

JAPAN'S ENERGY

10 questions for understanding the current energy situation

1 Energy Security How much energy can Japan supply independently?	2 Economic Efficiency How are electric power rates changing?	3 Environment What is carbon neutrality?	4 Safety What steps are being taken to ensure a stable energy supply and safety?
5 S+3E What is the government's basic energy policy?	6 Innovation What innovations is Japan working on to achieve decarbonization?	7 Renewable Energy Is Japan advancing the introduction of renewable energy?	
8 Reconstruction of Fukushima Is Japan advancing the reconstruction of Fukushima?	9 Nuclear Power Is nuclear power generation necessary?		
10 Energy Efficiency How much energy efficiency has Japan accomplished?			

Issued: **February 2022**



経済産業省
資源エネルギー庁

Ministry of Economy, Trade and Industry
Agency for Natural Resources and Energy



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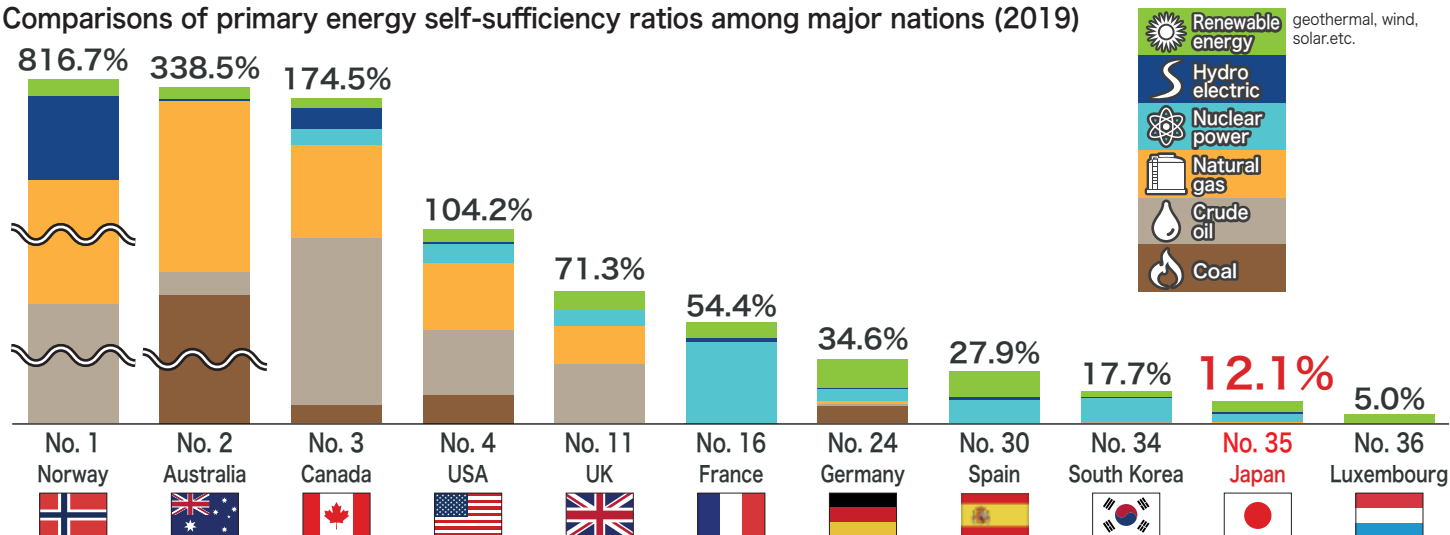
1. Energy Security

Changes in Energy Self-Sufficiency Ratio

Q How much energy can Japan supply independently from domestic resources?

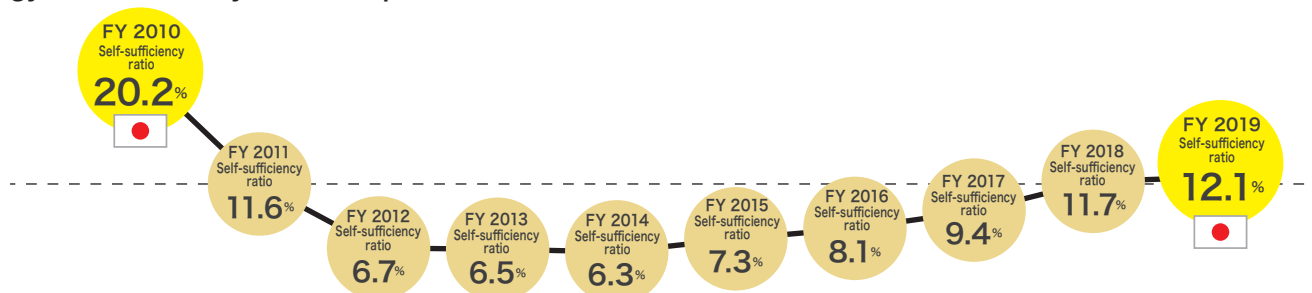
A In FY 2019, Japan's self-sufficiency ratio was 12.1%—lower than other OECD countries.

Comparisons of primary energy self-sufficiency ratios among major nations (2019)



Source: Estimates for 2019 from IEA "World Energy Balances 2020", except for data for Japan, which are confirmed values of FY 2019, derived from "Comprehensive energy statistics of Japan", Agency for Natural Resources and Energy. * The ranks in the table are those of the 36 OECD member countries.

Energy self-sufficiency ratio in Japan



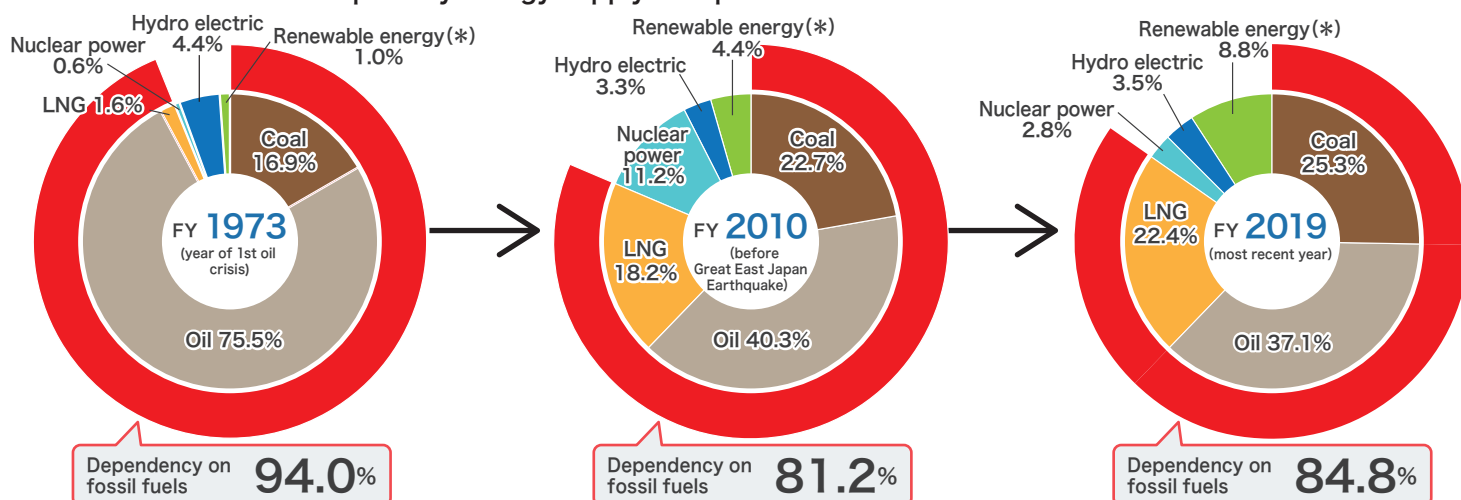
Primary energy sources: Primary forms of energy, including oil, natural gas, coal, nuclear power, solar power, and wind power.

Energy self-sufficiency rate: The percentage of the primary energy resources required for people's daily life and economic activities which can be produced or acquired in their own country.

Q What sources of energy does Japan depend on?

A Japan is largely dependent on oil, coal, natural gas (LNG), and other fossil fuels imported from outside Japan. Following the Great East Japan Earthquake, the degree of dependence on fossil fuels increased to 84.8% in FY 2019 in Japan.

Trends in the mix of the primary energy supply in Japan



Source: confirmed values of FY 2019, derived from "Comprehensive energy statistics of Japan", Agency for Natural Resources and Energy

* The sum of the values shown may not be 100% in some cases due to rounding of values.

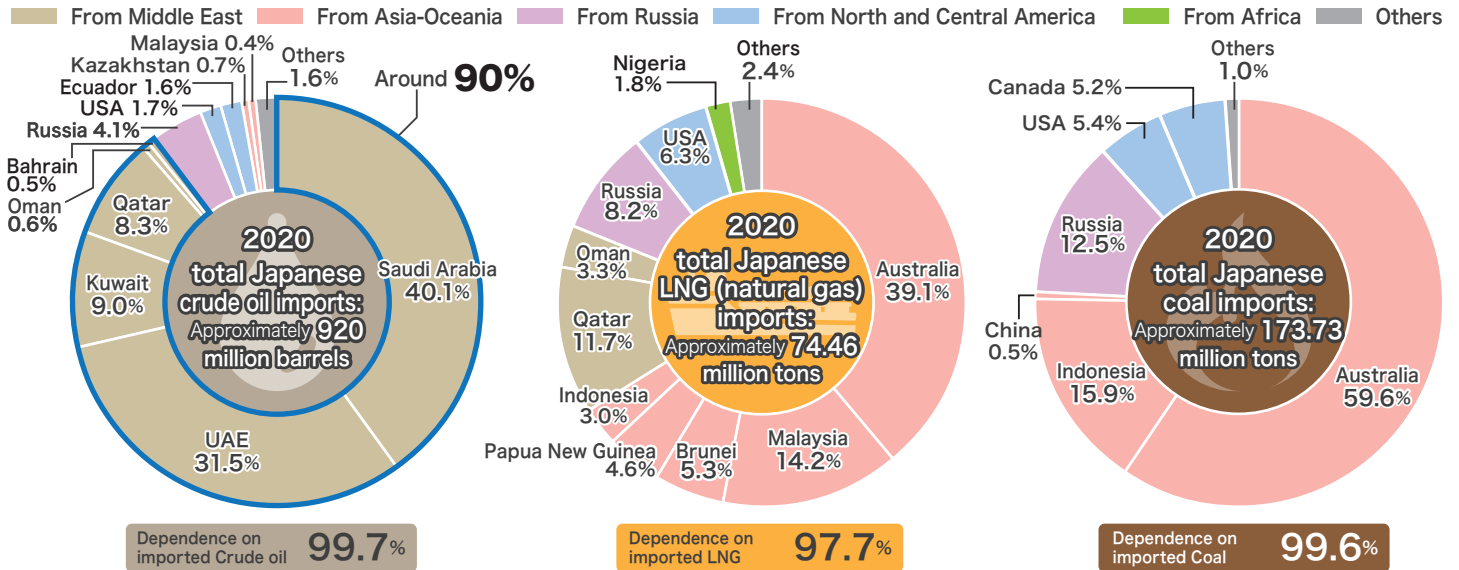
* Renewable energy here, including geothermal power, wind power, and solar power, but not hydroelectric power, includes unused energy.

Resource Procurement Status

Q What countries does Japan import fossil fuels from?

A Japan depends on the Middle East for around 90% of its crude oil imports. For LNG and coal, although dependence on the Middle East is low, Japan still relies on imports from Asia and other overseas sources.

Sources of Japanese fossil fuel imports (2020)



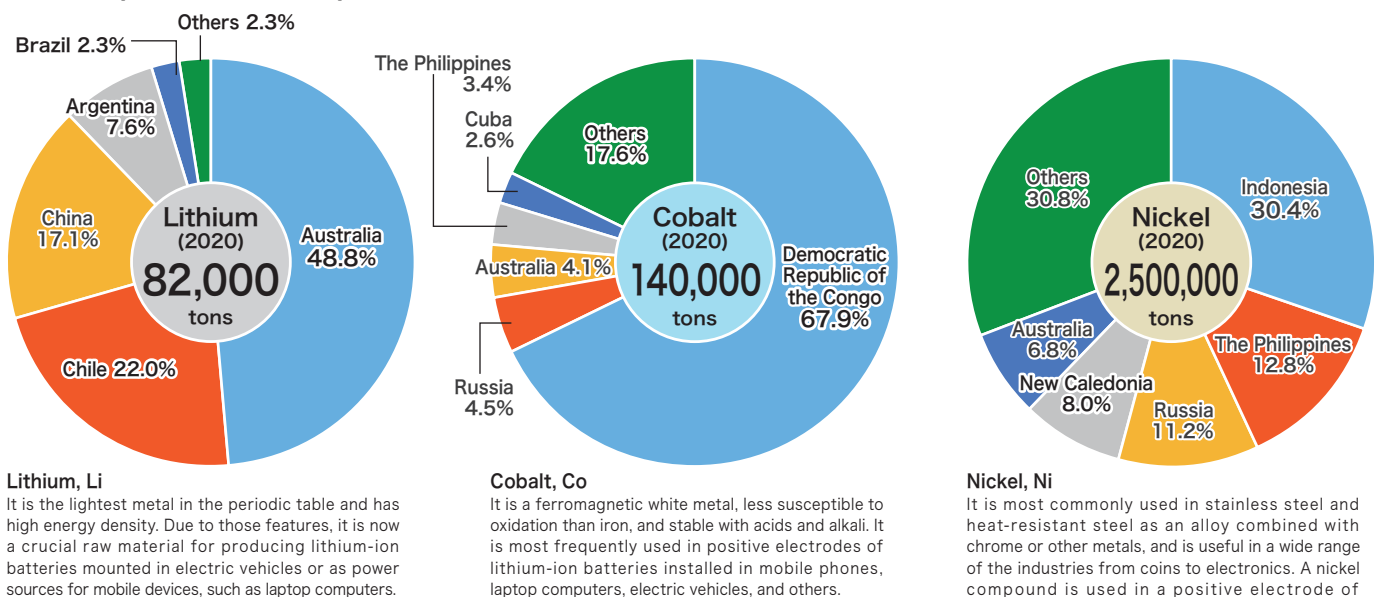
Source: "Trade statistics of Japan", Ministry of Finance (The degree of dependence on sources outside Japan is derived from "Comprehensive energy statistics of Japan".)

Efforts to secure the stable supply of resources: Japan is strengthening its relationships with the Middle East countries that are its main sources of crude oil. Aiming to increase the amount of LNG in the market, which is low compared to crude oil, Japan is also diversifying its supply sources, and working for further acquisition of resource rights and interests.

Q What kinds of mineral resources are used?

A As an example, the lithium-ion batteries that are used in electric vehicles require rare metals such as lithium, cobalt, and nickel. Japan depends almost 100% on imports for its mineral resources.
(Japan depends 100% on imports for the following 3 minerals.)

Global annual production of important rare metals



Source: USGS "Mineral Commodity Summaries 2021"

Efforts to secure the stable supply of mineral resources: The government has developed the Act for Establishing Energy Supply Resilience, which permits the revision of the JOGMEC Act. It can enhance support for risk capital, i.e., funding and debt guarantee, to the mining development business (upstream) and refining business (midstream) in order to secure a stable supply of mineral resources.

