermal, nuclear, and other power plants to meet the required demand. Here is a list and map of the country's major power plants:

Principal Thermal Power Plants (1,500MW or greater)

As of March 31, 2016

	Name of Plant	Company	Installed Capacity (MW)	Fuel
1	Tomato-atsuma	Hokkaido	1,650	Coal
2	Higashi Niigata	Tohoku	5,149	LNG, heavy, crude oil, city gas
3	Haramachi	Tohoku	2,000	Coal
4	Akita	Tohoku	1,633	Heavy, crude, light oil
5	Kashima	Tokyo	5,660	Heavy, crude oil, city gas
6	Futtsu	Tokyo	5,040	LNG
7	Hirono	Tokyo	4,400	Heavy, crude oil, coal
8	Chiba	Tokyo	4,380	LNG
9	Anegasaki	Tokyo	3,600	Heavy, crude, light oil, LNG, LPG
10	Sodegaura	Tokyo	3,600	LNG
11	Yokohama	Tokyo	3,379	Heavy, crude oil, LNG
12	Kawasaki	Tokyo	2,710	LNG
13	Yokosuka	Tokyo	2,274	Heavy, crude, light oil, city gas
14	Hitachinaka	Tokyo	2,000	Coal
15	Higashi Ogishima	Tokyo	2,000	LNG
16	Goi	Tokyo	1,886	LNG
17	Kawagoe	Chubu	4,802	LNG
18	Hekinan	Chubu	4,100	Coal
19	Chita	Chubu	3,966	Heavy, crude oil, LNG
20	Shin Nagoya	Chubu	3,058	LNG
21	Joetsu	Chubu	2,303	LNG
22	Atsumi	Chubu	1,900	Heavy, crude Oil
23	Chita Daini	Chubu	1,708	LNG
24	Toyama Shinko	Hokuriku	1,500	Heavy, crude oil, coal
25	Himeji Daini	Kansai	4,086	LNG
26	Kainan	Kansai	2,100	Heavy, crude oil
27	Sakaiko	Kansai	2,000	LNG
28	Gobo	Kansai	1,800	Heavy, crude oil
29	Nanko	Kansai	1,800	LNG
30	Maizuru	Kansai	1,800	Coal
31	Himeji Daiichi	Kansai	1,507.4	LNG
32	Shin Oita	Kyushu	2,295	LNG
33	Shin Kokura	Kyushu	1,800	LNG
34	Tachibanawan	J-Power	2,100	Coal
35	Shinchi	Soma JP	2,000	Coal
36	Nakoso	Joban JP	1,625	Heavy oil, coal

(Continued)



Nuclear Power Plants

● In Operation

As of March 31, 2016

	Name of Plant	Unit Number	Company	Installed Capacity (MW)	Type of Reactor	Start
1	Tomari	1	Hokkaido	579	PWR	1989.6
		2		579	PWR	1991.4
		3		912	PWR	2009.12
2	Higashi-Dori	1	Tohoku	1,100	BWR	2005.12
3	Onagawa	1	Tohoku	524	BWR	1984.6
		2		825	BWR	1995.7
		3		825	BWR	2002.1
4	Fukushima Daini	1	Tokyo	1,100	BWR	1982.4
		2		1,100	BWR	1984.2
		3		1,100	BWR	1985.6
		4		1,100	BWR	1987.8
5	Kashiwazaki Kariwa	1	Tokyo	1,100	BWR	1985.9
		2		1,100	BWR	1990.9
		3		1,100	BWR	1993.8
		4		1,100	BWR	1994.8
		5		1,100	BWR	1990.4
		6		1,356	ABWR	1996.11
		7		1,356	ABWR	1997.7
6	Hamaoka	3	Chubu	1,100	BWR	1987.8
		4		1,137	BWR	1993.9
		5		1,380	ABWR	2005.1
7	Shika	1	Hokuriku	540	BWR	1993.7
		2		1,206	ABWR	2006.3
8	Mihama	3	Kansai	826	PWR	1976.12
9	Takahama	1	Kansai	826	PWR	1974.11
		2		826	PWR	1975.11
		3		870	PWR	1985.1
		4		870	PWR	1985.6
10	Ohi	1	Kansai	1,175	PWR	1979.3
		2		1,175	PWR	1979.12
		3		1,180	PWR	1991.12
		4		1,180	PWR	1993.2
11	Shimane	2	Chugoku	820	BWR	1989.2
12	Ikata	2	Shikoku	566	PWR	1982.3
		3		890	PWR	1994.12
13	Genkai	2	Kyushu	559	PWR	1981.3
		3		1,180	PWR	1994.3
		4		1,180	PWR	1997.7
14	Sendai	1	Kyushu	890	PWR	1984.7
		2		890	PWR	1985.11
15	Tokai Daini		Japan Atomic Power Co.	1,100	BWR	1978.11
16	Tsuruga	2	Japan Atomic Power Co.	1,160	PWR	1987.2
	Total	42 Units		41,482MW		

