Japan's Action for Reaching the Target of Carbon Neutrality

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Abstract. Nowadays, global warming involves in many aspects of our daily life and plays a crucial part in global economy, science-technology development, and the environment. Many countries care about the issue of carbon neutrality, which tends to cut down emissions. This paper will focus on Japan's participation in carbon neutrality in different fields. Its target is to seek some effective approaches to carbon neutrality goal. The research analyzed 15 articles screened from Google scholar. The conclusion is that Japan has taken plenty of measures in manufacturing, new energy, and many other fields to promote carbon neutrality.

Keywords: Carbon neutrality; Japan government; new energy; Carbon price mechanism.

1. Introduction

Carbon neutrality means countries, businesses, products, activities, or individuals in a certain time, directly or indirectly the carbon dioxide or greenhouse gas emissions, through the use of low carbon energy to replace fossil fuels, tree planting, energy conservation, and emissions reduction, such as form, to offset the carbon dioxide or greenhouse gas emissions, achieve offset, achieve relatively "zero emissions" [1]. The concept came up in the 1990s. It captured the attention both of the government and the public. In recent years, many countries set the target time to reach carbon neutrality. They also made some policies accompanied by the target. Carbon neutrality becomes more and more vital in global climate governance.

Many scholars focus on climate change and reducing emissions. Kurramovich, K.K. et al. make a road map for carbon neutrality [2]. Herrador, Manuel, et al. Finished a comparative study between Japan and South Korea about Circular economy and zero-carbon strategies [3]. Zahedi, A. even did some research on renewable energy like solar energy at ***an*** early time [4]. However, there are few articles concerning a country's specific carbon neutrality policies. And nearly no scholars focus on Japan' action about carbon neutrality, which country has huge impact on global environment and economy. Japan is the birthplace of the Kyoto Protocol and its low-carbon development strategy started earlier. As an economic power and a small country in resources, Japan is extremely short of energy and highly dependent on imports for energy supply, with the import rate up to 95%. At the same time, as an island country, Japan is far more affected by global climate change than any other country. Global warming is likely to have profound effects on Japan's land, agriculture, fisheries, environment, and national health. In this context, Japan has long attached great importance to low-carbon development and upheld the priority strategy of energy conservation and comprehensive utilization of resources. In 2020, Prime Minister Yoshihide suga announced that Japan aims to be carbon neutral by 2050 and "will make every effort to build a green society with a virtuous economic and environmental cycle as the pillar of its growth strategy" [5]. Considering the above reasons, low-carbon development and the priority strategy of energy conservation and the comprehensive utilization of resources adopted by Japan are of great research value.

This paper would like to reveal the Japan s goal of carbon neutrality and the measures Japanese government has taken. This paper uses 'Japan carbon neutrality' as a keyword to search articles from 2000 to present on Google Scholar. After screening, a total of 15 articles were included in the analysis scope of this paper.

2. Japan's participation about carbon neutrality in different fields

The Japanese government's carbon-neutral plan can be traced back to the 'Kyoto Protocol targets implementation plan' in 2005. It divided the objects of Kyoto Protocol into different aspects. The carbon dioxide emissions from energy sources increased by 0.6%, the gas emissions from non-energy sources decreased by 1.2%, the gas emissions from fluorination and other three gases increased by 0.1%, the gas emissions from forest carbon sinks decreased by 3.9%, the gas emissions from foreign countries decreased by 1.6% through CDM projects, and the total reduction of greenhouse gas emissions was 6%. Different source causes a different amount of emissions. (See Figure1 in Appendix)

2.1. The Carbon Price Mechanism

The Japanese government also plans to introduce a carbon price mechanism to help cut emissions, with a system of charging based on carbon dioxide emissions to be set in 2021, according to Kyodo News [7]. It is understood that carbon pricing is a mechanism that requires enterprises and households to bear the cost of carbon dioxide emissions, aiming to reflect the environmental and social impact of carbon-intensive goods and services by making them more expensive. It mainly includes five forms: carbon tax, carbon emission trading system (ETS), carbon credit mechanism, results-based climate finance (RBCF), and internal carbon pricing [8]. At present, Tokyo and Saitama Prefecture in Japan are implementing carbon emissions trading. Tokyo ETS was established in 2010 and Saitama ETS in 2011. Regional carbon trading system is an innovation of Japan's carbon trading system. Both regions adopt the Cap&Trade model with compulsory participation, which is independent and linked to each other.

What's more, Japan has also established a Subsystem of carbon price mechanism---Joint credit mechanism (JCM). JMC is designed for helping host country with financial and technical support to implement emission reduction projects. Thus it can meet Japan's own obligations to reduce emissions. Additionally, In 2014 the Japanese government has invested $71.1 million to set up joint credit mechanism fund, managed by the Asian Development Bank The fund aims to provide funding support for developing member countries of the Asian Development Bank, and encourage the financing and management in the Asian Development Bank's sovereignty and sovereign project adopts advanced low carbon technologies By 2019, the fund has been sent to five adopts advanced low The Carbon Technology program provided $31.6 million in funding [9]. Japan's composite mechanism of carbon trading and carbon tax has played a crucial part in encouraging the market to reduce emissions.

