



Transition of Japan's Energy Policy Under Carbon Neutrality Goals

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How to cite this paper: Ruijia Zhang, Mengyu Li, Xiaoyue Wu, Xiao Gao. (2024) Transition of Japan's Energy Policy Under Carbon Neutrality Goals. *Engineering Advances*, 4(3), 126-129.
DOI: 10.26855/ea.2024.07.003

Received: June 12, 2024

Accepted: July 8, 2024

Published: August 5, 2024

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Abstract

Japan has traditionally relied heavily on the global marketplace to meet its energy demands. However, with the emergence of global initiatives aimed at promoting new energy policies and achieving carbon neutrality, Japan has been compelled to undergo a significant transformation in its energy consumption structure. The analysis of Japan's energy policy transformation commences with a thorough examination of its current energy consumption patterns. Furthermore, it delves into the various factors that have influenced these consumption patterns. In response to the global push for clean energy and carbon reduction, Japan has embarked on a journey to diversify its energy mix and reduce its reliance on fossil fuels. Additionally, Japan is also promoting energy conservation and efficiency measures to reduce overall energy consumption and waste. The article further explores the challenges and opportunities that Japan faces in its energy policy transformation. Moreover, it highlights the role of international cooperation and partnerships in helping Japan achieve its energy policy goals. In conclusion, Japan's energy policy transformation is a complex and ongoing process that involves a multifaceted approach. By diversifying its energy mix, investing in renewable energy sources, and promoting energy efficiency, Japan is paving the way towards a more sustainable and resilient energy future.

Keywords

Carbon Neutrality; Japan; Energy Policies; Energy Sources

1. Energy consumption structure

Japan is a highly industrialized country, and its energy consumption is enormous to meet the basic requirements of major cities. However, Japan's energy storage is scarce, and 99.68% of oil, 97.56% of natural gas, and 99.35% of coal [1] are imported, with a much higher dependence than other countries. Its energy self-sufficiency rate is only about 4%.

Rely on natural gas and coal. Firstly, in terms of natural gas, Japan is the second largest consumer in the world. According to relevant data, Japan's natural gas imports in 2020 were 76.36 million tons, of which more than 60% was used for power generation. Currently, Japan mainly relies on natural gas suppliers in Australia (40% of imports) and Malaysia (14% of imports). Secondly, in terms of coal, coal accounts for the second highest proportion of total power generation in Japan, but this is also a helpless move. Coal-fired power generation will emit a large amount of carbon dioxide and other harmful substances, which should be eliminated in the context of pursuing the goal of carbon neutrality. However, in fact, Japan cannot give up coal-fired power generation, mainly because the supply of coal is relatively stable and the resources are very abundant, which can be found in Europe, Asia, North America, and Oceania. Japan does not need to purchase coal from distant places such as the Middle East; besides, coal is cheap, with the price per unit of heat being 1/2 of that of oil and 1/3 of that of natural gas, which can help save a large part of fiscal expenditure.

Fossil energy power generation in Japan accounted for 76.3% in 2020, of which oil accounted for 6.3%, coal accounted for 31%, and natural gas accounted for 39%. Fossil energy power generation produces greenhouse gases during combustion, which has an impact on the warming of the earth. Nuclear power, which does not produce greenhouse gases, currently

accounts for 3.9%, while renewable energy accounts for 19.8%. Among the 19.8% of renewable energy, solar power generation accounts for the highest proportion of 7.9% (in 2012, Japan adopted a Feed-in Tariff (FIT) system, which greatly increased the proportion of solar power generation), followed by hydropower generation with a proportion of 7.8%, followed by biomass power generation with a relatively low proportion of 2.9%, wind power generation with a proportion of 0.9%, and geothermal power generation with a proportion of 0.3%.

2. Energy crisis issue

As mentioned earlier, Japan suffers from a lack of energy storage and an unreasonable and imbalanced energy consumption structure. With the intensification of the global energy crisis in the second half of 2021 and changes in the international situation, Japan's internal energy crisis issue is gradually emerging and becoming more severe.