● Under Construction (Estimated start)

Name of Plant	Unit Number	Company	Installed Capacity (MW)	Type of Reactor	Start
Higashi-Dori	1	Tokyo	1,385	ABWR	U.D
Shimane	3	Chugoku	1,373	ABWR	U.D
Ohma		J-Power	1,383	ABWR	U.D
Total	3 Units		4,141MW		

● Preparing for Construction (Estimated start)

Name of Plant	Unit Number	Company	Installed Capacity (MW)	Type of Reactor	Start
Higashi-Dori	2	Tohoku	1,385	ABWR	U.D
Higashi-Dori	2	Tokyo	1,385	ABWR	U.D
Hamaoka	6	Chubu	1,400	ABWR	U.D
Kaminoseki	1	Chugoku	1,373	ABWR	U.D
	2		1,373	ABWR	U.D
Sendai	3	Kyushu	1,590	APWR	U.D
Tsuruga	3	Japan Atomic Power Co.	1,538	APWR	U.D
	4		1,538	APWR	U.D
Total	8 Units		11,582MW		

Principal Hydroelectric Power Plants (360MW or greater)

As of March 31, 2016

	Name of Plant	Company	Installed Capacity (MW)	Type
1	Daini Numazawa	Tohoku	460	Pumped Storage
2	Shin Takasegawa	Tokyo	1,280	Pumped Storage
3	Kazunogawa	Tokyo	1,200	Pumped Storage
4	Tamahara	Tokyo	1,200	Pumped Storage
5	Imaichi	Tokyo	1,050	Pumped Storage
6	Kannagawa	Tokyo	940	Pumped Storage
7	Shiobara	Tokyo	900	Pumped Storage
8	Azumi	Tokyo	623	Pumped Storage
9	Okumino	Chubu	1,500	Pumped Storage
10	Okuyahagi Daini	Chubu	780	Pumped Storage
11	Okutataragi	Kansai	1,932	Pumped Storage
12	Okawachi	Kansai	1,280	Pumped Storage
13	Okuyoshino	Kansai	1,206	Pumped Storage
14	Kisenyama	Kansai	466	Pumped Storage
15	Matanogawa	Chugoku	1,200	Pumped Storage
16	Nabara	Chugoku	620	Pumped Storage
17	Hongawa	Shikoku	615	Pumped Storage
18	Omarugawa	Kyushu	1,200	Pumped Storage
19	Tenzan	Kyushu	600	Pumped Storage
20	Ohira	Kyushu	500	Pumped Storage
21	Shin Toyone	J-Power	1,125	Pumped Storage
22	Shimogo	J-Power	1,000	Pumped Storage
23	Okukiyotsu	J-Power	1,000	Pumped Storage
24	Numappara	J-Power	675	Pumped Storage
25	Okukiyotsu Daini	J-Power	600	Pumped Storage
26	Okutadami	J-Power	560	
27	Tagokura	J-Power	400	

● End of Operation (End)

Name of Plant	Unit Number	Company	Installed Capacity (MW)	Type of Reactor	End
Fukushima Daiichi	1	Tokyo	460	BWR	2012.4
	2		784	BWR	2012.4
	3		784	BWR	2012.4
	4		784	BWR	2012.4
	5		784	BWR	2014.1
	6		1,100	BWR	2014.1
Hamaoka	1	Chubu	540	BWR	2009.1
	2		840	BWR	2009.1
Mihama	1	Kansai	340	PWR	2015.3
	2		500	PWR	2015.3
Shimane	1	Chugoku	460	BWR	2015.3
Ikata	1	Shikoku	566	PWR	2016.3
Genkai	1	Kyushu	559	PWR	2015.3
Tokai		Japan Atomic Power Co.	166	GCR	1998.3
Tsuruga	1	Japan Atomic Power Co.	357	BWR	2015.3
Total	15 Units		9,024MW		

● Others

Name of Plant	Company	Installed Capacity (MW)	Type of Reactor
Fugen	Japan Atomic Energy Agency	165	ATR(Prototype) End of Operation
Monju	Japan Atomic Energy Agency	280	FBR(Prototype)

Note: PWR=Pressurized Water Reactor, BWR=Boiling Water Reactor, APWR=Advanced Pressurized Water Reactor, ABWR=Advanced Boiling Water Reactor, GCR=Gas Cooled Reactor, ATR=Advanced Thermal Reactor, FBR=Fast Breeder Reactor

The Federation of Electric Power Companies

Electricity supply in Japan is carried out by privately-owned independent regional electric power companies and close cooperation among these companies is essential for efficient operations. In 1952, the nine electric power companies established the Federation of Electric Power Companies (FEPC) to promote smooth operations within the industry. Since then, FEPC has played an important role as a base for close communication between the electric power companies and as a forum for exchanging views to create the electric power industry of the future. Moreover, FEPC undertakes various activities to ensure stable operations of the electric power industry, with an awareness of its role in the energy industry of Japan.