JOGMEC Act: This is the Act on the Japan Oil, Gas and Metals National Corporation, which stipulates the scope of business for the JOGMEC.

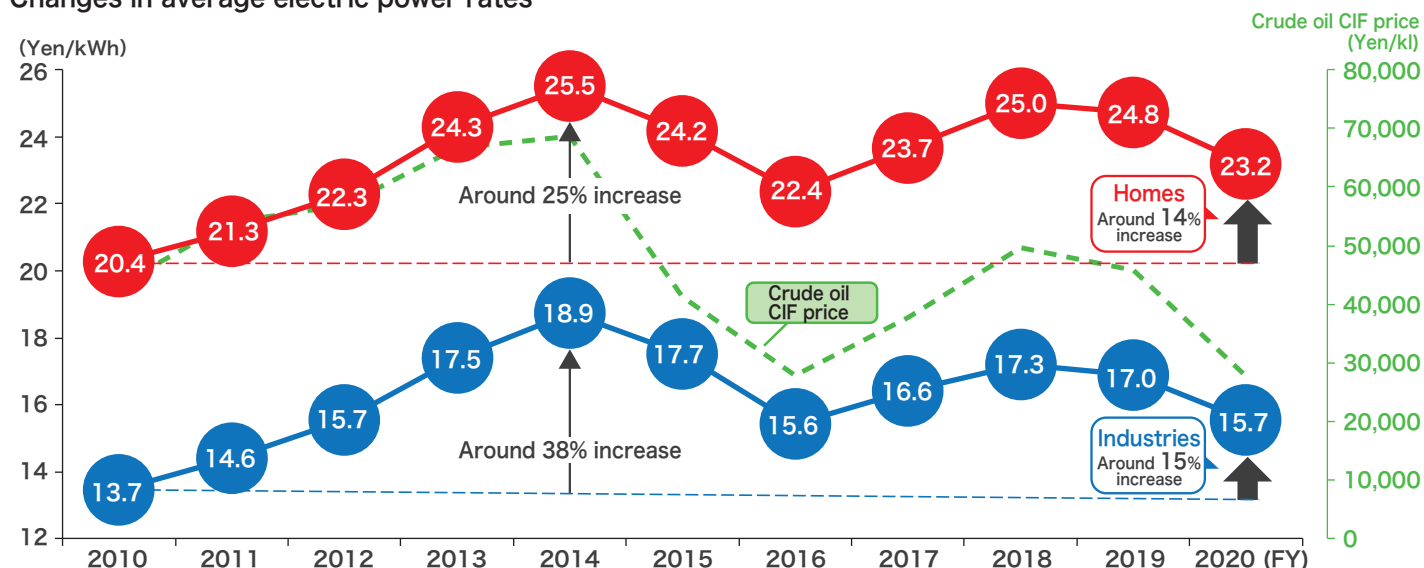
2. Economic Efficiency

Changes in Electric Power Rates

Q How are electric power rates changing?

A Electric power rates have been rising since the Great East Japan Earthquake. The rates declined from FY 2014 to 2016 as a result of falling oil prices, but they are rising again.

Changes in average electric power rates

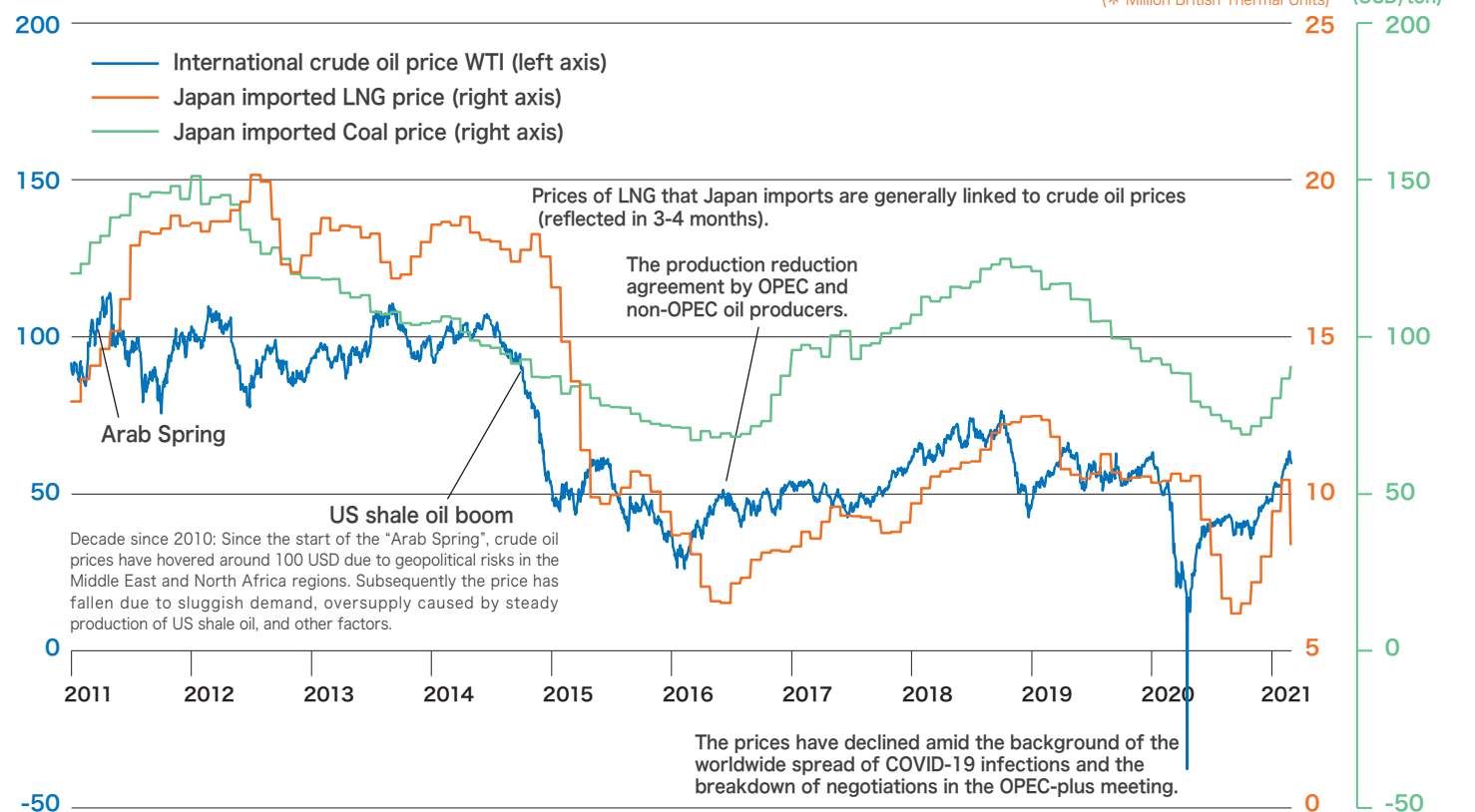


Factor 1: Fuel prices

Fuel prices have an effect on electric power rates and energy cost.

The past decline in crude oil prices and the current situation

International crude oil price WTI (USD/barrel)

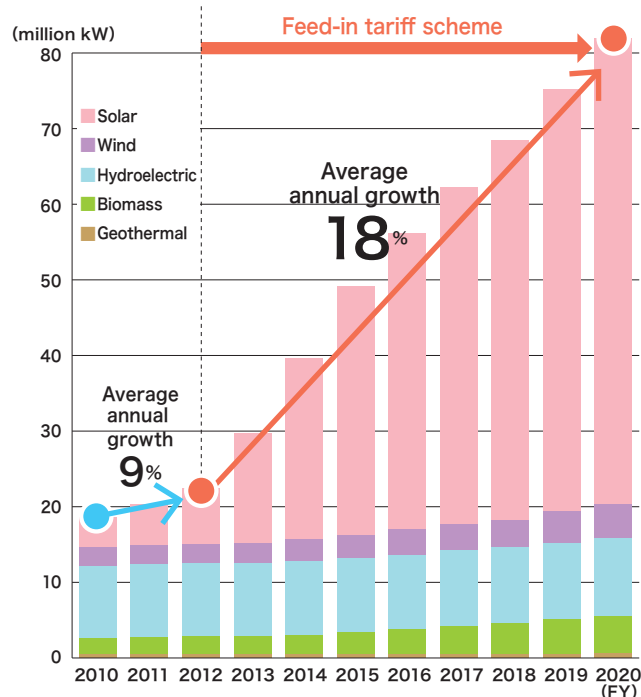


Source: Created based on CME Nikkei and Trade Statistics published by the Ministry of Finance.

Factor 2: Cost of renewable energy

Thanks to the introduction of the Feed-In Tariff scheme (FIT) in 2012, the installed capacity of renewable energy systems is growing rapidly. On the other hand, the purchase costs have reached 3.8 trillion yen (approximately 36 billion USD), and the cost of the surcharge to ordinary households based on the average model (260 kWh/month) has risen to 873 yen/month. We are working to expand the introduction of renewable energy sources in a cost-efficient way in order to maximize the use of renewable energy while suppressing the financial burden on the people.

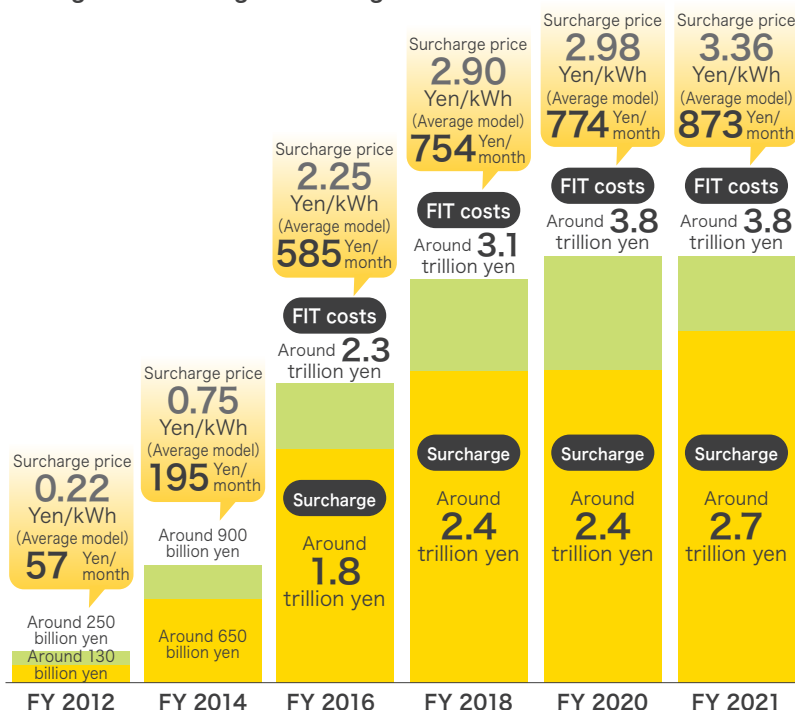
Changes in the installed capacity of renewable energy (excluding large-scale hydroelectric power)



Source: Created by the Agency for Natural Resources and Energy based on JPEA solar panel shipment statistics, NEDO wind power capacity/generation statistics, surveys for potential waterpower, current status and trends of geothermal power generation, and certification results from the RPS system/FIT scheme.

Feed-In Tariff (FIT) scheme: In this scheme, the electricity generated by renewable energy is purchased by electric power companies at a fixed rate for a certain period. The electric power companies will cover the costs of purchasing the electric power from renewable energy through a surcharge that is paid by electricity users.

Changes in surcharges following the introduction of the FIT scheme

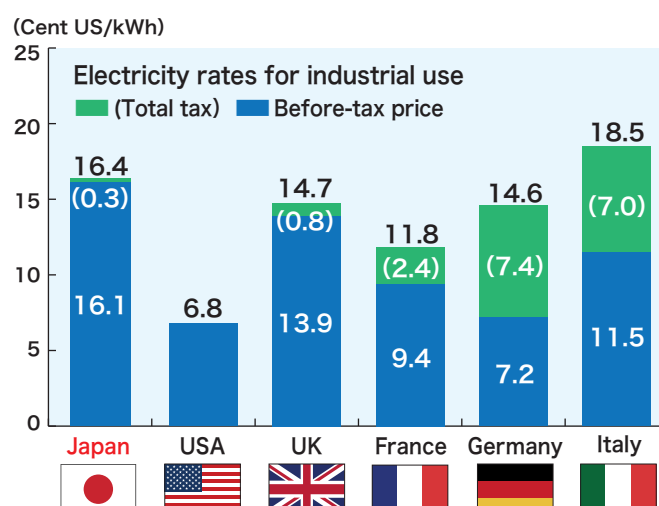
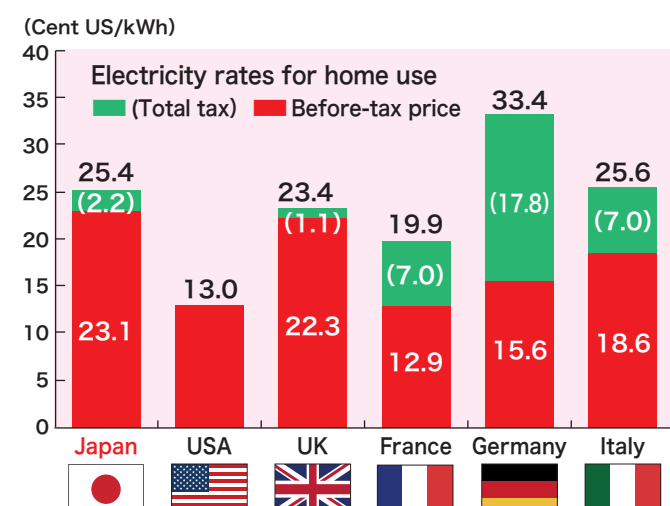


International comparison of electric power rates

The electric power rates in Japan were in a higher level for both home and industrial uses than other countries, but increasing burdens on the electric power companies overseas due to taxation and policies of promoting the introduction of renewable energy has reduced the gap in the rates between Japan and other countries.

We will have to continue efforts aimed at improving the efficiency of the electric power business and reducing electric power rates. On the other hand, we should be thoughtful of our country's specific conditions, meaning our issues related to resource supply. We should consider that most fuels and raw materials are largely dependent on imports from outside Japan, and thus it is critical for us to secure a stable supply of resources.

International comparison of electric power rates (2019)



Source: Created based IEA "Energy Prices and Taxes for OECD Countries 2020".

Note: The details of tax and before-tax prices are not known for the United States.

3. Environment

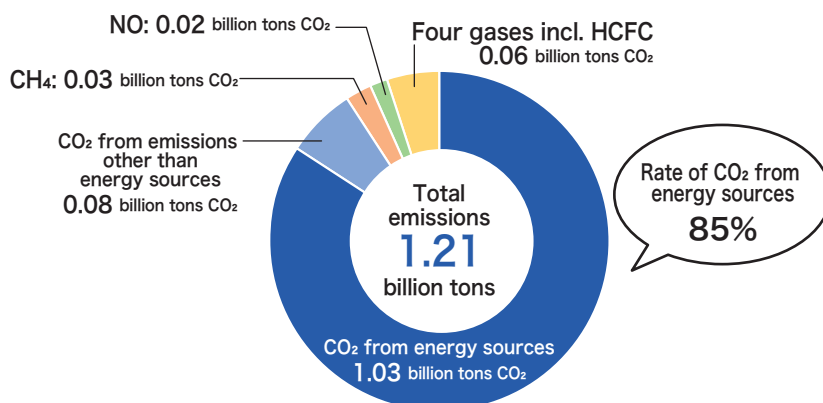
Global Warming Countermeasures: Carbon Neutrality

Q What is carbon neutrality?