Firstly, the nationwide "electricity shortage" is inevitable. The electricity price in Japan has skyrocketed, and the power supply reserve rate is low, resulting in a severe situation of electricity supply nationwide. The Japanese government has asked the citizens to "reduce electricity consumption as much as possible" from July 1 to September 30, 2022. The crisis is also reflected in the decline of power supply capacity and the continuous rise of electricity prices of power companies. Firstly, the power supply capacity of most power utilities in Japan is already at a "dangerous level". The power supply reserve rate of several major power supply companies such as Tokyo Electric Power Company is only about 3%, and there is even a possibility of negative values. Usually, the power supply reserve rate is maintained at 7%-8% before it becomes stable. In addition, statistics from the private credit bureau Empire Database in Japan show that as of April 2021, there were a total of 706 electric power companies registered in Japan. So far this year, 31 have decided to withdraw from the business, of which 14 electric power companies have declared bankruptcy due to "high electricity prices". Secondly, many Japanese power producers have repeatedly raised electricity prices, affecting residents' lives. As early as 2017, data showed that 3.3% of households in Japan reported arrears in electricity bills due to economic reasons, with single-parent households reporting arrears in electricity and gas bills at 15.0% and 17.7% respectively. More than 10% of single elderly male households reported that they could not maintain a suitable temperature in their homes due to economic reasons [1]. In August 2022, the Chubu Electric Power Company announced that the average household electricity price would increase by 78 yen from October, reaching the national limit of 9189 yen (People's Daily Online Tokyo August 31st).

Secondly, the new energy strategy is "showy but hollow". Japan's newly proposed new energy-related strategic plan lacks pertinence and relies too much on technologies still in development. In order to stabilize energy supply sources and reduce energy dependence on other countries, Japan has long been exploring the development of renewable energy. According to the clean energy strategy draft released by Japan in May 2022, in the next 10 years, Japan will invest 150 trillion yen to promote the development of innovative technologies such as clean energy and hydrogen-derived ammonia; Japan will also issue a new type of government bond called "green economic transformation bond" to provide financing for decarbonization measures. However, careful research shows that this energy strategy draft not only lacks basic details such as government funding and incentives, but also fails to mention the issuance rules and financing details of government bonds.

Third, restarting nuclear power involves high risks and numerous challenges. Faced with numerous energy crisis issues, Japan is attempting to restart nuclear power to alleviate the situation but is met with strong opposition from both domestic and international public opinion. Domestic citizens also hold a cautious attitude towards restarting nuclear power, and discussions surrounding nuclear power often become stagnant. In addition, restarting nuclear power requires strict examination and must pass the final risk evaluation by the Atomic Energy Regulation Commission. However, this evaluation process is lengthy and stringent, with some electronic companies "stumbling at the last mile" during the review process [2]. Once stricter restart standards are introduced, power companies will face explosive costs in renovating nuclear power plants to meet the new safety standards. This means they may pass on the high renovation costs to end consumers by raising electricity prices [3]. Furthermore, although the Atomic Energy Regulation Commission in Japan has established strict safety guidelines for restarting nuclear power, these standards mainly focus on nuclear leakage accidents and do not take into account new threats such as cyber security and climate change. Climate change, in particular, is causing sea levels to rise, which will further increase the threat of extreme weather events such as tsunamis to Japan's coastal nuclear power plants.

Fourthly, it is difficult to break free from dependence on Russian energy. Since the Russia-Ukraine conflict, the international environment has been changing. Japan is highly dependent on Russia in terms of energy, especially natural gas. Although it has repeatedly expressed "verbal" sanctions against Russia, it cannot take too many actions in practice. Japan and Russia have collaborated on the construction of two major liquefied natural gas (LNG) production projects, Sakhalin Island 1 and 2, in the Far East region. The joint venture partners for this project include Gazprom (50%), Mitsui (12.5%) and Mitsubishi (10%) from Japan, as well as Shell (27.5%) from the UK. The project has been transporting liquefied natural gas since 2009, with an annual gas transmission capacity of up to 10 million cubic meters, with 60% exported to Japan. Data shows that in 2021, the total value of liquefied natural gas imported by Japan reached 4.3 trillion yen, and the

value of the Sakhalin Island 2 project, which is cooperating with Russia, reached around 300 billion yen [3]. Japanese Prime Minister Fumio Kishida has made it clear that Japan will not abandon the Sakhalin 2 liquefied natural gas project in Russia.

3. Energy policy transformation and adjustment

Energy issues are the bottleneck restricting Japan's economic development. The Japanese government has been working hard to formulate and implement various energy policies that diversify the composition of energy, diversify energy imports, and save energy simultaneously. Since October 2021, when Shinzo Abe became Prime Minister of Japan, the Japanese government has faced a continuously turbulent international environment, which has caused an unprecedented and tremendous impact on Japan's energy security environment. In order to ensure the safety and sufficiency of its energy supply, the Japanese government has adjusted its energy policy, mainly showing the following new trends.