With the return of Okinawa to Japan in 1972, the Okinawa Electric Power Company rejoined Japan's electric power industry, becoming an FEPC member in March 2000.

Board of Directors

Chairman
Satoru Katsuno

Vice Chairman
Michiaki Uriu

Vice Chairman
Akihiko Mayumi

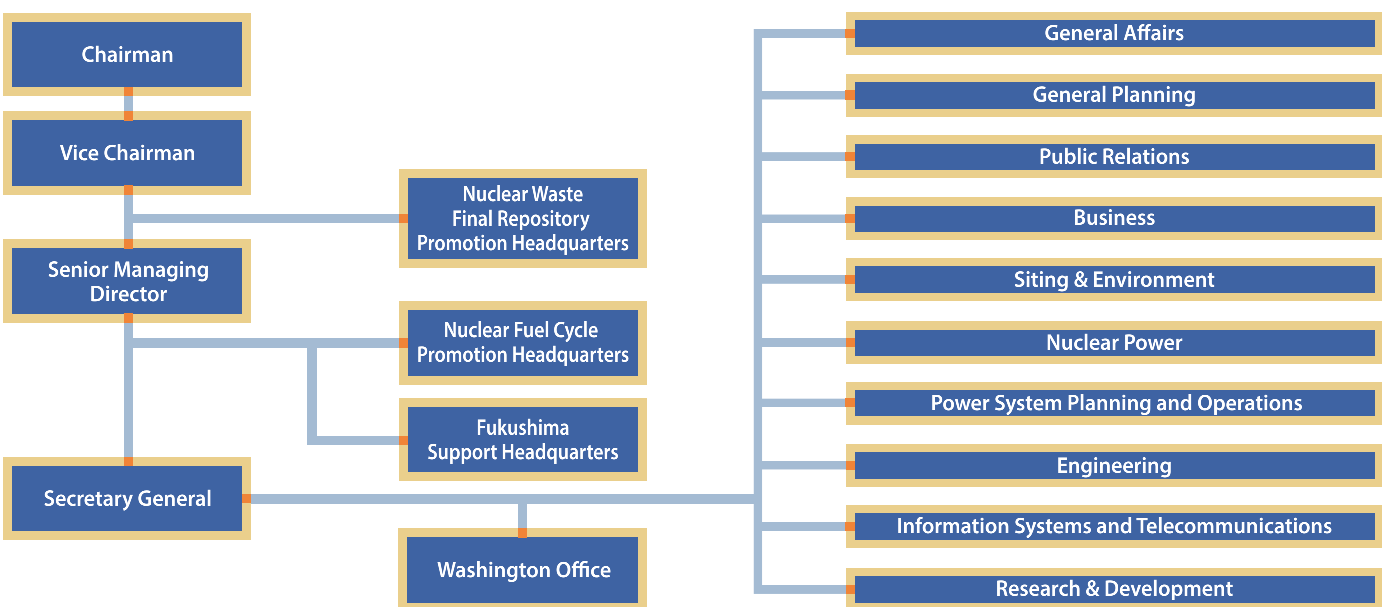
Vice Chairman
Head of Nuclear Waste Final Repository Promotion Headquarters
Yuzuru Hiroe

Senior Managing Director
Head of Fukushima Support Headquarters
Satoshi Onoda

Director
Secretary General
Hirohisa Yashiro

Director
Deputy Secretary General
Yoshihiro Tomioka

Organization of FEPC



contents

Company Data (Fiscal year ending March 31, 2016)

Company	Capital Stock (Million yen)	Total Assets (Million yen)	Generating Capacity (MW)	Electricity Supplied (GWh)	Electricity Sales (GWh)	Revenues from Electricity Sales (Million yen)	Number of Employees
Hokkaido	114,291	1,765,091	7,957	31,900	28,592	695,219	5,680
Tohoku	251,441	3,841,884	17,956	82,209	75,057	1,857,249	12,542
Tokyo	1,400,975	13,189,615	66,802	265,591	247,075	5,791,368	33,463
Chubu	430,777	5,065,581	33,168	131,869	121,967	2,572,453	17,525
Hokuriku	117,641	1,458,977	8,074	30,372	27,518	493,043	4,869
Kansai	489,320	6,433,093	36,573	138,054	127,516	2,806,454	21,164
Chugoku	185,527	2,840,161	11,536	61,778	56,719	1,116,837	9,637
Shikoku	145,551	1,348,660	6,617	28,193	25,754	575,416	5,760
Kyushu	237,304	4,321,442	18,701	85,488	79,210	1,692,316	13,111
Okinawa	7,586	384,459	2,155	8,581	7,649	173,211	1,606
Total	**3,380,413**	**40,648,963**	**209,537**	**864,036**	**797,057**	**17,773,566**	**125,357**