A It refers to achieving net zero greenhouse gas emissions.

- “Greenhouse gas” covers **not only CO₂** but all gases with a “greenhouse effect,” including methane.
- “Net zero gas emissions” means balancing gas emissions with the absorbed amount through removing such gases from the atmosphere, making **the total gases emitted to be equal to zero** (net zero, or substantially zero).

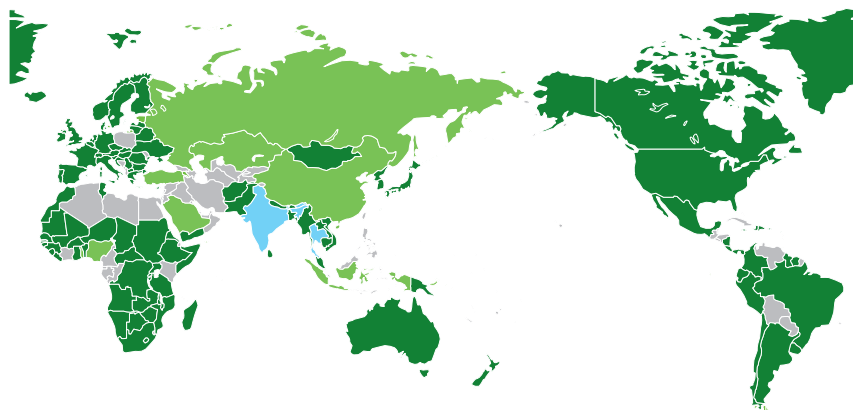
Greenhouse gas emissions in Japan (FY 2019)



Source: from GIO's "Data of Greenhouse Gas Emissions in Japan"

*The amounts for greenhouse gases other than CO₂ are converted to CO₂ equivalents.

Countries/regions that have agreed with the principle of achieving carbon neutrality



■ Countries that have agreed with the principle of achieving carbon neutrality by 2050 (144 countries including Japan)

■ Countries that have agreed with the principle of achieving carbon neutrality by 2060

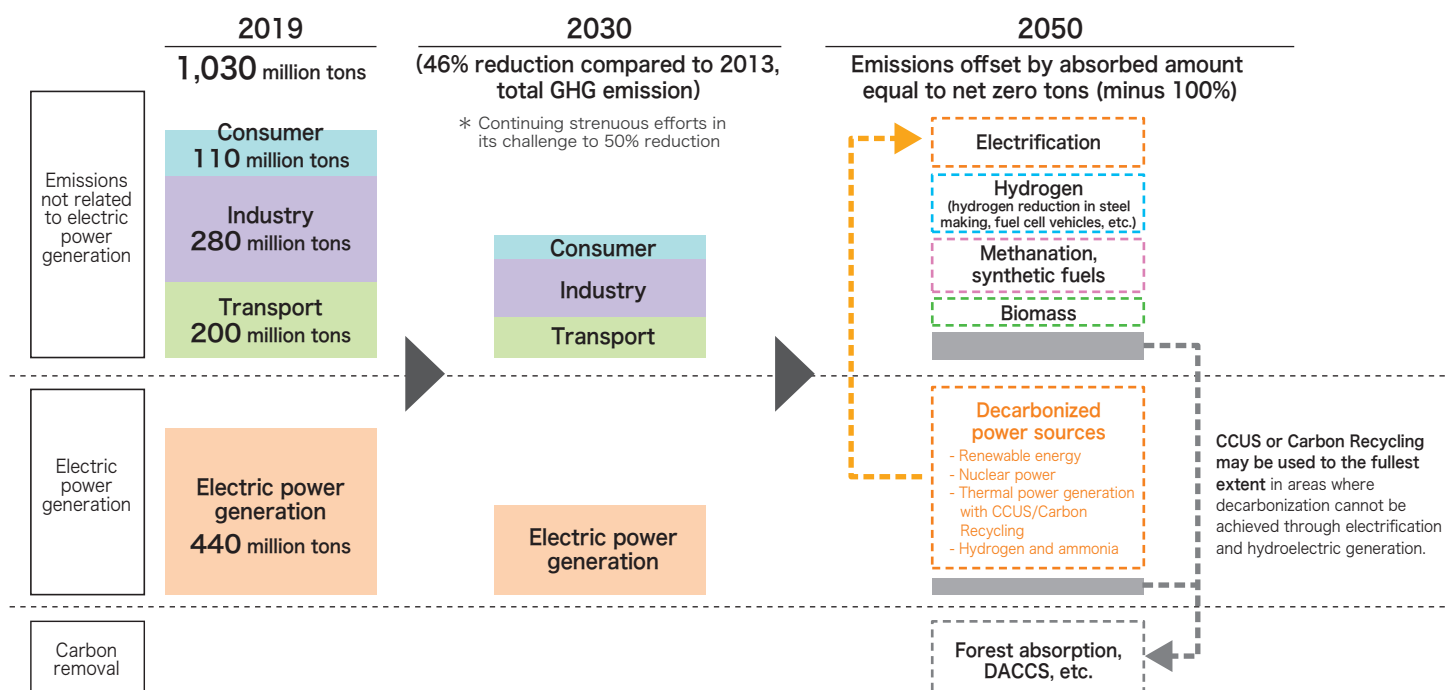
■ Countries that have agreed with the principle of achieving carbon neutrality by 2070

* (1) Countries participating in the Climate Ambitions Alliance, (2) Countries that have submitted a long-term strategy to the United Nations and announced CN by 2050, and countries that announced CN by 2050 at the Leaders' Summit on Climate in April 2021 and COP26. Created by METI by counting those countries (as of November 9, 2021)

* CO₂ emissions are counted only for CO₂ emissions from energy sources, based on CO₂ Emissions from Fuel Combustion IEA (2020.)

- Countries/regions working toward carbon neutrality (CN) by 2050*1: 144
- 42.2% of the world's total CO₂ emissions is from these countries (2018 results*2)
- In addition, China (28.4%), Russia (4.7%), Indonesia (1.6%), Saudi Arabia (1.5%) and others have announced CN by 2060, and India (6.9%) by 2070. In this way, the movement to set carbon-neutral targets is expanding. (88.2% of the world's total CO₂ emissions are from these countries.)

Image of transition to carbon neutrality



* Values shown are the amounts of CO₂ derived from energy

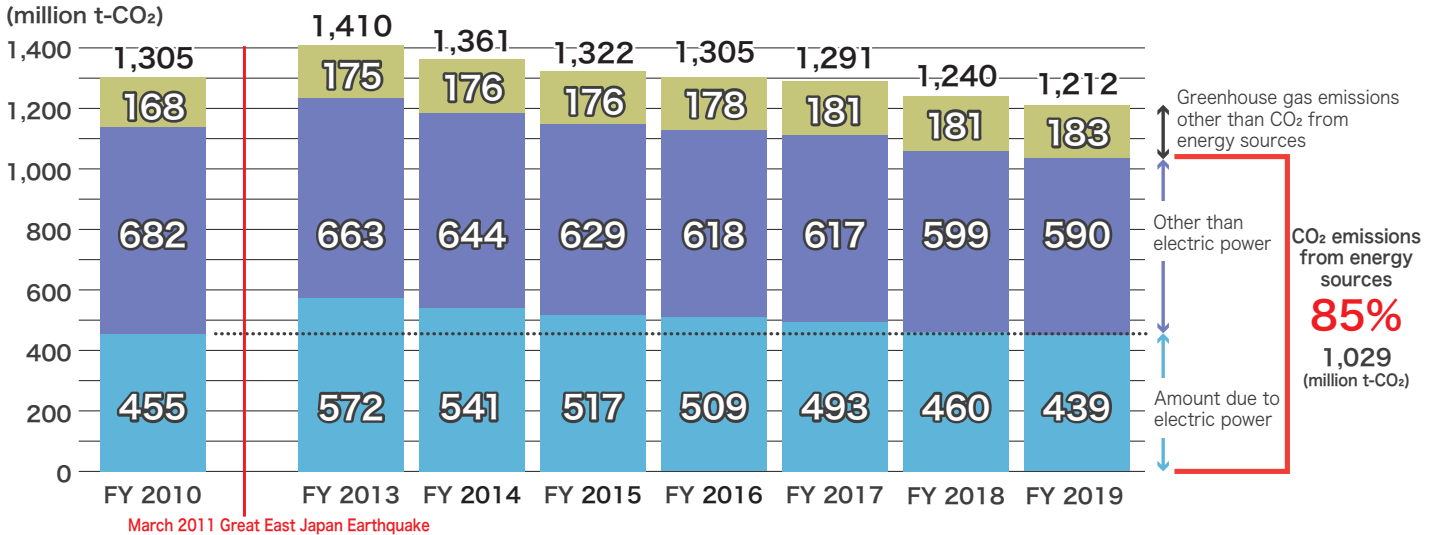
5 DACCS (direct air capture with carbon storage): A technology that directly captures and stores CO₂ that already exists in the atmosphere.

Emissions of Greenhouse Gases

Q How much greenhouse gas is being emitted in Japan?

A The amount of greenhouse gas emissions in Japan increased after the Great East Japan Earthquake. However, in FY 2019, emissions dropped to 1.21 billion tons. Japan must continue efforts toward reducing emissions.

Changes in Japan's greenhouse gas emissions

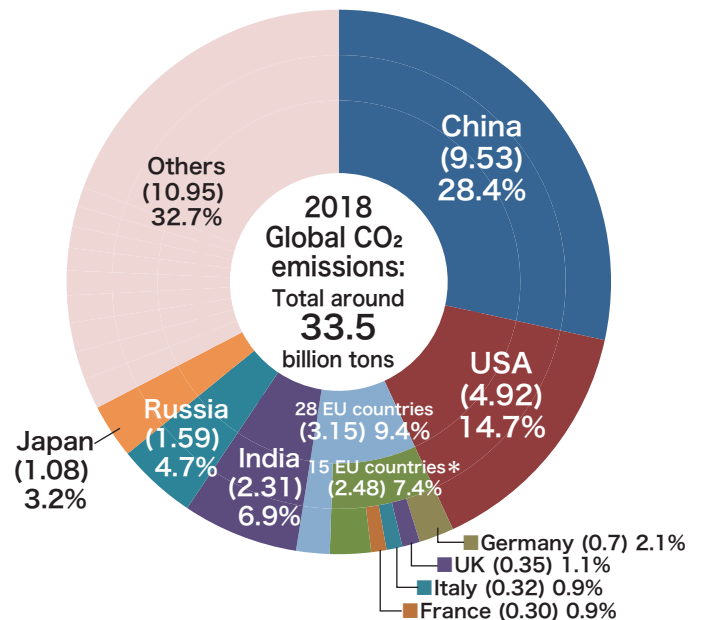
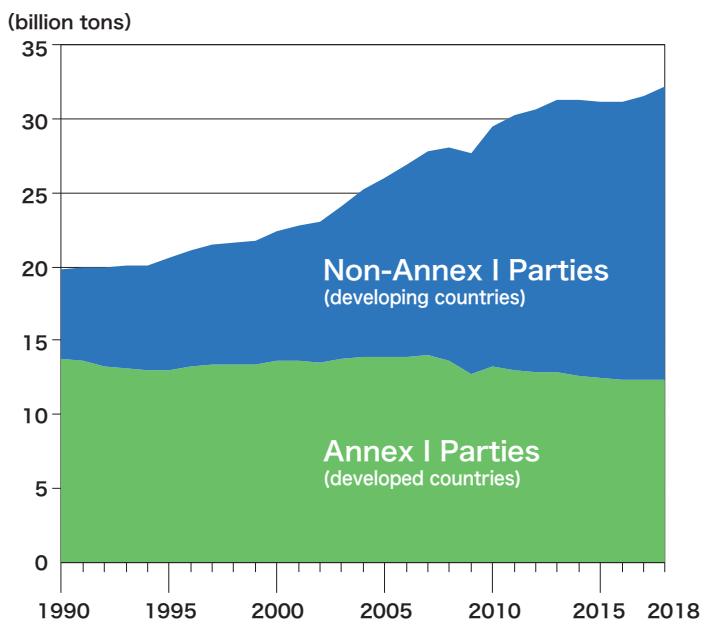


Source: Created based on the "Comprehensive energy statistics" and "Calculation results for the amount of greenhouse gas emissions in Japan", published by the Ministry of the Environment.

Greenhouse gases: There are 6 main gases: carbon dioxide, methane, dinitrogen oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Column - Outlook for global CO₂ emissions

Changes in global CO₂ emissions



Source: IEA "CO₂ Emissions from Fuel Combustion Highlights 2020"

* CO₂ from energy sources only

* (Emissions) unit: 100 million tons CO₂

* The 15 EU countries that were member states at the time of COP3 (Kyoto Conference).

* Due to rounding, the total emissions of each country may not match the total emissions of the world.

Source: Created based on IEA "Energy related CO₂ emissions 1990-2019"

Note: "Developed countries" refers to Australia, Canada, Chile, European Union countries, Iceland, Israel, Japan, the ROK, Mexico, Norway, New Zealand, Switzerland, Turkey, and the United States.

What is the "green growth strategy," as an industrial policy toward carbon neutrality?

The era of believing that addressing global warming causes "constraints on and costs of economic growth" is over. Now we are entering the era of seeing this as an "opportunity for growth". Decarbonization has become an important agenda from the viewpoint of the industrial policy.

https://www.enecho.meti.go.jp/about/special/johoteikyogreen_growth_strategy.html



Use this QR code to view the article. (Japanese only)

4. Safety

Ensuring safety

Q What steps are being taken to ensure a stable supply of energy and safety in the face of intensifying natural disasters?

A In June 2020, a Cabinet decision was made to enact the Act of Enhancing Energy Supply Resilience, and a partial revision of the Electricity Business Act was made. They will help to enhance collaborations in case of natural disasters, enhance resilience of the electricity transmission/distribution networks, and build disaster-resilient, distributed power systems.

Damage to the fuel and electric power infrastructure caused by typhoons and torrential rains



Collapsed wind turbine in Awaji City, Hyogo Prefecture (Due to a typhoon in August 2018)



Damaged floating solar power plant in Ichihara City, Chiba Prefecture (Due to a typhoon in September 2019)



Collapsed power transmission tower in Kimitsu City, Chiba Prefecture (Due to a typhoon in September 2019)



Flooded refinery facilities (Due to a typhoon in October 2019)



Submerged tank lorries (Due to torrential rain in July 2020)

Damage caused by tsunamis

Fukushima Daiichi Nuclear Power Station, which suffered a steam explosion due the effects of tsunamis following the Great East Japan Earthquake (March 2011)



Photo: Tokyo Electric Power Company Holdings Photo & Video Library <https://photo.tepco.co.jp>

Act for Enhancing Energy Supply Resilience

The Act for Enhancing Energy Supply Resilience is formally named "the Act of Partial Revision of the Electricity Business Act and Other Acts for Establishing Resilient and Sustainable Electricity Supply Systems". As stated in the name ("the Electricity Business Act and Other Acts"), this act contains partial revisions not only for the act governing the electricity business, which is called "the Electricity Business Act," but also for "the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities" ("the Act on Renewable Energy Special Measures") and "the Act on the Japan Oil, Gas and Metals National Corporation" ("JOGMEC Act").