The carbon price is a vital system to limit emissions from companies and factories. Though some enterprises suppose that it will increase the economic burden and make the budget rise sharply, the Japanese government intends for a national promotion. The officials of the Ministry of environment state it will raise people's awareness of low carbon [10].

2.2. New Energy

In the past, the primary energy in Japan was coal. Because of the lack of energy, Japan always imported coal and oil from foreign countries. Due to the rapid development of the economy and industry, imports of coal have risen dramatically since the 1960s (See Table 1). After the 2011 Great East Japan Earthquake, nearly a third of the country's nuclear power plants were offline. Consequently, the demand for coal was rising again.

Table 1. Changes in domestic coal production and imports in Japan [11].

(/thousand tons)

Year	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Production	50113	38329	18597	18095	16454	7980	6317	3126	1114	917	1308
Imports	16936	50950	62339	72711	93691	104835	124170	145278	180808	184560	188409
Degree of self-sufficiency	74.7%	42.9%	23.0%	19.9%	14.9%	7.1%	4.8%	2.1%	0.6%	0.5%	0.7%

However, coal is facing with being displaced. The goal of '2050' lays out a clear plan for clean power generation in Japan, aiming to quadruple the share of electricity generated from renewable to 50-60% by 2050, compared with the current level, while maximizing the use of clean energy such as nuclear, hydrogen and ammonia. Offshore wind will also be a major focus of Japan's future power sector [12]. The offshore wind power industry and energy storage battery industry will be the top priority of strategic growth industries.

Japan's domestic electricity demand is expected to surge by 30-50% by 2050 as industry, transport and household electricity are electrified at an accelerating pace, the government said. Around half of its electricity will come from renewable sources; 10% of electricity will be supplied by hydrogen and ammonia; the remaining 30-40% comes from nuclear power and coal-fired power stations equipped with carbon capture technology. Decarbonization of the power sector is a prerequisite for the green development of all key industries. Japan will maximize the use of hydrogen power generation, reduce the cost of hydrogen energy, and use ammonia combustion does not produce carbon dioxide as a fuel for power generation, and develop an ammonia fuel industry; Since coal-fired power generation will have to be partly relied on for a long time, the carbon dioxide recovery industry must be developed to reduce the carbon emissions of coal-fired power generation. The Japanese government is committed to building a multi-tiered energy structure to minimize the use of traditional energy which will emit too much carbon.

In addition, for 2050 carbon neutral, not only need clean energy, especially renewable energy gradually replace fossil energy, innovation energy structure, also need to solar energy, wind power easily with the weather changes the output of energy power supply network, an energy storage device for digital precision control, in order to reduce energy waste, achieve energy saving. At the same time, energy terminal consumption, such as electric vehicles, fuel cell vehicles, unmanned aerial vehicles, aerial vehicles to realize autonomous driving, as well as a large number of factory robots and automation control, residential buildings using intelligent energy control systems and other electrification, intelligent, energy-saving upgrading are inseparable from digitalization. Digital infrastructure is an important basis for supporting the green transformation and upgrading of industries and realizing the great green development [13].

2.3. Manufacture

Japan is a country with a developed manufacturing industry. The manufacturing industry is a major source of carbon dioxide. So how to reduce the emissions produced by the process of manufacture becomes the key point of the policy.

The government's strategy explicitly states that petrol-powered cars will be phased out in Japan over the next 15 years, leaving the gap to be filled by hybrid and electric vehicles. During this period, the government will also accelerate the reduction of the overall cost of electric vehicles. For example, the Japanese government plans to cut the battery cost of electric vehicles to 10,000 Yen/kWh by 2030. Reduce charging and other related costs to bring the burden on electric car users to the same level as those on petrol-powered cars [14].

However, for Japan at the moment, it will be a big challenge to phase out fuel cars altogether. Of the more than 60 million people employed in Japan today, more than 5 million are employed in the manufacturing, sales, and service industries. It has many famous motor companies like Honda, Mitsubishi, and Toyota. In particular, some large auto companies are associated with many parts suppliers. Once the sale of fuel vehicles is stopped, serious unemployment will be caused. In addition, the development environment of electric vehicles in Japan is still not perfect, and the serious shortage of charging stations restricts the popularity of electric vehicles. It still has a long road to take to displace fuel cars with electric vehicles.

Besides the auto industry, Japan has implemented emission reduction measures in industries such as construction. The government plans to vigorously develop and popularize new building materials, and promote the middle and high-rise buildings using wood or wood biomass new materials to replace plastic and other fossil materials for building materials, thus reducing carbon emissions. One strategy

determines that the development of the carbon dioxide recycling industry will focus on minerals such as concrete, algae, and biomass fuels, and biomass chemical products to promote cost reduction, expand the use of technology development and obtain the international market.