Source: Handbook of Electric Power Industry

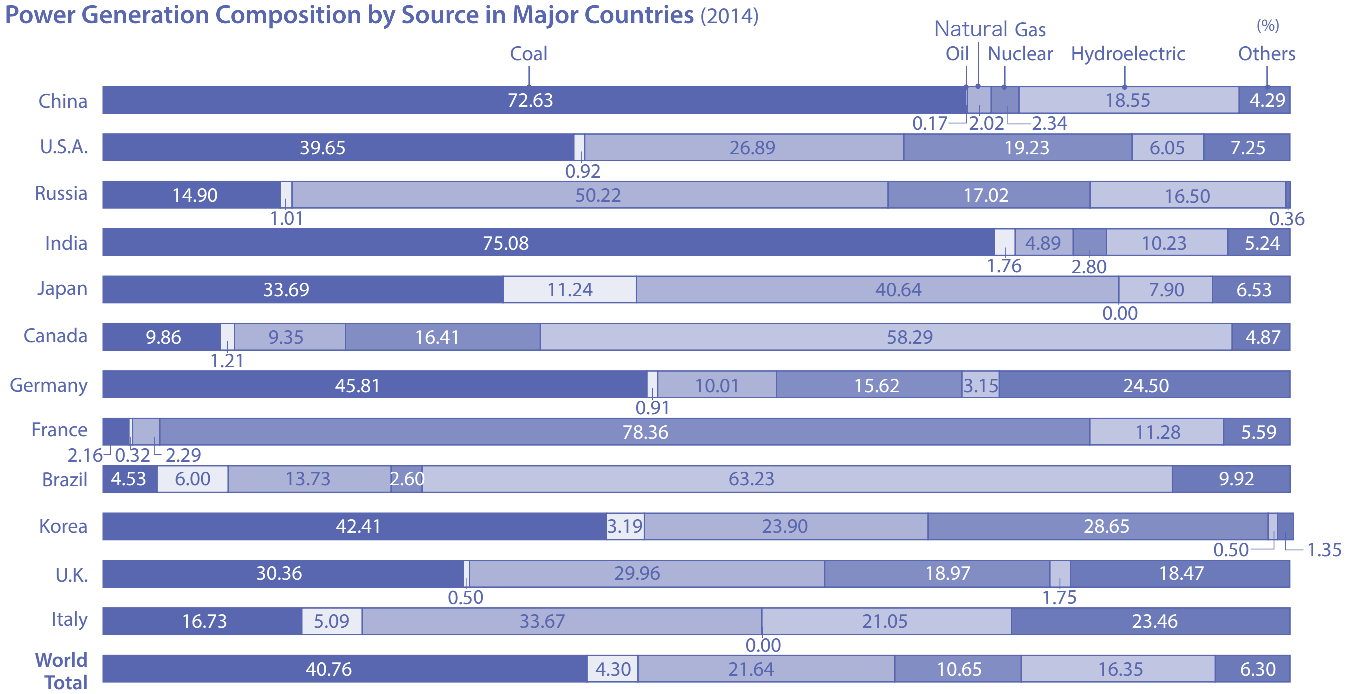
Changes in Electric Power Generation

(TWh)

Fiscal Year		1990	1995	2000	2005	2010	2013	2014	2015
Ten Companies	Hydro	65.4	62.3	66.5	60.0	62.9	58.9	60.6	63.9
	Thermal	392.0	401.1	426.4	459.3	485.4	673.0	649.2	603.8
	Geothermal	1.4	2.8	3.0	2.9	2.4	2.4	2.4	2.4
	Nuclear	181.1	271.4	302.5	287.0	271.3	9.3	0.0	9.4
Subtotal		639.9	737.6	798.4	809.2	822.0	743.7	712.3	679.7
Industry-Owned and Others		217.4	252.3	293.1	348.7	334.9	346.8	341.4	344.4
Total		**857.3**	**989.9**	**1,091.5**	**1,157.9**	**1,156.9**	**1,090.5**	**1,053.7**	**1,024.1**

Source: Handbook of Electric Power Industry

Power Generation Composition by Source in Major Countries (2014)



Sources: World energy balances 2016 Edition

Changes in Electricity Sales for Ten Companies

(TWh)