The Electricity Business Act

The Act on Renewable Energy Special Measures

The JOGMEC Act

Revisit dos and don'ts in the event of a "power outage"

Natural disasters such as typhoons, floods, and earthquakes can damage power infrastructure and cause power outages. Here are some points to be aware of when a power outage occurs due to a natural disaster.

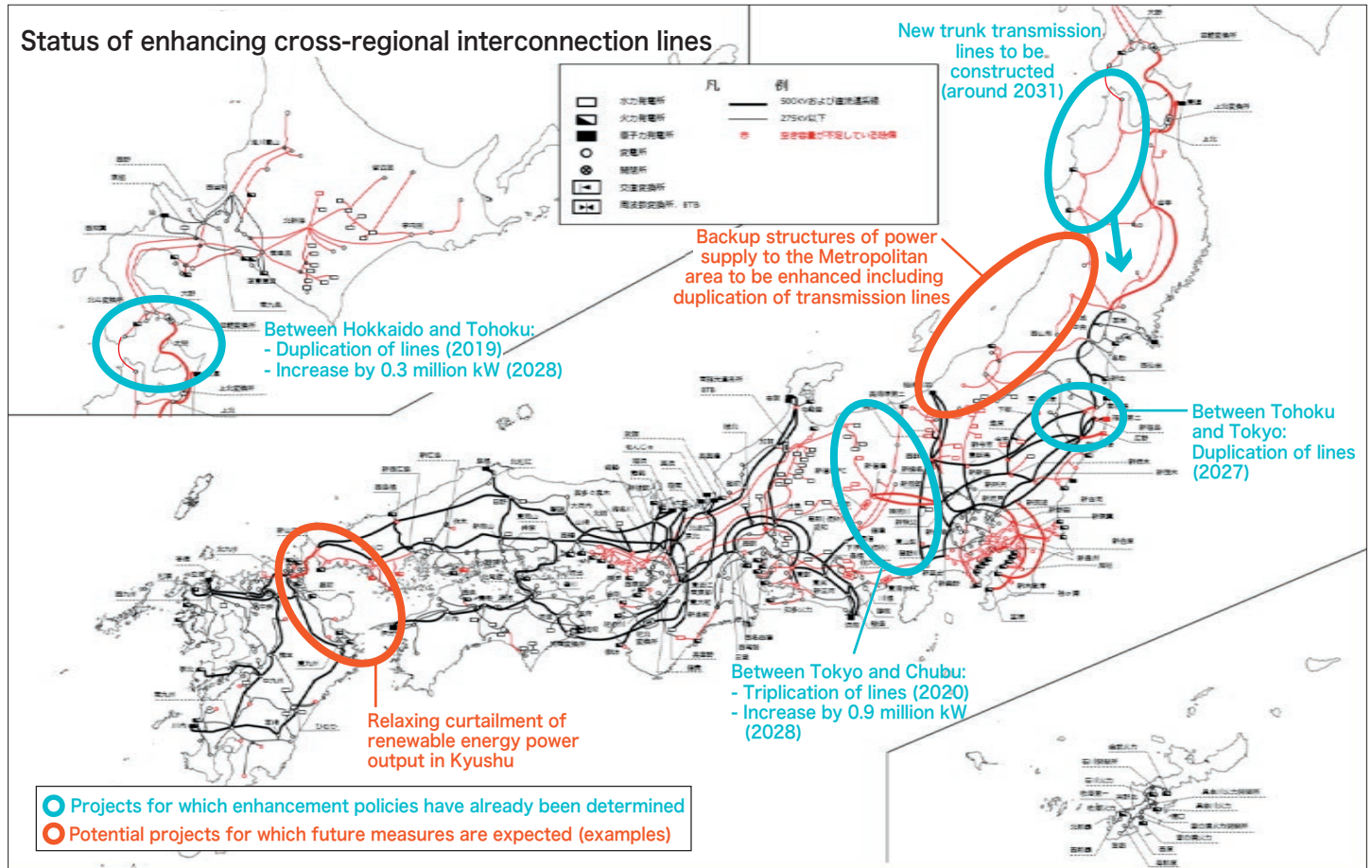
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Effort 1: Enhancing the resilience of electric power infrastructure

In the context of potential risks of large-scale disasters, such as massive typhoons or earthquakes directly beneath the Tokyo Metropolitan Area, as well as increasing demands for decarbonization, it is essential to drastically enhance the resilience of electric power networks in Japan. There is also a high demand to make the transition to next-generation networks suitable for the introduction of large volumes of renewable energy. We will strive to duplicate the nationwide networks to enhance the backup structure for those systems and ensure the resilience of the power infrastructure.



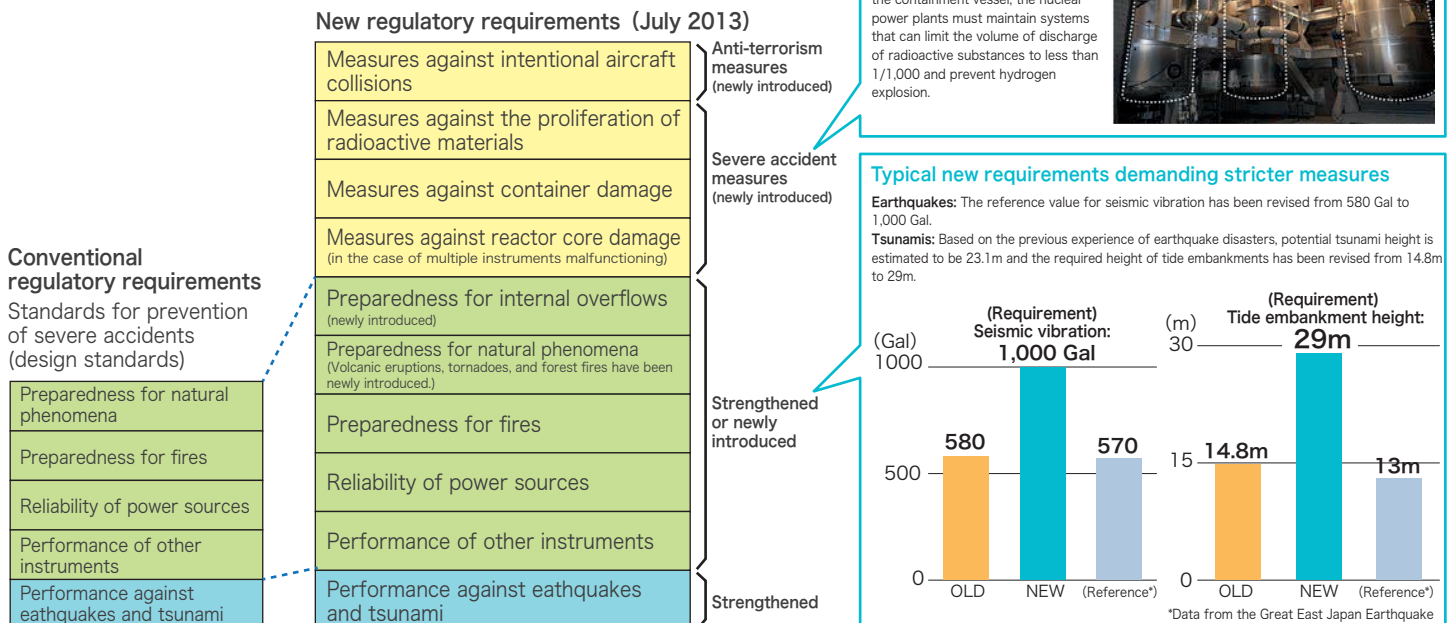
Source: Interim report for building next-generation power networks (Published on September 3, 2021)

Resilience: means sturdiness, recuperative power or elasticity.

Cross-regional interconnection lines: power transmission lines, frequency converters and AC/DC converters that connect different control areas, allowing the exchange of power across area borders.

Effort 2: Conforming to new regulatory requirements for higher levels of safety

When nuclear power plants are restarted, the Nuclear Regulation Authority will require them to conform to new regulatory requirements, which demand stricter accident-prevention measures than the former requirements. The power plants are also required to prepare provisions for contingencies and anti-terrorism measures.



Source: Documents of the Nuclear Regulation Authority.

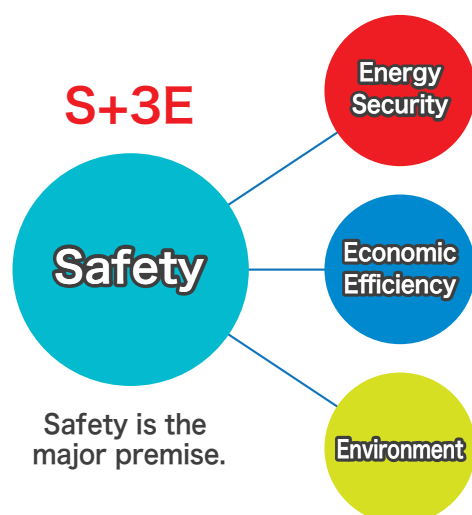
Source: TEPCO website

5. S+3E

Basic Policy

Q What is the government's basic energy policy?

A On the premise of Safety, we are making efforts to simultaneously achieve Energy Security (self-sufficiency rate), Economic Efficiency, and Environment (S+3E). Japan is a country with limited natural resources. There is no one source of energy that is superior in every way. Therefore, it is essential to create a multi-layered energy supply structure where each energy resource is exploited fully for its best performance and compensates for disadvantages of other resources.



Energy Security (Self-sufficiency rate)

Exceed the level from before the Great East Japan Earthquake (around 20%).
Approximately 30% in FY 2030 (currently 12.1%)

Economic Efficiency (Electricity cost)

Expected to be 8.6 to 8.8 trillion yen in 2030, which is lower than 9.7 trillion yen in 2013

Environment (Greenhouse gas emissions)

Expected to be down by 46%* in FY2030 compared to FY2013, which is an ambitious reduction target consistent with 2050 carbon neutrality.

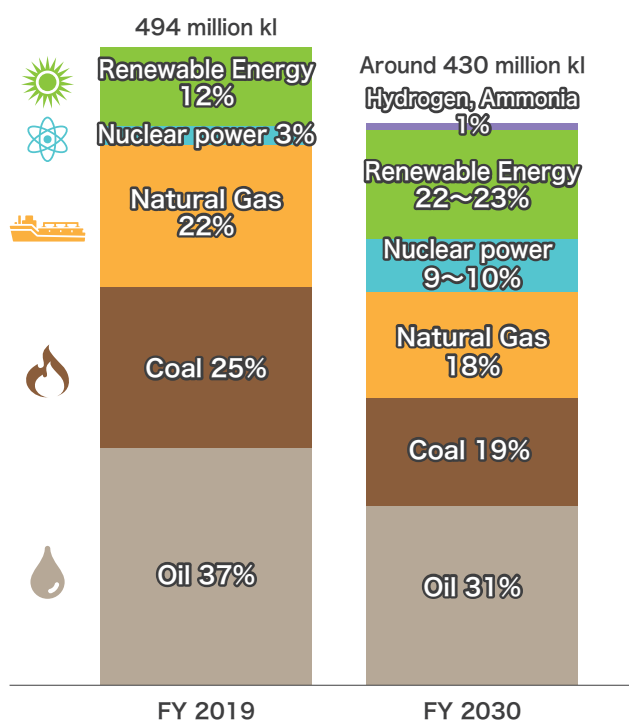
* Reduction target for all greenhouse gases including CO₂ from non-energy sources, etc.

Q What will the primary energy supply and the structure of power sources in the future be?

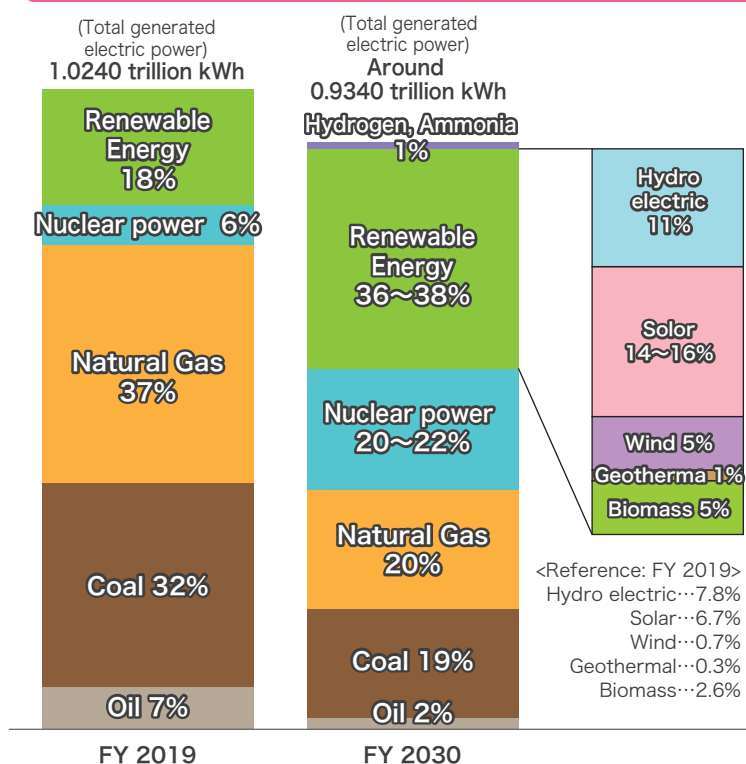
A The figure show the outlook for energy supply and demand* in FY 2030 (energy mix).

* In the light of new GHG emission reduction target in FY2030, this outlook shows energy supply and demand on the ambitious assumption that various challenges in both aspects of supply and demand in promoting thorough energy conservation and expansion of non-fossil energy will be overcome.

Primary Energy Supply



Power Generation Mix



Source: "Comprehensive energy statistics of Japan"; 2019 confirmed figures published by the Agency for Natural Resources and Energy, outlook for energy supply and demand in FY2030 (related materials)

* The sum of the values shown may not be 100% in some cases for a reason of round values.

* Renewable energy here, including geothermal power, wind power, and solar power, but not hydroelectric power, includes unused energy.