2.4. Other Effective Measures

Although the policies in the carbon price mechanism, new energy, and manufacture are quite typical and representative. Japanese government and society come up with many other effective and constructive methods to get closer to the goal of carbon neutrality.

The New Energy and Industrial Technology Development Organization (NEDO), the national research and development legal entity, will set up a 2 trillion Yen fund to continue to support the green development of electricity and the relative enterprises in key areas such as electrification, hydrogen society, carbon dioxide capture and reuse in the next 10 years. It appeals to people to innovate with new technologies [15].

The Japanese government is keen to involve the public in this issue. Japan will formulate policies and measures to guide private investment in green, transformation, and innovation. For example, the government will set up a transformation fund to support necessary technologies in the transformation stage, and an innovation fund to support enterprises committed to decarbonizing innovation [16].

To achieve the goal, the government has not only kept an eye on domestic affairs but also uses diplomacy--strengthen cooperation with major countries. The strategy of 2050 points out that the Japanese government will cooperate with the United States and Europe in innovation policy and technology standardization in key areas in the future. At the same time, the government also cooperates with a large number of emerging countries and international organizations (such as IEA and ERIA) to promote bilateral and multilateral cooperation from the perspective of market access. We will hold international conferences and strengthen international communication and cooperation. In the future, the Japanese government will hold intensive energy and environment-related conferences, bringing together world leaders and experts in various fields to discuss carbon neutrality. At the same time, the Japanese government will promote green growth strategies to the world and strive to promote exchanges and cooperation between advanced scientific research institutions. Japan looks forward to playing an increasing role in global climate governance [17].

3. Conclusion

Relying on its own economy, science and technology, industrial characteristics, and its international status, Japan has made various policies, strategies, and plans in order to fully implement the carbon neutrality target. Firstly, Japan’s government built the system of carbon price mechanism more than ten years ago, which led the world. In addition, when it comes to new energy, Japan is actively promoting decarbonization and exploring renewable energy. What’s more, in manufacturing, Japan speeds up the use of new building materials and develops new energy vehicles. However, some of these strategies are still ideas and they are still in their infancy. In the future, scholars and researchers ought to attach more importance to the implementation of these measures and their impact on the local environment, Japan's carbon neutrality process, and even foreign countries, aiming to find some beneficial experience for a global carbon neutrality goal.

Appendix

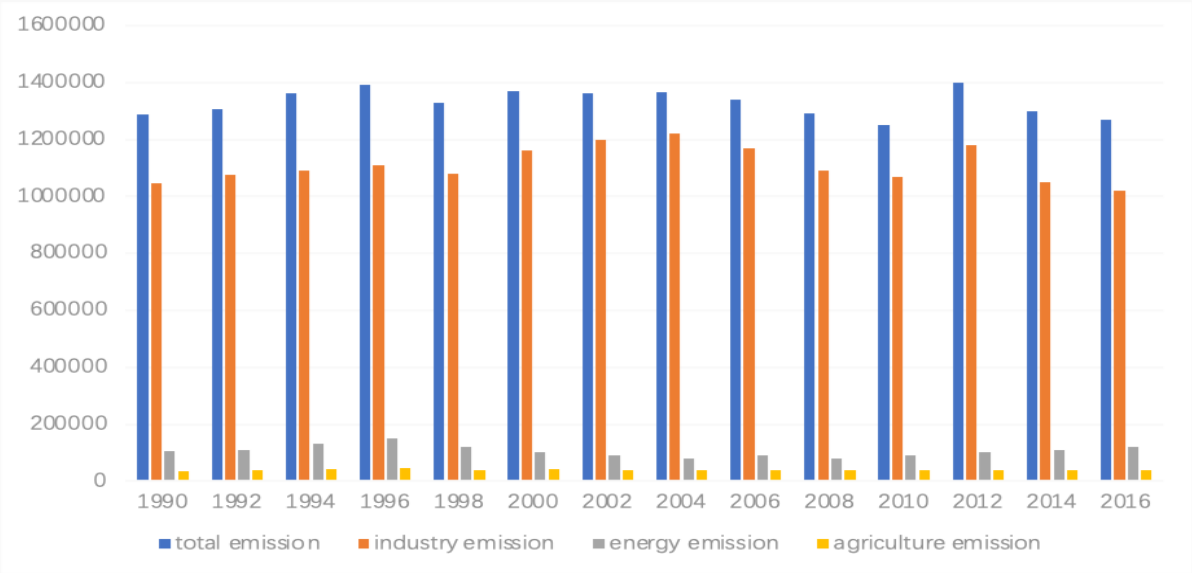

Figure 1. Emissions trends by category in Japan (/hundred tons) [6].

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