Fiscal Year	1990	1995	2000	2005	2010	2013	2014	2015
Residential (Lighting)	177.4	224.6	254.6	281.3	304.2	284.3	273.1	266.9
Commercial and Industrial	481.5	532.3	583.3	601.2	602.2	564.2	549.9	530.2
Commercial	116.3	152.8	157.9	—	—	—	—	—
Low Voltage	100.1	108.0	115.8	39.4	35.5	31.7	29.9	29.0
Large Industrial	248.1	254.7	74.8	—	—	—	—	—
Others	17.0	16.8	15.0	13.4	12.0	11.1	10.6	10.1
Eligible Customers' Use	—	—	219.8	548.4	554.7	521.4	509.4	491.1
Total	**658.9**	**757.0**	**837.9**	**882.5**	**906.4**	**848.5**	**823.0**	**797.1**

Source: Handbook of Electric Power Industry

Changes in Electricity Sales for Ten Companies (to large industrial and commercial customers)

(TWh)

Fiscal Year		1990	1995	2000	2005	2010	2013	2014	2015
Mining and Industry	Mining	1.5	1.4	1.3	1.0	0.9	0.9	1.0	0.9
	Foodstuffs	11.3	13.2	15.3	15.4	17.7	17.9	17.8	17.9
	Textiles	6.8	5.1	3.9	3.1	4.5	4.0	4.0	3.8
	Pulp and Paper	11.9	9.5	10.5	10.3	9.9	8.5	8.1	7.5
	Chemicals	27.4	25.4	25.9	27.7	27.9	26.4	26.1	25.3
	Oil and Coal Products	2.4	2.6	1.5	1.5	2.1	2.2	2.3	2.2
	Rubber	3.5	3.4	3.5	3.4	3.1	2.9	2.9	2.7
	Clay and Stone	15.0	14.4	11.9	11.0	11.5	10.7	10.4	9.9
	Iron and Steel	41.3	38.3	36.5	36.2	36.3	37.3	36.6	34.1
	Non-ferrous Metals	12.3	13.1	14.2	14.1	16.0	14.3	14.6	14.4
	Machinery	57.3	62.9	69.8	74.0	74.0	68.8	68.5	67.3
	Others	22.1	24.4	27.0	27.6	29.0	27.5	26.9	25.9
Subtotal		212.7	213.8	221.2	225.2	232.9	221.4	219.0	212.0
Railways		16.4	17.9	18.1	19.1	18.1	17.3	17.1	17.2
Others		19.0	23.0	27.7	29.6	29.4	27.8	27.1	26.7
Total		**248.1**	**254.7**	**267.0**	**273.8**	**280.4**	**266.5**	**263.2**	**255.9**

Source: Handbook of Electric Power Industry

Investment by Type of Power Facility for Ten Companies

(Billion yen)

Fiscal Year	2008	2009	2010	2011	2012	2013	2014	2015
Generation	816	771	887	1,100	1,097	1,053	1,099	1,252
Distribution,others	1,308	1,262	1,235	1,023	988	906	916	1.008
Total	**2,124**	**2,034**	**2,123**	**2,123**	**2,086**	**1,960**	**2,016**	**2,260**

Note: Figures rounded down to nearest digit
Source: Handbook of Electric Power Industry

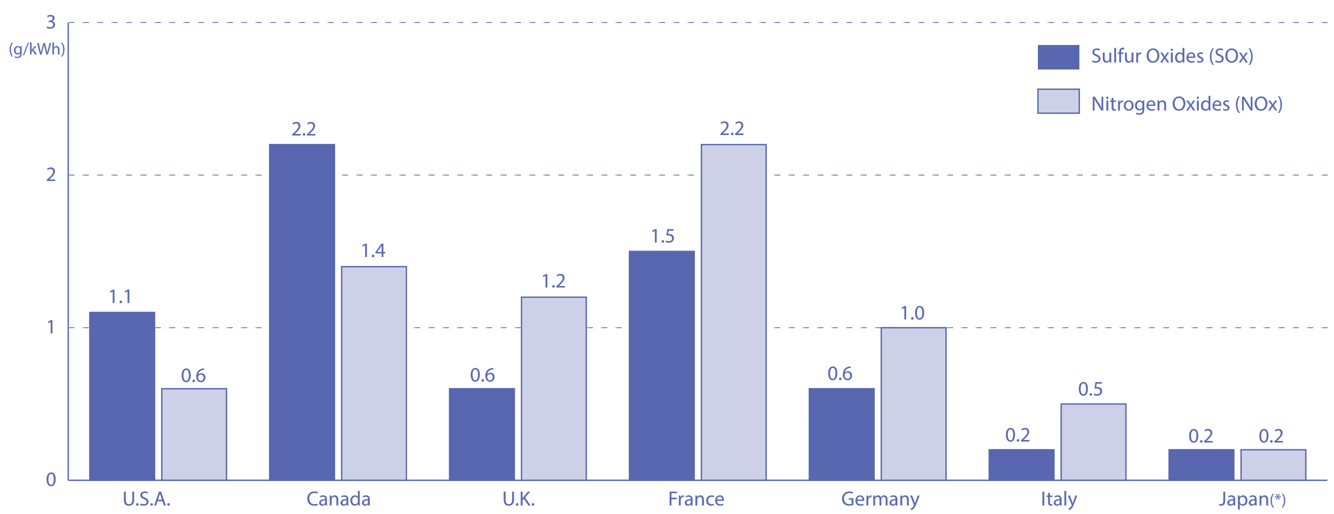
Changes in Electricity Sales* / Consumption** for Major Countries