6. Innovation

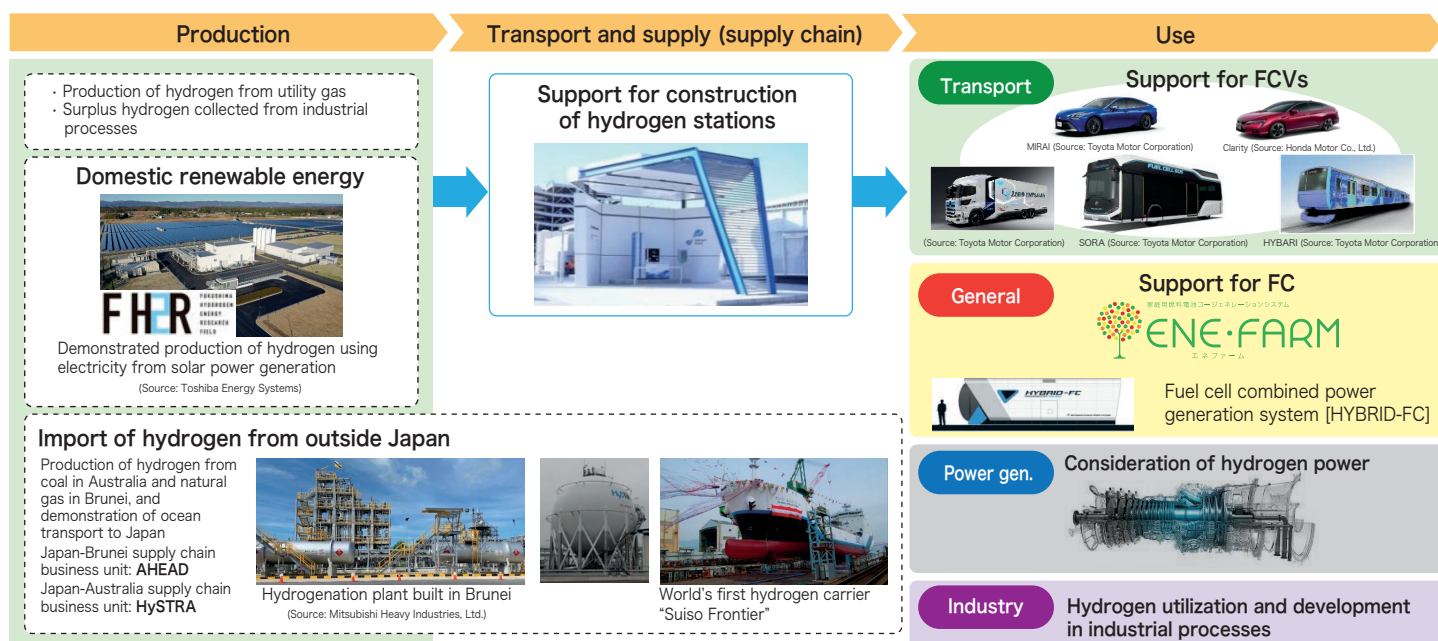
Hydrogen, Ammonia

Q What innovations is Japan working on to achieve decarbonization?

A For example, production of CO₂-free hydrogen from renewable energy sources, wide-ranging use of hydrogen in fuel cell vehicles and other equipment, fuel ammonia, and Carbon Recycling are promising.

Efforts for creating a hydrogen-based society

We are promoting the use of hydrogen in a wide variety of fields, including fuel cell vehicles and household fuel cells, in addition to the construction of supply chains aimed at enabling large-scale hydrogen supply and international trade in hydrogen.



How to produce hydrogen, a next-generation energy source

There are high hopes for hydrogen to become the next-generation energy as it does not emit CO₂. Also, hydrogen has a great advantage in that it can be made from various resources such as coal and gas, not to mention water. This section introduces how hydrogen is produced.

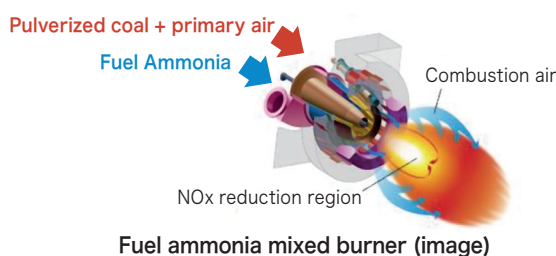
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Efforts to utilize fuel ammonia

Fuel ammonia can be used as a hydrogen carrier, and it can be manufactured and used at a lower cost than pure hydrogen since it can use existing infrastructure. In addition, fuel ammonia has a combustion speed close to that of coal, so it is suitable for use in coal-fired power generation. Japan is developing the only technology in the world to directly use fuel ammonia in thermal power generation facilities. Currently, Japan has succeeded in stable combustion and suppression of NO_x (nitrogen oxide) emissions by co-firing fuel ammonia by 20%. By co-firing fuel ammonia at existing thermal power plants, it will be possible to generate thermal power with lower CO₂ emissions.



Facility used to demonstrate mixed combustion
(JERA Hekinan Thermal Power Station)

Will ammonia really be available as "fuel"? (Part 1 and Part 2)

When speaking of "ammonia," the image that comes to mind is "a toxic substance with a pungent odor." However, fuel ammonia has great potential as a next-generation energy source.

https://www.enecho.meti.go.jp/about/special/johoteikyo/ammonia_01.html



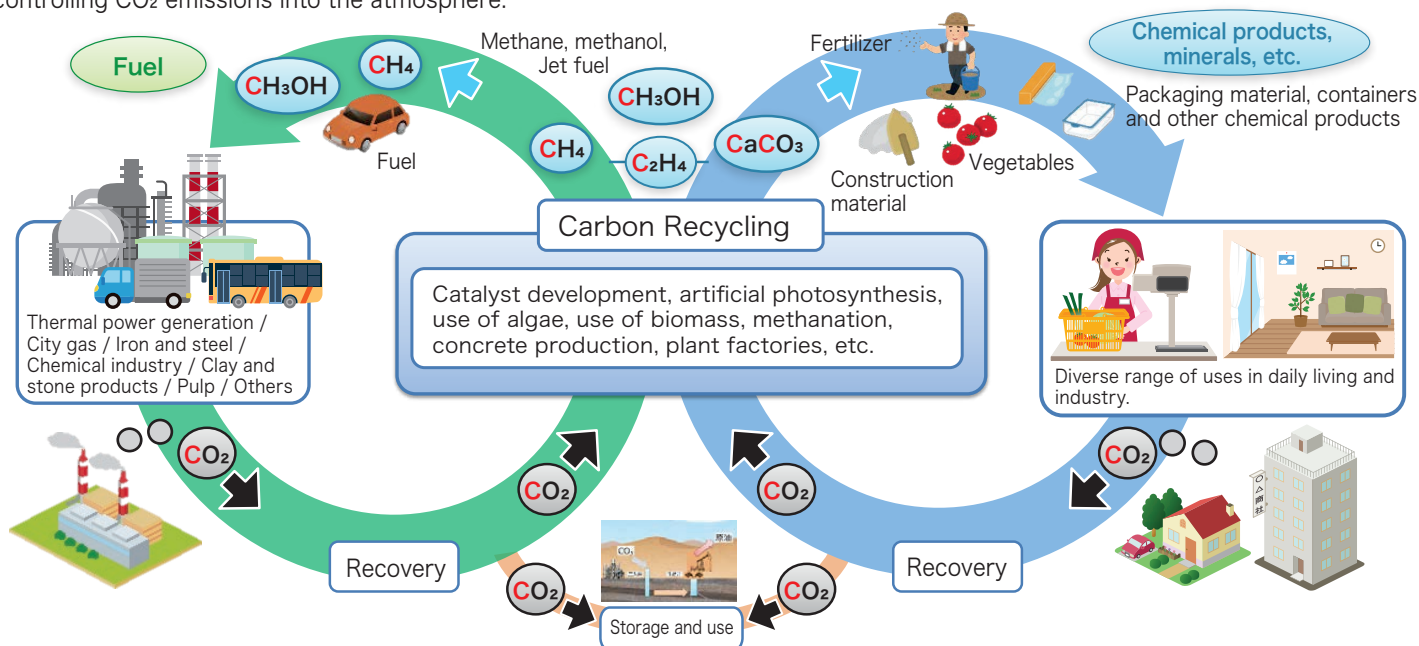
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6. Innovation

Development of technology to reduce CO₂ emissions

Carbon Recycling (reuse of CO₂)

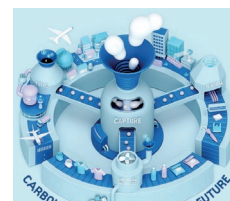
This is a technology used for capturing CO₂, and utilizing it as a raw material resource in concrete, plastics or others thereby controlling CO₂ emissions into the atmosphere.



Dream technology for CO₂ emissions reduction — Development and implementation of "carbon recycling"

"Carbon recycling" is one of the technologies that hold the key to achieving carbon neutrality. Not only can it directly contribute to CO₂ emissions reduction; it also has potential to be utilized and synergized with hydrogen and renewable energy.

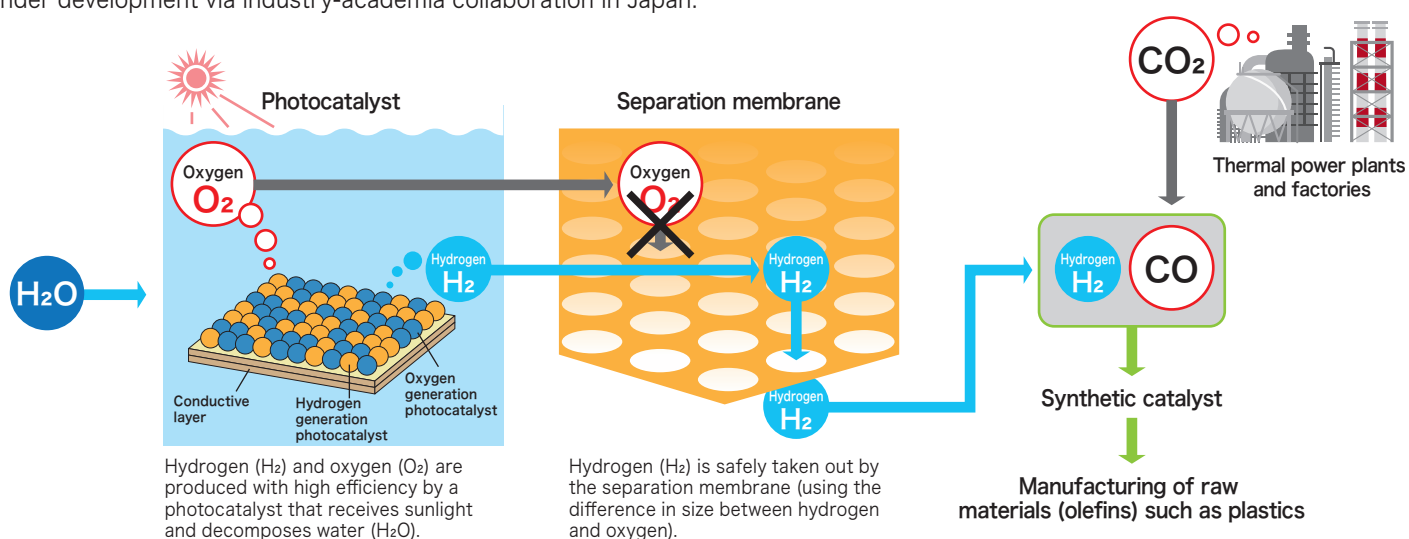
https://www.enecho.meti.go.jp/about/special/johoteikyo/carbon_recycling2021.html



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Artificial photosynthesis

This technology attempts to utilize CO₂ in the chemical industry, which manufactures raw materials for familiar products such as plastics. Japan leads the world in the technology of artificial photosynthesis using photocatalysts. This technology is currently under development via industry-academia collaboration in Japan.



How much progress has there been on "artificial photosynthesis" using solar energy and CO₂ to produce chemicals?

"Natural photosynthesis" is the process in which plants use solar energy to produce organic matter (starch) and oxygen from CO₂ and water. "Artificial photosynthesis" technology attempts to synthesize chemicals with solar energy and CO₂ by imitating natural photosynthesis.

<https://www.enecho.meti.go.jp/about/special/johoteikyo/jinkoukougousei2021.html>



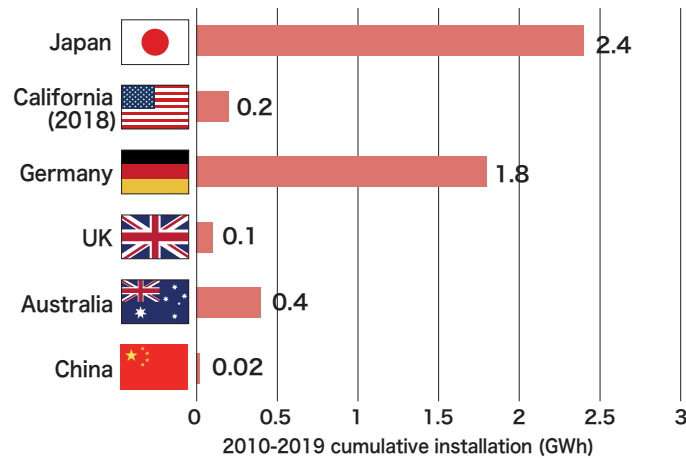
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Practical Application of Innovation

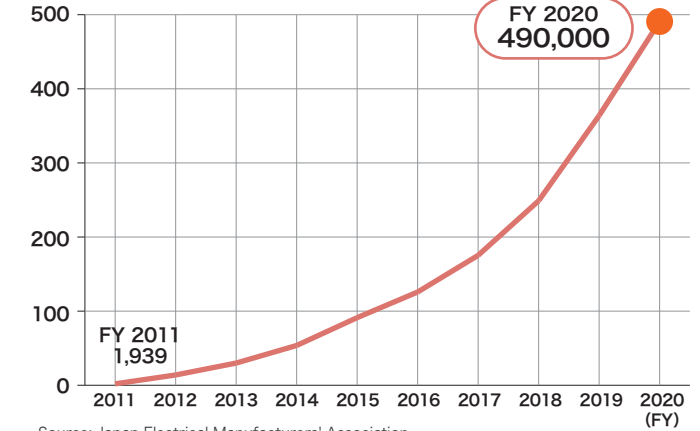
Widespread use of power storage systems

Japan is leading the way in technological development and dissemination of power storage systems in its efforts to expand the use of fuel cells and Ene-Farms.

Installation record of home power storage systems in major markets



Stationary lithium-ion power storage systems in Japan (cumulative)



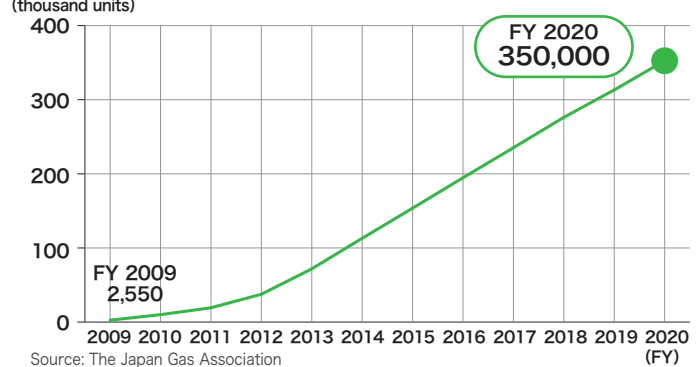
Source: Japan Electrical Manufacturers' Association



Ene-Farm, a fuel cell that utilizes hydrogen, was commercialized in Japan in 2009 for the first time in the world. As of June 2021, more than 400,000 units have been installed.

Going forward, further technological development will take place to reduce the number of parts and pursue further cost reduction. Efforts will focus on ways to maximize the potential of fuel cells, for instance demonstrating their supply capacity and adjustment capability in the power grid. We will support the improvement of the environment in which this technology can be utilized.