3.1 Emphasis on the priority development of renewable energy

In order to achieve the goal of "carbon neutrality by 2050", Japan has mainly adopted two implementation paths. The first is to reduce its dependence on traditional energy sources such as coal and crude oil, and the second is to vigorously develop green and clean energy. In October 2021, the Japanese government identified a number of documents related to energy transformation, including the Sixth Edition of the Basic Energy Plan, the 2030 Energy Supply and Demand Outlook, and the Long-term strategy under the Paris Agreement. The Sixth Edition of the Basic Energy Plan proposed for the first time that renewable energy should be given "top priority" development and the proportion of renewable energy power generation in 2030 will be increased from 22%-24% to 36%-38%. The new version of the energy plan means that by 2030, Japan's renewable energy power generation will be twice as high as that in 2019.

Japan's total energy demand is expected to decrease from about 363 million tons of oil equivalent in 2013 to about 280 million tons of oil equivalent in 2030. The primary energy supply to meet the energy demand after energy conservation is expected to be about 430 million tons of oil equivalent, of which oil accounts for about 30%, renewable energy 20%, natural gas 20%, coal 20%, and nuclear 10%. The self-sufficiency rate of energy has reached 30%, which is 5% higher than the target set in the Fifth Energy Basic Plan in 2015.

3.2 Vigorously promote the optimization of energy structure

Promoting the optimization of Japan's energy structure is a key point in the transformation and adjustment of energy policies, of which supporting the development of nuclear energy and promoting the development of hydrogen energy are two main contents.

First, support the nuclear energy development plan. Due to the impact of the Fukushima nuclear leak accident, the suspension of nuclear power directly led to a surge in Japan's alternative fuel expenditure. The new version of the energy basic plan proposes that nuclear power is crucial for decarbonizing society, and also mentions that the government will minimize its dependence on nuclear power as much as possible, indicating the Japanese government's cautious attitude towards restarting nuclear power. However, the recent rising costs of importing liquefied natural gas and oil in Japan have exacerbated the energy shortage situation in Japan, and the Japanese government's position on nuclear power has become increasingly clear. In May 2022, Japanese Minister of Economy, Trade and Industry Hagiuda Guang said, "The purpose of the clean energy strategy is to make full use of all available resources including nuclear energy under the premise of safe use of nuclear energy to cope with energy supply shortages and other situations." Prime Minister Fumio Kishida also spoke in support of nuclear power, saying that restarting nuclear power plants is the key for Japan to overcome difficulties.

Second, vigorously promote the development of the hydrogen energy industry. In the 1970s, Japan began to carry out research and development of hydrogen technology. After the Fukushima nuclear leakage incident, then-Prime Minister Shinzo Abe proposed the goal of building a "hydrogen energy society". In October 2021, the basic plan for energy clearly stated that the proportion of hydrogen energy in the energy structure should reach 11% by 2030. In 2022, the Agency for Natural Resources and Energy and the Ministry of Economy, Trade and Industry (METI) of Japan issued two reports, both of which explained Japan's hydrogen energy development strategy in detail.

3.3 Stabilize energy prices through multiple means

In addition to developing renewable energy and adjusting the energy structure, the Japanese government has also taken a series of measures to stabilize the fluctuating energy prices in the country, including releasing crude oil reserves to stabilize energy prices, increasing financial subsidies for energy-related companies, and restarting offshore oil and gas exploration. Through a number of effective measures, the Japanese government has been able to stabilize energy prices.

First, the emergency release of crude oil reserves. In order to cope with energy shortages and price increases, and to stabilize the confidence of the Japanese people, the Japanese government has released oil reserves urgently to curb the

rise in energy prices. On April 7, 2022, the Japanese government announced that it would release 15 million barrels of oil, of which 9 million tons came from national reserves and 6 million tons came from private reserves. This is the first time that Japan has released national oil reserves on the grounds of concerns about insufficient supply.

Second, increase subsidies in the energy sector. In order to alleviate the negative impact of rising prices on consumers and small and medium-sized enterprises, the Japanese government has increased subsidies in the energy sector. On April 26, 2022, the Japanese government launched an emergency economic response with a total of 6.2 trillion yen, of which the largest part of the expenditure was used to cope with soaring energy prices [6].

Third, restarting offshore oil and gas exploration. On January 17, 2022, the International Petroleum Development Company, Japan's largest oil and gas development company, announced that it would conduct exploration operations in the waters of Shimane and Yamaguchi Prefectures from March. This is a preliminary exploratory mining for the development of oil and gas fields and is also the first offshore oil and gas field mining project in Japan for about 30 years. This project is of great significance for alleviating the difficulties caused by high energy prices and improving Japan's energy self-sufficiency rate.

Funding

This paper is funded by the Fundamental Research Funds for the Central Universities (2023MS161); The key research project of humanities and social sciences of the education department of Hebei province (ZD202310).

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