(TWh)

		2008	2009	2010	2011	2012	2013	2014
U.S.A. (*)All electric utilities	Residential	1,380.7	1,364.8	1,445.7	1,422.8	1,374.5	1,394.8	1,407.2
	Commercial and Industrial	2,345.6	2,224.3	2,301.4	2,319.4	2,312.8	2,322.4	2,349.7
	Others	7.7	7.8	7.7	7.7	7.3	7.6	7.8
	Total	**3,734.0**	**3,596.8**	**3,754.8**	**3,749.8**	**3,694.7**	**3,724.9**	**3,764.7**
U.K. (*)All electric utilities	Residential	119.8	118.5	118.8	111.5	114.2	112.8	107.4
	Commercial and Industrial***	198.1	185.4	191.0	186.6	184.4	184.0	173.8
	Others	14.3	9.9	10.1	9.9	9.9	10.0	10.2
	Total	**329.2**	**313.8**	**319.9**	**308.0**	**308.4**	**306.7**	**291.4**
Germany (**)Electric consumption	Residential	139.5	139.2	141.7	136.9	138.0	136.0	127.3
	Commercial and Industrial	327.7	299.8	326.2	326.1	322.3	321.4	315.0
	Others	71.2	70.3	72.7	72.5	74.0	71.8	69.2
	Total	**538.4**	**509.3**	**540.6**	**535.5**	**534.3**	**529.2**	**511.5**
Canada (**)All electric utilities	Residential	160.0	148.3	146.8	153.0	151.2	157.3	148.3
	Commercial and Industrial	164.7	141.0	149.6	149.7	151.2	149.5	141.0
	Others	168.6	154.9	156.4	160.1	162.7	174.4	154.9
	Total	**493.4**	**444.2**	**452.8**	**462.8**	**465.2**	**481.2**	**444.2**
France (**)Electric consumption	High voltage	263.0	250.8	259.3	248.8	243.6	240.4	234.8
	Low voltage	198.0	202.3	216.9	195.4	209.5	216.7	195.6
	Total	**461.0**	**453.1**	**476.1**	**444.3**	**453.1**	**457.1**	**430.4**
Italy (*)All electric utilities	Residential	68.4	68.7	69.2	69.1	68.3	66.1	63.3
	Commercial and Industrial	218.3	201.7	207.7	209.0	202.5	195.0	192.0
	Others	12.0	11.9	11.9	11.8	11.9	11.2	10.8
	Total	**298.7**	**282.4**	**288.8**	**289.9**	**282.7**	**272.3**	**266.1**
Japan (*)Ten companies	Residential	285.3	285.0	304.2	288.9	286.2	284.3	273.1
	Commercial and Industrial	603.7	573.6	602.2	570.9	565.4	564.2	549.9
	Others	—	—	—	—	—	—	—
	Total	**888.9**	**858.5**	**906.4**	**859.8**	**851.6**	**848.5**	**823.0**

(***) Including public facilities
Source: Overseas Electric Power Industry Statistics (2016)

SOx and NOx Emissions per Unit of Electricity Generated by Thermal Power in Each Country (2014)



Note: (*) = 10 Electric Power Companies + Electric Power Development Company
Sources: OECD "StatExtracts" and IEA "World energy balances 2016 Edition", FEPC