Number of Ene-Farms in Japan (cumulative)

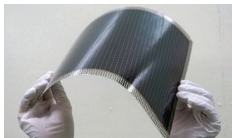


Source: The Japan Gas Association

Practical use of various technologies can reduce CO₂ emissions

Photovoltaic generation operable anywhere

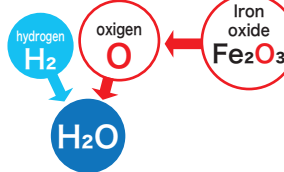
Flexible, lightweight, high-efficiency photovoltaic generation



Next-generation solar cells (perovskite solar cell)

Zero-Carbon steelmaking with CO₂-free hydrogen

Developing a technology for the reduction of iron ore with hydrogen



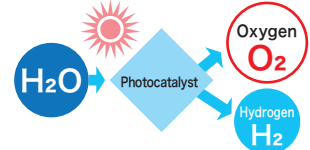
Producing materials such as concrete using captured CO₂

Separating and collecting CO₂ from emissions from thermal power plants or other facilities and recycling it into construction materials



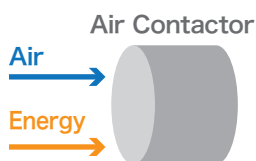
Artificial photosynthesis

Developing the world's first photocatalyst that decomposes water with a quantum yield close to 100%



DAC (Direct Air Capture of CO₂)

Developing technologies to capture CO₂ from the atmosphere and solidify it



Bio jet fuel

Developing next-generation electrified aircraft and establishing technologies to realize such aircraft



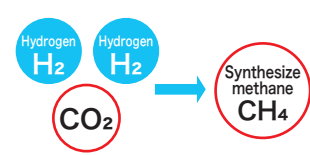
"CCS" to collect and bury CO₂

Demonstration test to be completed soon on using this technology to store CO₂ deep underground below the seabed



Methanation

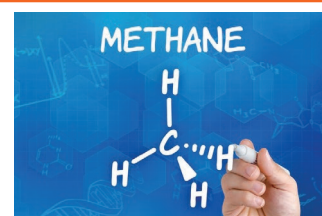
Reacts hydrogen with CO₂ to synthesize methane (CH₄), which is the main component of natural gas.



"Methanation" technology for decarbonizing gas

Development of technology for decarbonizing gas is also accelerating. Methanation technology is one of the promising methods. The goal is to replace the natural gas used today for city gas with synthetic methane produced via methanation.

<https://www.enecho.meti.go.jp/about/special/johoteikyomethanation.html>



Use this QR code to view the article. (Japanese only)

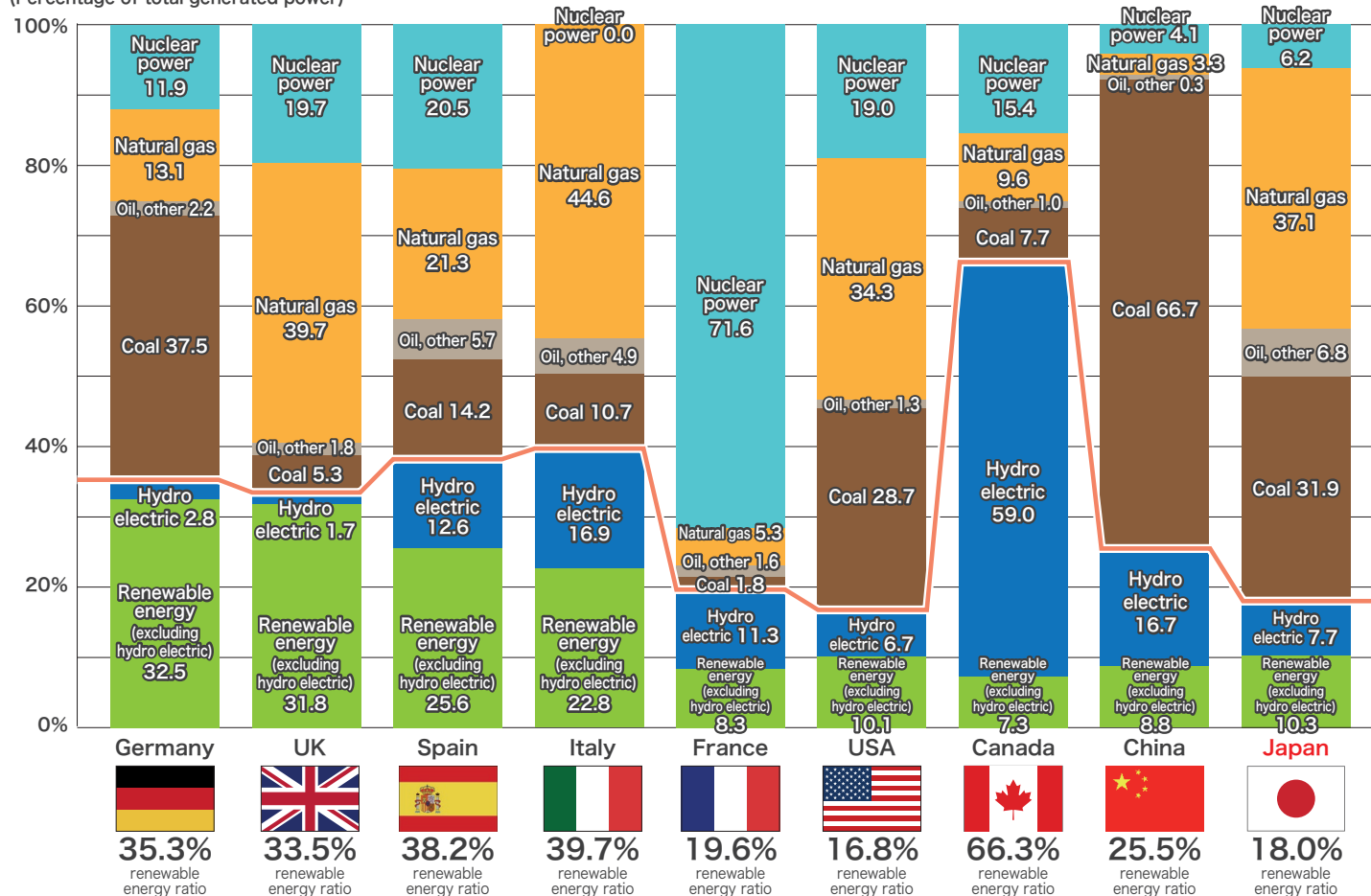
7. Renewable Energy

Introduction of Renewable Energy

Q Is Japan advancing the introduction of renewable energy?

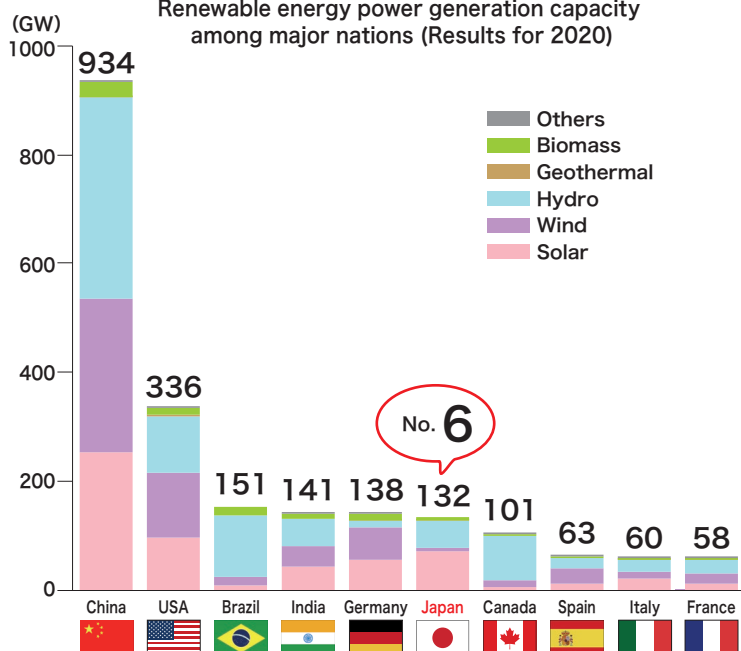
A The percentage of renewable energy power in Japan was 18% in FY 2019. Japan ranks 6th in the world in terms of renewable energy generation capacity, and 3rd in the world for solar power generation.

Comparison of percentages of renewable energy in total power generation in major nations
(Percentage of total generated power)

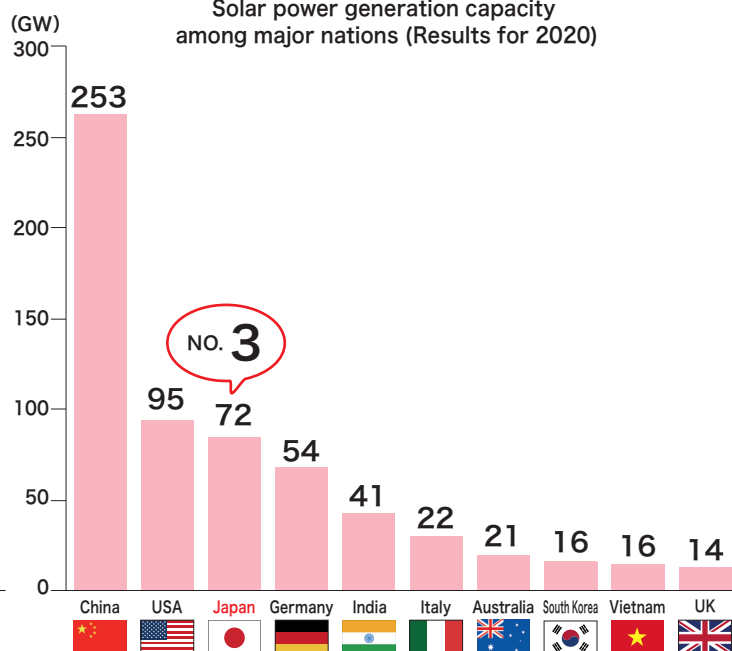


Source: Created by the Agency for Natural Resources and Energy based on IEA Data Services and other data published by respective countries

Renewable energy power generation capacity among major nations (Results for 2020)



Solar power generation capacity among major nations (Results for 2020)



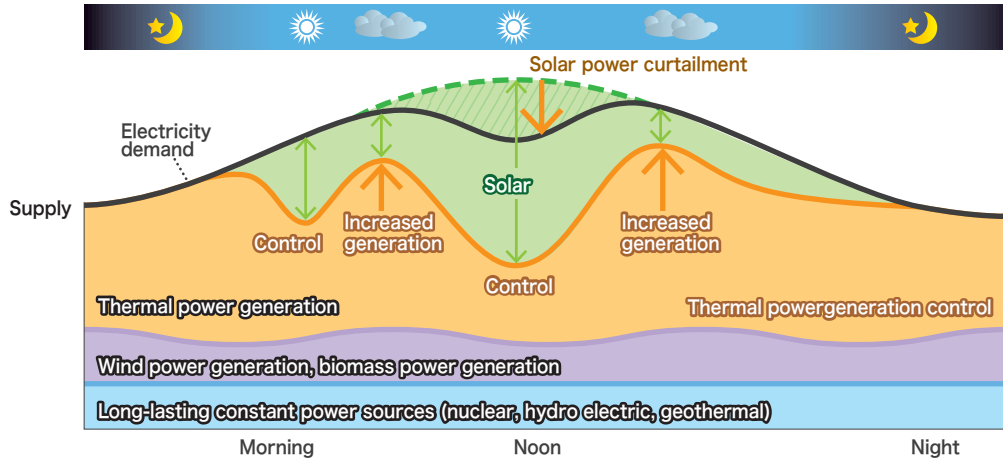
Source: Created by the Agency for Natural Resources and Energy based on the IEA "Renewables 2021"

Making renewable energy a primary source of power

Q Is it possible to meet all demands of electric power only with renewable energy?

A The amount of electricity generated by renewable energy varies significantly depending on the weather and season. In order to ensure a stable supply, it is necessary to secure a method of energy storage to complement renewable energy in combination with flexible output power sources, such as thermal power generation and storage batteries.

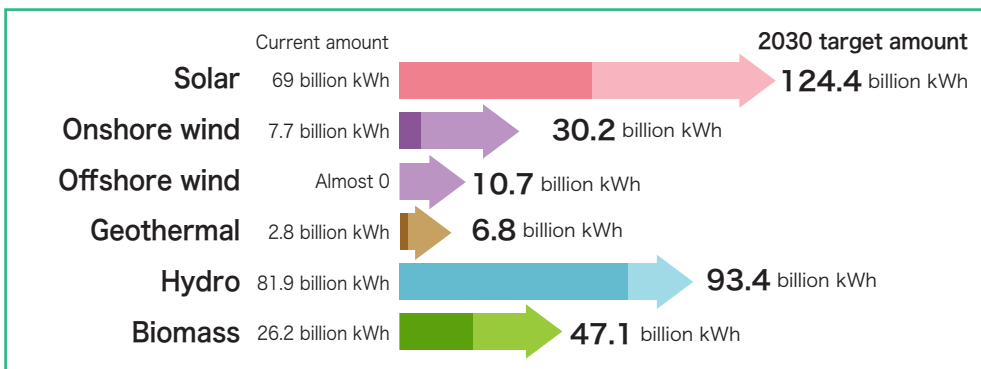
Supply/demand situation on the lowest demand day (such as a sunny day in May)



The power generation (supply) should be balanced with consumption (demand) at all times to ensure stable access to electric power. To this end, power sources with variable output such as thermal power generation are used to compensate for fluctuations in the output of renewable energy generation.

Q What are the policies being implemented by the government to make renewable energy a major power source?

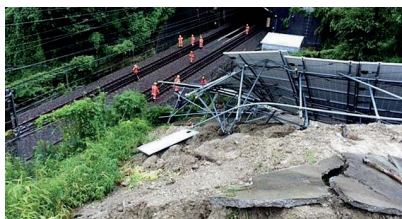
A In the energy mix for 2030, the goal is to utilize renewable energy to contribute 330 to 350 billion kWh. While maximizing the introduction of renewable energy, such as utilizing not only solar power generation but also wind power generation and promoting the introduction of ZEH in newly built houses, policies will also be implemented to minimize safety concerns and environmental impacts.



+ Strengthening policies to promote introduction of renewable energy

- Introducing more wind power by reinforcing the networks
- Achieving ZEH targets for newly built houses, etc.

Regarding solar power, safety concerns about potential damage caused by disasters and issues related to the coordination with the local community regarding the impact on the landscape and environment have become apparent. As a result, there is a movement among some local municipalities to establish ordinances to require that notification be filed when developing systems larger than a certain size.



Examples of damage to solar power generation equipment caused by disasters



Cases affecting the landscape

Changing the methods of connecting to the power grid to increase the amount of usable renewable energy

With the progress of the mass introduction of renewable energy, problems related to the power grid are becoming apparent, such as the lengthy time and high cost of connecting to the grid. Click below to learn more about a new nationwide initiative called "non-farm type connection".

https://www.enecho.meti.go.jp/about/special/johoteikyoo/non_firm.html



Use this QR code to view the article.
(Japanese only)

8. Reconstruction of Fukushima

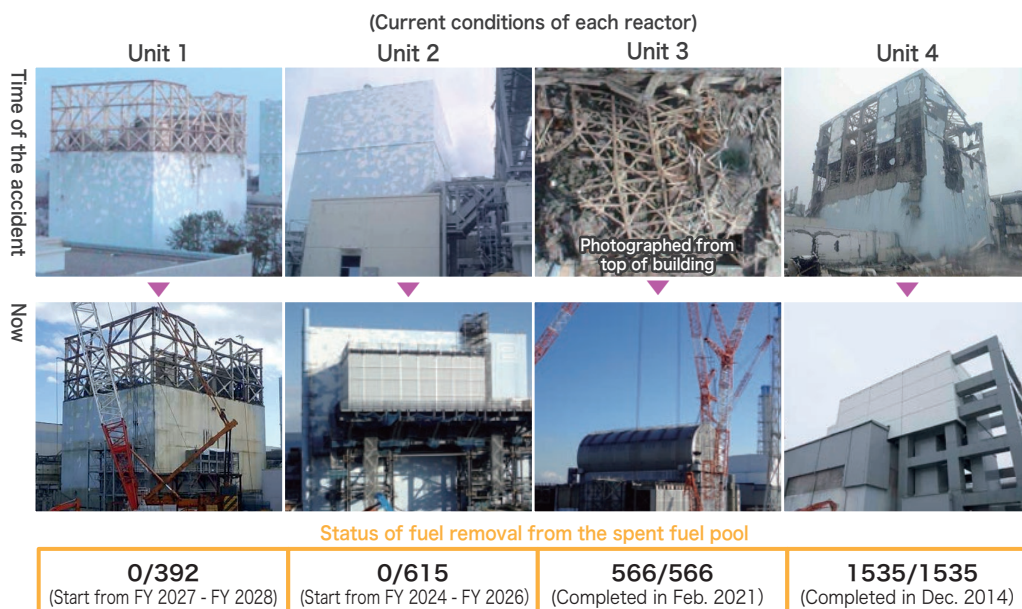
Decommissioning Contaminated Water and Treated Water Management of Fukushima Daiichi Nuclear Power Station (FDNPS)

Q Are decommissioning contaminated water and treated water management at FDNPS progressing?

A Although decommissioning contaminated water and treated water management are unprecedented challenges, measures are being implemented safely and steadily based on the “Mid-and-Long-Term Roadmap”.

Decommissioning

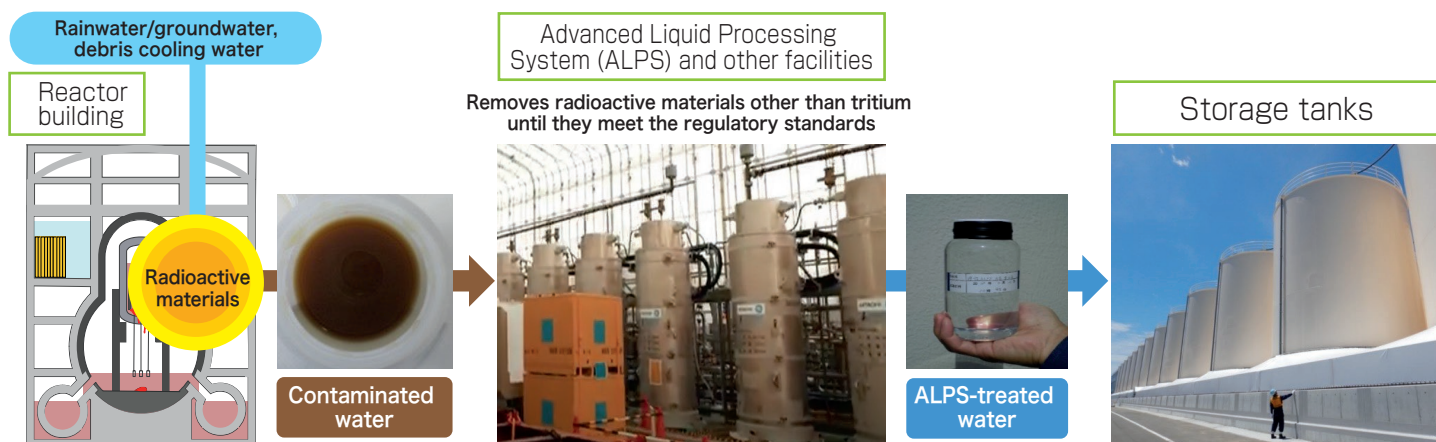
All reactors are kept in stable conditions, and rubble removal, decontamination, and other measures are being carried out toward fuel removal from the spent fuel pools. For the retrieval of fuel debris (melted and solidified fuel), a robot arm for retrieval arrived in Japan from the United Kingdom in July 2021, and development work is underway jointly between the United Kingdom and Japan. As soon as preparations are in place, trial retrieval will start at Unit 2 and it is planned to gradually expand the scale of the work.



Countermeasures for contaminated water and treated water

The amount of contaminated water generated per day at the FDNPS has been reduced to around 1/4 of the initial amount through multi-layered countermeasures (such as frozen-soil walls). Contaminated water is treated using multiple purification facilities that remove as many of the radioactive materials as possible before the water is stored in tanks.

Currently, these tanks and their piping equipment occupy a large area of the site, and if this situation is not changed, they may become a major obstacle to the future decommissioning work. Under such circumstances, on April 2021, the Government of Japan announced its basic policy, based on which preparation will be started for discharging the ALPS treated water into the sea in about two years, on the premise that strict compliance with various laws and regulations is ensured and that all measures are taken to minimize adverse impacts on reputation. Going forward, the government as a whole will work to eliminate people's concerns.



Efforts for decommissioning, contaminated water and treated water management at the FDNPS

Decommissioning, contaminated water and treated water management are also explained on the website.

- Moving Toward “Reconstruction and Decommissioning”, Handling of treated water safely and securely
- Ten years after the disaster, what is happening “now” in Fukushima in 2021, etc.

<https://www.enecho.meti.go.jp/about/special/keyword/?k=廃炉>



Use this QR code to view the article. (Japanese only)

Reconstruction of Fukushima

Q Is Japan advancing the reconstruction of Fukushima?

A The evacuation order has been lifted on all regions except for the “Restricted Area.” Regarding the “Restricted Area,” the evacuation order around the railway station was lifted in line with the reopening of the entire JR Joban Line in March 2020. The government proceeds with the improvement of living environment for lifting the evacuation order on the Specified Reconstruction and Revitalization Base Areas scheduled for spring this year. Also, for the areas outside the Reconstruction and Revitalization Base Areas, based on the government policy of August 2021, in the 2020s, the government will work to lift the evacuation order, so that residents with the intention to return can do so. In addition to rebuilding businesses and livelihoods, we will promote the Fukushima Innovation Coast Framework and the Fukushima Plan for a New Energy Society toward new industrial clustering and development. Efforts are also being made to ensure food safety. All these measures are being taken to realize the regional revitalization of Fukushima.

Fukushima Innovation Coast Framework

Various efforts are underway to create new industries in order to achieve industrial restoration in the Hamadori and other areas of Fukushima Prefecture.

With the Fukushima Robot Test Field as the core of an industrial cluster, 62 robot-related companies have entered the area since the earthquake.



Fukushima Robot Test Field (Minamisoma City, Namie Town):

This test field is one of the largest flight airspaces and runways in Japan for unmanned aerial vehicle. The research building is home to research and development of advanced technologies such as flying cars (opened in March 2020).



Examples of new initiatives in the Hamadori area of Fukushima Prefecture

Development of drones with water takeoff and landing capabilities in collaboration with local companies. The developed drones to be used to demonstrate next-generation mobile communication systems (5G).

Fukushima Plan for a New Energy Society

In order to make Fukushima a pioneer of the new energy society of the future, efforts are being accelerated to further expand the introduction of renewable energy and realize a hydrogen-based society. These measures are being implemented to support the reconstruction from the energy field.



Support for the introduction of renewable energy

Supporting the development of shared transmission lines to expand the introduction of wind power generation in the Abukuma Mountains and the coastal areas of Fukushima Prefecture.



Fukushima Hydrogen Energy Research Field (FH2R):

Conducting demonstration projects for large-scale production of hydrogen from renewable energy using the world's leading 10,000 kW-class water electrolyzer (opened in March 2020).

Food safety in Fukushima Prefecture

Agricultural, forestry and fishery products produced in Fukushima are tested for safety before shipment. Any items exceeding the radiation standards are restricted from shipment at each city, town, or village level; therefore, such items will not be distributed to the market.

- In regard to rice, the staple food, all rice produced and shipped in all areas of Fukushima was inspected for safety. As no products exceeding the radiation standards have been found since 2015, all rice harvested in 2020 onward in Fukushima, except for 12 areas of cities, towns, and villages covered by the evacuation orders, is now subject to less restrictive monitoring.
- In the 12 areas of cities, towns, and villages covered by the evacuation order, there are some areas where farming has not resumed, or rice fields are being newly planted, so we will continue to inspect all bags.
- The prefectural government will firmly ensure the safety of rice produced in the prefecture by taking measures to suppress the absorption of radioactive substances and ensure reliable prevention of secondary pollution due to contamination by foreign materials.

Source: Created based on “Progress of Fukushima Recovery”

Status of monitoring inspections for agricultural, forestry and fishery products (April 1, 2020 - March 31, 2021)

Classification	Number of inspections	Number exceeding standard	Percentage exceeding standard
Brown rice	1,055	0	0.00%
Vegetables/fruits	2,195	0	0.00%
Livestock products	3,952	0	0.00%
Cultivated plants/mushrooms	1,084	0	0.00%
Marine seafood	3,943	0	0.00%
Fish from inland fisheries	31	0	0.00%
Edible wild plants/mushrooms	557	0	0.00%
Fish in rivers and lakes	766	0	0.00%

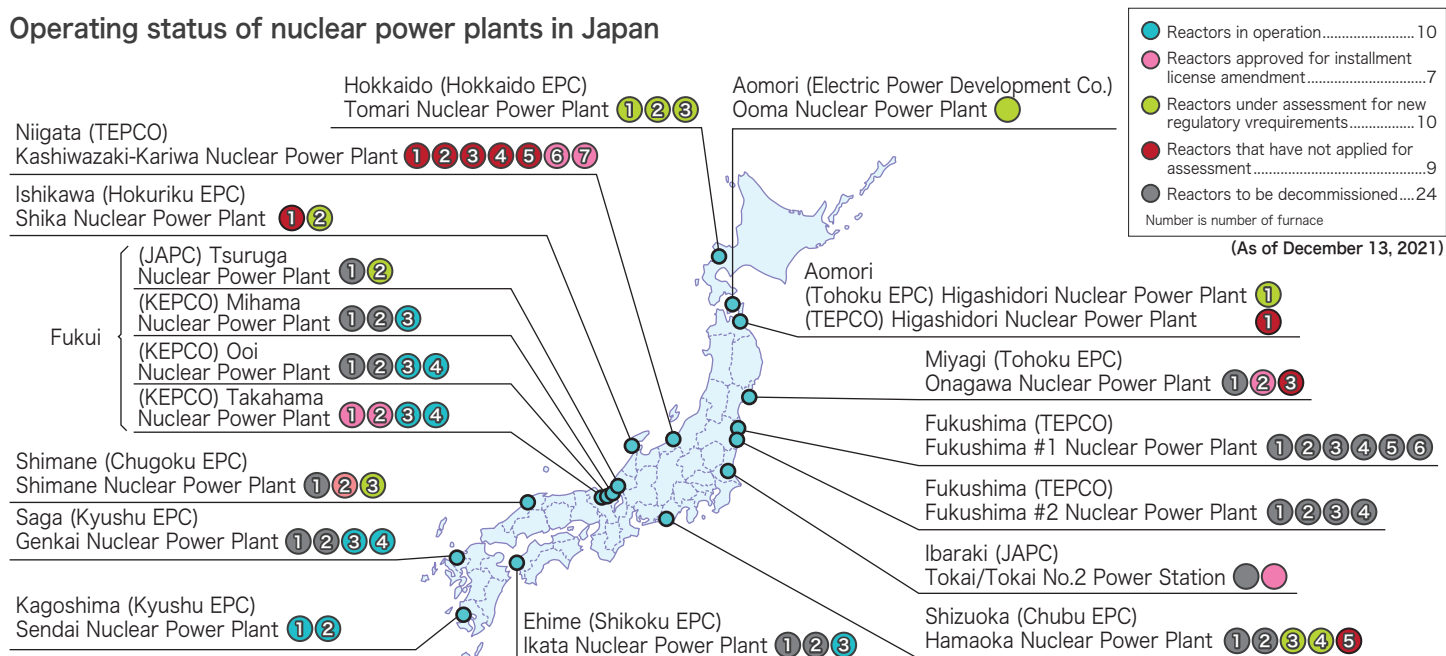
9. Nuclear Power

Operational Status of Nuclear Power Plants

Q Is nuclear power generation necessary?

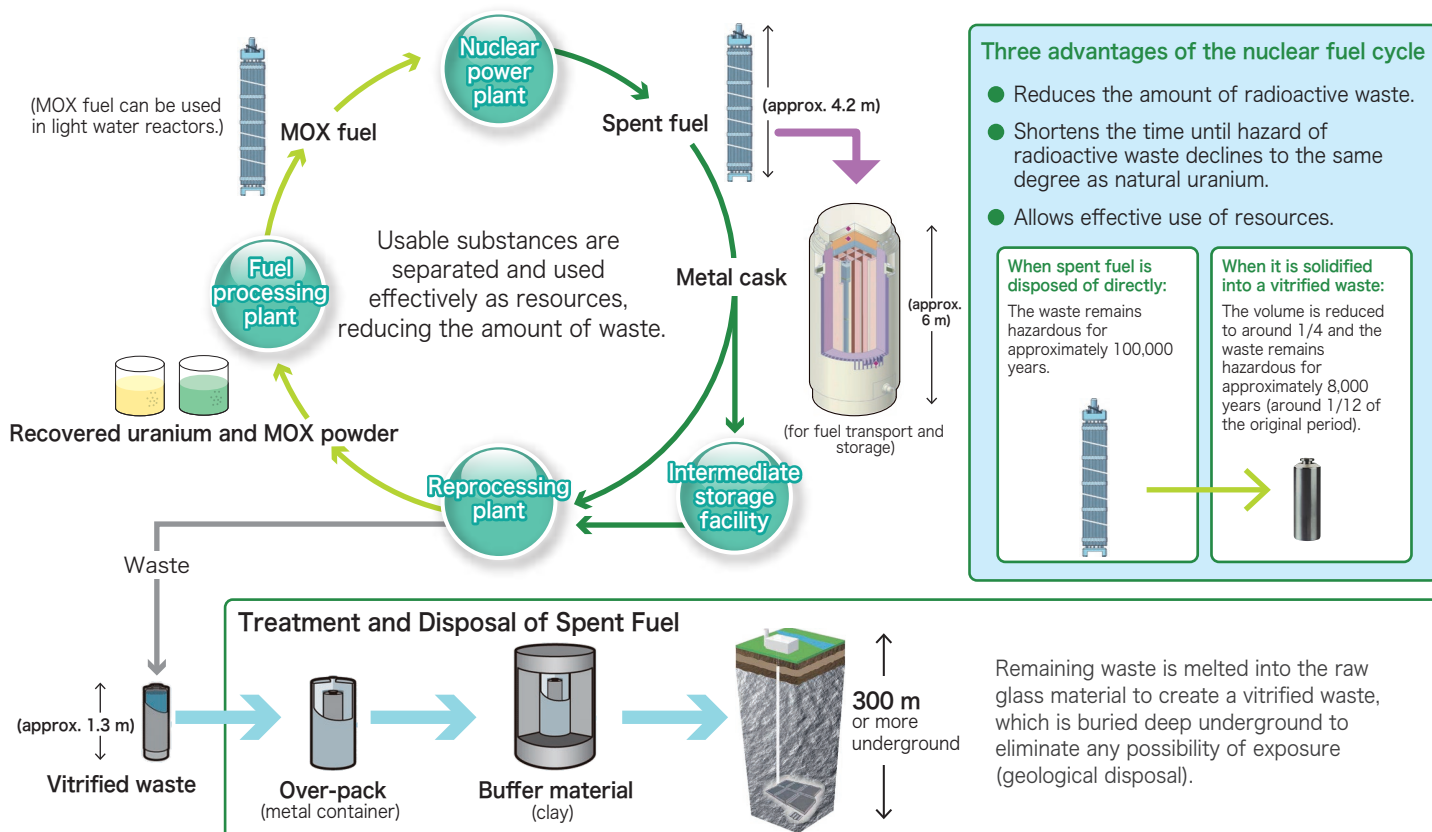
A For a country that lacks natural resources, nuclear power generation is essential in order to achieve the following 3 objectives: (1) securing the stable supply of power, (2) reducing electric power costs, (3) reducing greenhouse gas emissions. In order for nuclear power plants to be restarted, they are required to conform with new regulatory requirements that prioritize safety.