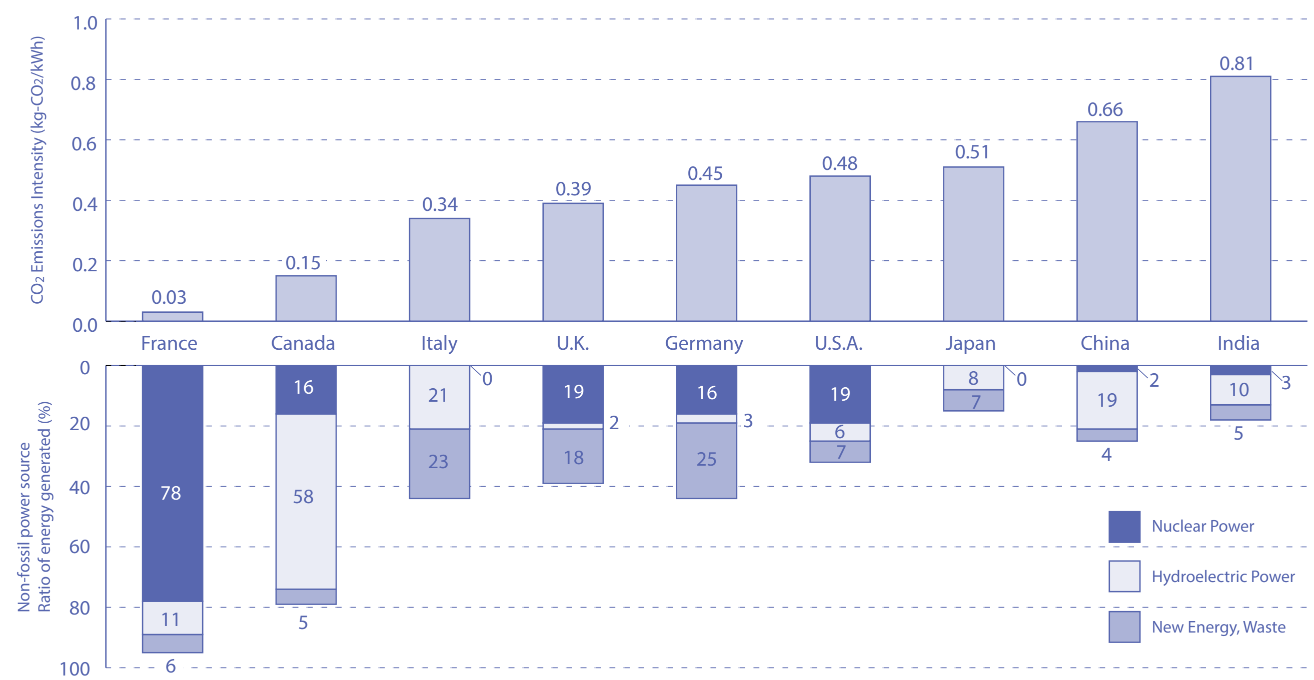
Country Comparison of Thermal Efficiency, Transmission and Distribution Loss, and Annual Load Factor

(%)

		1990	1995	2000	2005	2010	2012	2013
U.S.A.	Thermal Efficiency	37.0	35.9	37.6	38.6	39.9	41.0	40.8
	Transmission and Distribution Loss	5.7	7.0	6.6	6.6	6.4	6.4	6.2
	Annual Load Factor	60.4	59.8	61.2	58.7	59.7	58.6	59.8
U.K. / Ireland	Thermal Efficiency	37.7	40.6	43.5	43.1	45.9	42.9	43.5
	Transmission and Distribution Loss	8.1	8.6	9.0	8.7	7.8	8.5	8.0
	Annual Load Factor	62.2	65.4	67.4	66.3	64.7	66.3	70.8
Germany (Former W. Germany)	Thermal Efficiency	(34.0)	36.0	38.5	39.2	40.0	40.0	39.9
	Transmission and Distribution Loss	(4.3)	5.0	4.7	5.7	5.0	5.4	5.5
	Annual Load Factor	(68.6)	(71.9)	74.5	77.0	69.1	63.0	64.1
Canada	Thermal Efficiency	34.5	32.6	32.9	33.4	—	—	—
	Transmission and Distribution Loss	7.7	6.8	8.0	7.1	10.3	9.0	7.8
	Annual Load Factor	65.7	66.0	68.5	69.2	—	66.4	66.4
France	Thermal Efficiency	39.2	38.3	41.5	41.0	35.4	40.6	41.2
	Transmission and Distribution Loss	7.5	7.4	6.8	6.6	7.2	7.4	7.7
	Annual Load Factor	62.9	67.9	69.5	64.1	60.6	54.7	61.0
Italy	Thermal Efficiency	37.7	38.6	39.0	42.7	—	—	—
	Transmission and Distribution Loss	7.0	6.7	6.4	6.2	6.2	6.4	6.7
	Annual Load Factor	52.4	50.3	59.0	58.4	57.9	60.0	58.3
Japan Ten Companies	Thermal Efficiency	41.4	41.7	43.2	43.2	44.7	44.8	44.5
	Transmission and Distribution Loss	5.7	5.5	5.2	5.1	4.8	4.7	5.0
	Annual Load Factor	56.8	55.3	59.5	62.4	62.5	66.9	65.4

Source: Overseas Electric Power Industry Statistics (2016) , Ecofys[INTERNATIONAL COMPARISON OF FOSSIL POWER EFFICENCY AND CO_2 INTENSITY 2016], Handbook of Electric Power Industry

Comparison of CO_2 Emissions Intensity by Country (2014)