Operating status of nuclear power plants in Japan



Nuclear Fuel Cycle and Geological Disposal

Japan is advancing technologies for the “nuclear fuel cycle”, in which spent fuel from nuclear reactors is reprocessed, the recovered uranium and plutonium are reused, and the volume of waste is reduced.



MOX: Mixed Oxide (Mixture of Uranium oxide and Plutonium oxide)

Fuel assembly and metal cask: “Graphical Flip-chart of Nuclear & Energy Related Topics”, Japan Atomic Energy Relations Organization

Nationwide Map of Scientific Features and Literature Survey

To promote a better understanding of the mechanism of geological disposal and the geological environment of Japan, the "Nationwide Map of Scientific Features" was published in July 2017.

Classification of area into 4 colors based on scientific features

- ◆ **Orange:** Areas close to a volcano, active fault, etc.
- ◆ **Silver:** Areas with underground mineral resources
- ◆ **Green:** Areas assumed to be favorable
- ◆ **Dark green:** Areas assumed to be preferable also from the viewpoint of safe waste transportation

Read more about a map



Use this QR code to view the article.

* Even in the green areas, step-by-step investigations need to be conducted to confirm precisely whether a particular location satisfies the required conditions for geological disposal.

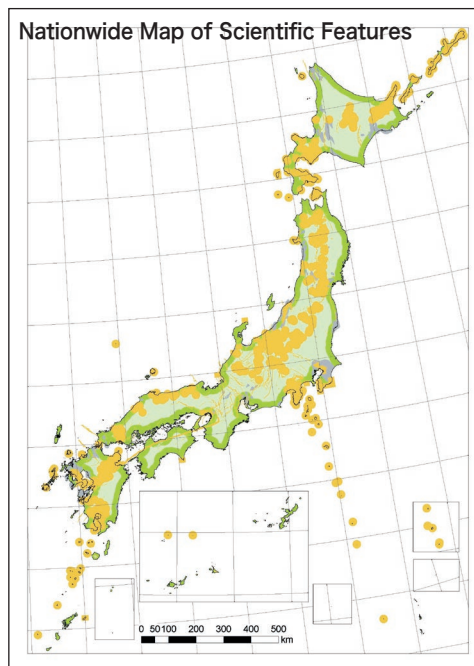
https://www.enecho.meti.go.jp/en/category/electricity_and_gas/nuclear/rwm/

Read more about the literature survey

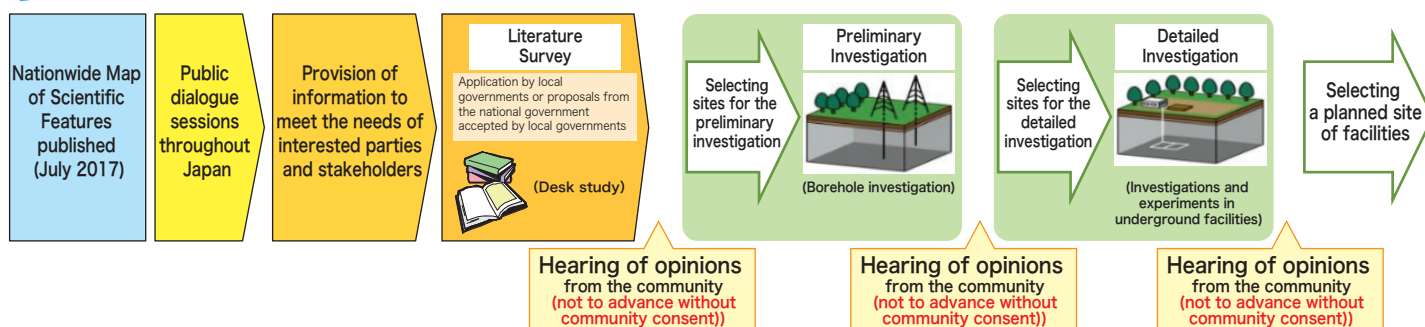


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Since the Nationwide Map of Scientific Features was published, public dialogue sessions with local people have been held throughout Japan. Building on these past efforts, dialogues will continue to be held across Japan aiming to conduct literature survey in as many areas as possible.



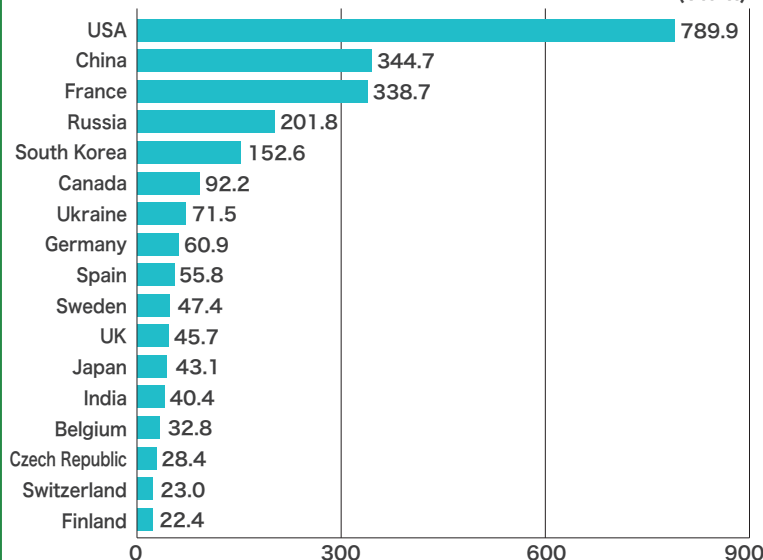
No radioactive substances will be brought into the target area during the investigations period which is expected to be approximately 20 years.



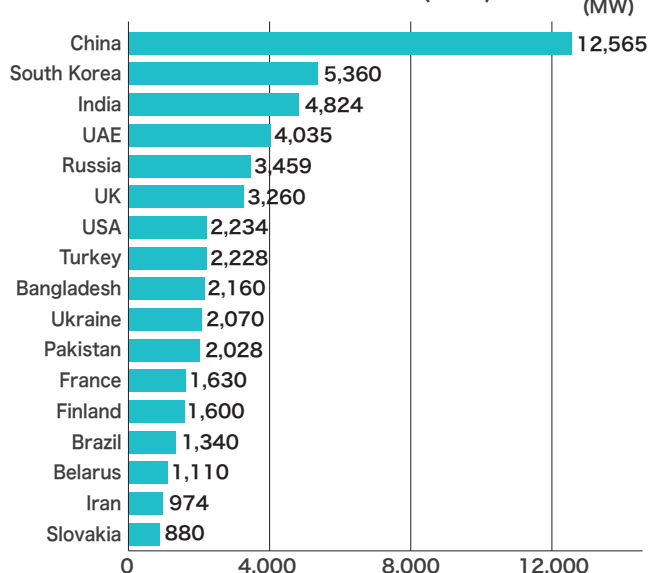
Column: Global trends in nuclear power generation

From the viewpoint of the total output results of nuclear power generation, the leading countries are, in order, the United States, China, France, Russia, and South Korea. However, for the generation capacity of nuclear power plants under construction, China will be the leader as it is constructing an overwhelmingly large number of plants.

World power output of nuclear power plants (2020) (TW·h)



Power generation capacity of nuclear power plants under construction (2020) (MW)



Source: IAEA Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 REFERENCE DATA SERIES No. 1 2021 Edition

10. Energy Efficiency

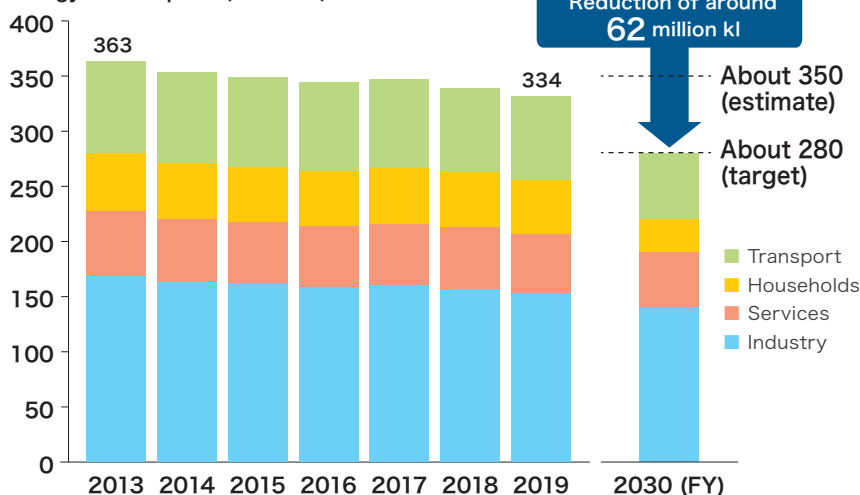
Energy Efficiency

Q How much energy efficiency has Japan accomplished?

A Japan has strengthened its efforts to improve energy consumption efficiency and achieved a reduction in energy consumption by about 62 million kl crude oil equivalent. The goal is to improve energy consumption efficiency by about 40%, to reach an all-time high level.

Final energy demand with the currently planned energy mix

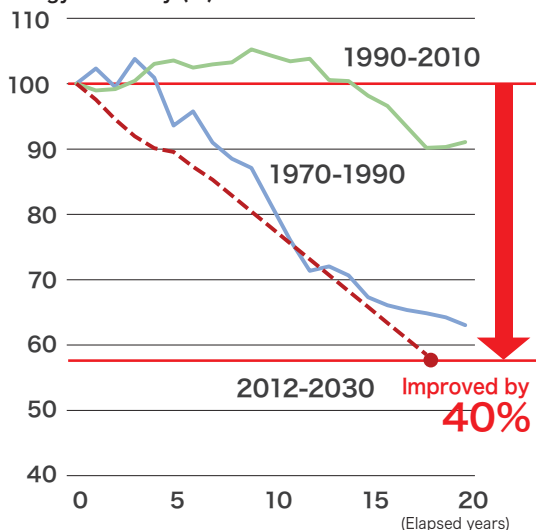
Energy consumption (million kl)



Source: Created based on "Comprehensive Energy Statistics of Japan", published by the Agency for Natural Resources and Energy; "System of National Accounts", published by the Cabinet Office; and "Handbook of Japan's & World Energy & Economic Statistics", published by the Institute of Energy Economics, Japan.

Energy efficiency improvements

Energy efficiency (%)



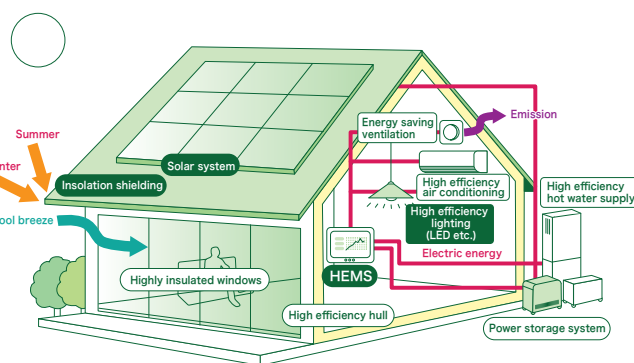
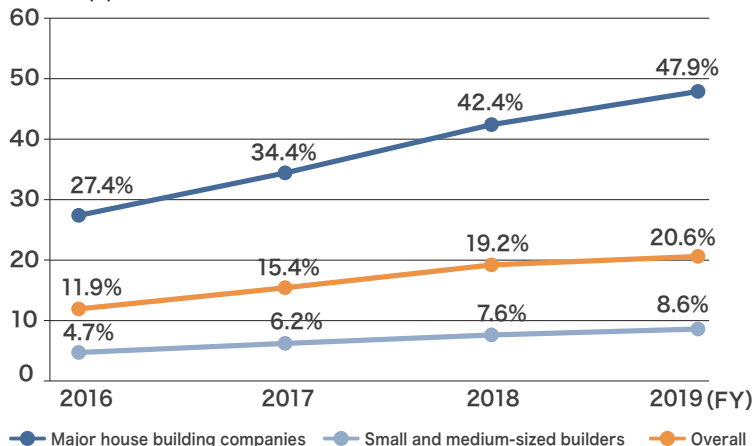
* Assuming energy efficiency in 1970, 1990, and 2012 to be 100
* Energy efficiency = Final energy consumption / Real GDP

Improvement of energy-saving efficiency performance of ZEH houses and buildings

In the business/housing sector, with the aim of ensuring energy efficiency at the level of ZEH/ZEB standards for new houses and buildings built after 2030, efforts are underway to make energy efficiency standards mandatory and raise those standard levels under the Act on the Improvement of Energy Consumption Performance of Buildings, as well as raise the "top-runner" standards in building materials and equipment.

Trends in the ZEH ratio of new custom-built homes

ZEH ratio (%)



ZEH (net Zero Energy Houses) are houses that make the balance of annual primary energy consumption net zero while maintaining indoor comfort levels. They achieve significant levels of energy efficiency by using high-performance heat insulation on the exterior of the homes and adopting highly efficient equipment and systems, while also using renewable energy.

Basic terms "ZEH."

ZEH is an abbreviation for net Zero Energy House, which means a house that consumes zero energy in a year, or even contributes surplus energy back to the power grid.

<https://www.enecho.meti.go.jp/about/special/johoteikyozeh.html>



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Contact : Research and Public Relations Office, General Policy Division, Director-General's Secretariat, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry
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