Sources: IEA World energy balances 2016Edition

Business Addresses

The Federation of Electric Power Companies of Japan (FEPC)
Keidanren-kaikan, 1-3-2, Otemachi, Chiyoda-ku, Tokyo 100-8118, Japan
Tel: (03) 5221-1440 URL http://www.fepc.or.jp

Hokkaido Electric Power Co., Inc.
2, Higashi 1-chome, Odori, Chuo-ku, Sapporo, Hokkaido 060-8677, Japan
Tel: (011) 251-1111 URL http://www.hepco.co.jp

Tohoku Electric Power Co., Inc.
1-7-1 Honcho, Aoba-ku, Sendai, Miyagi 980-8550, Japan
Tel: (022) 225-2111 URL http://www.tohoku-epco.co.jp

Tokyo Electric Power Company Holdings, Inc.
1-1-3 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-8560, Japan
Tel: (03) 6373-1111 URL http://www.tepco.co.jp

Chubu Electric Power Co., Inc.
1, Higashi-shincho, Higashi-ku, Nagoya, Aichi 461-8680, Japan
Tel: (052) 951-8211 URL http://www.chuden.co.jp

Hokuriku Electric Power Co., Inc.
15-1, Ushijima-cho, Toyama, Toyama 930-8686, Japan
Tel: (076) 441-2511 URL http://www.rikuden.co.jp

The Kansai Electric Power Co., Inc.
3-6-16, Nakanoshima , Kita-ku, Osaka, Osaka 530-8270, Japan
Tel: (06) 6441-8821 URL http://www.kepco.co.jp

The Chugoku Electric Power Co., Inc.
4-33, Komachi, Naka-ku, Hiroshima, Hiroshima 730-8701, Japan
Tel: (082) 241-0211 URL http://www.energia.co.jp

Shikoku Electric Power Co., Inc.
2-5, Marunouchi, Takamatsu, Kagawa 760-8573, Japan
Tel: (087) 821-5061 URL http://www.yonden.co.jp

Kyushu Electric Power Co., Inc.
1-82, Watanabe-dori 2-chome, Chuo-ku, Fukuoka, Fukuoka 810-8720, Japan
Tel: (092) 761-3031 URL http://www.kyuden.co.jp

The Okinawa Electric Power Co., Inc.
2-1, Makiminato 5-chome, Urasoe, Okinawa 901-2602, Japan
Tel: (098) 877-2341 URL http://www.okiden.co.jp

Electric Power Development Co., LTD. (J-Power)
15-1, Ginza 6-chome, Chuo-ku, Tokyo 104-8165, Japan
Tel: (03) 3546-2211 URL http://www.jpower.co.jp

The Japan Atomic Power Company (JAPC)
1-1,Kanda-Mitoshiro-cho, Chiyoda-ku, Tokyo 101-0053, Japan
Tel: (03) 6371-7400 URL http://www.japc.co.jp

Japan Nuclear Fuel Limited (JNFL)
4-108 Aza Okitsuke, Oaza Obuchi, Rokkasho-mura, Kamikita-gun, Aomori 039-3212, Japan
Tel: (0175) 71-2000 URL http://www.jnfl.co.jp

Japan Atomic Energy Agency (JAEA)
4-49, Muramatsu, Tokai-mura, Naka-gun, Ibaraki 319-1184, Japan
Tel: (029) 282-1122 URL http://www.jaea.go.jp

Central Research Institute of Electric Power Industry (CRIEPI)
6-1, Ohtemachi 1-chome, Chiyoda-ku, Tokyo 100-8126, Japan
Tel: (03) 3201-6601 URL http://criepi.denken.or.jp/

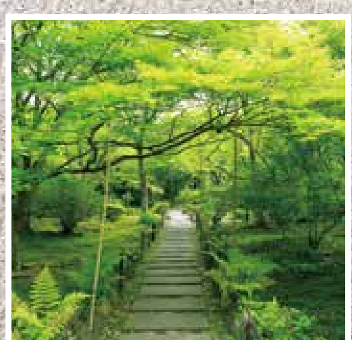
Japan Electric Power Information Center, Inc. (JEPIC)
15-33, Shibaura 4-chome, Minato-ku, Tokyo 108-0023, Japan
Tel: (03) 6361-8210 URL http://www.jepic.or.jp

World Association of Nuclear Operators Tokyo Centre (WANO-TC)
6F Igarashi Bldg., 2-11-5, Shibaura, Minato-ku, Tokyo 108-0023, Japan
Tel: (03) 6722-5900 URL http://www.wano.info

The Federation of
Electric Power Companies of Japan

Keidanren-kaikan,
1-3-2, Otemachi, Chiyoda-ku,
Tokyo 100-8118, Japan

http://www.fepc.or.jp/english/index.html



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