Application of Clean Energy in Transportation Infrastructure

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Abstract. It is of great significance to optimize the structure of transportation energy, promote the application of clean energy, and promote the comprehensive realization of new energy and clean transportation infrastructure. This paper describes the development process, application status and practical significance of clean energy in transportation infrastructure at home and abroad. By comparing the application of clean energy in transportation infrastructure at home and abroad and combining with the actual situation, feasible suggestions are put forward, and the future development prospect of clean energy in transportation infrastructure industry is predicted.

Key words: clean energy, transportation infrastructure, application status, development prospect, implementation suggestions.

1. Introduction
With the development of the times, the number of motor vehicles is increasing rapidly, and the problem of traffic pollution is becoming increasingly prominent. At the same time, the limited resources on the earth are gradually decreasing, and the traditional energy can no longer meet the needs of social development. It has become an important task to promote the development of clean energy application in transportation infrastructure. Since the beginning of the 20th century, various countries have embarked on the road of developing clean energy, setting up special research institutes to study clean energy and improve the utilization rate of clean energy. The application of clean energy in transportation infrastructure, such as supplying power supply system with solar energy, wind energy, water energy, tunnel energy consumption, mechanical and electrical equipment, can effectively reduce carbon dioxide emissions and environmental pollution, which is one of the important ways to implement environmental protection measures. The development of clean energy is not only conducive to alleviate the phenomenon of environmental pollution, but also an important means to effectively promote national economic progress.

2. Development history of clean energy

2.1. Foreign development history
The awareness of environmental protection in the United States began very early, but the real political strategy for energy began in the 20th century. In the 1970s, the price of oil soared rapidly due to the
problems of oil. The U.S. government realized the country's great dependence on energy. Since then, it has started large-scale research and development of renewable energy [1]. In "Ecological Economic Revolution - Five Steps to Save the Earth and Economy" published in 1999, it is pointed out that "the first task is the reform of energy economy", which has laid an important position of clean energy [2]. In 2009, the Obama administration proposed to increase investment every year within 10 years to create 5 million new energy, energy saving and other jobs. Professor of the University of Illinois in the United States believes that the intercontinental Highway Act, which was implemented in the United States in 1956, made the country invest a lot of money in the construction of expressways, and the investment in public transportation was seriously insufficient, resulting in a significant decline in the quality of service. In the same year, despite the outbreak of the global economic and financial crisis, the U.S. policy on energy still made major adjustments: the introduction of the bill affirmed the importance of clean energy [3]. In the late 1990s, clean energy has become a more common automotive energy materials.

The concept of "low-carbon economy" was formally put forward in "Our Future Energy: Creating a Low Carbon Economy" published in the UK [4]. The UK has long realized that low-carbon economy is the only way for better quality of life in the future, and it also provides more jobs for the unemployed.

2.2. Domestic development history
At the beginning of the founding of China, there was a serious shortage of national resources, not only a small output, but also a low level of equipment quality. According to statistics, in 1949, China's raw coal production was 30 million tons, crude oil production was 120000 tons, natural gas production was 10 million cubic meters, and power generation was only 4.3 billion kwh [5]. In the late 1990s, China began to appear liquefied gas vehicles and filling stations. In the 70 years since the founding of the People's Republic of China, all aspects of our country are gradually improving, but environmental pollution has had a huge impact on people's lives, and the country has begun to pay attention to the development of clean energy industry. Clean energy has become an important part of energy consumption, which can not be ignored. Since the 21st century, China has seized the opportunity to vigorously develop clean energy, rectify in many ways, drive the relevant industrial chain, and promote economic development.

3. Evaluation and analysis of the application of clean energy in transportation infrastructure

3.1. Application status abroad
By 2015, the solar energy application market of all countries has made initial achievements, and the development speed is amazing. The first solar power station in the world is odejo power station in France. Although its power generation rate was not high at that time, it laid the foundation for the follow-up research and development. The United States is very supportive of the development of clean energy, and has always been in a leading position in technology. Los Angeles has built a solar Bus Station Pavilion, which uses solar energy to provide power for the whole station. The government encourages public transportation, experiences the application of clean energy in transportation infrastructure and green energy charging station, and plans to popularize clean energy bus stations in the next few years [6].

The energy crisis in the 19th century has always been a warning to the British government. Since then, the British government has attached great importance to energy issues, and has always been in the forefront in the development and application of new energy. Whether in universities or in society, the development of clean energy is a very important topic. Britain has also made great contributions to the international solar energy development. The new solar cell technology developed in the UK not only improves its safety, but also improves its appearance. The design of solar-powered bus stops is also a popular research topic in the UK. Solar power supplies 24-hour power to bus stops, bringing more convenience to people, and becoming an indispensable part of people's lives [6].

Spain has a good geographical location, sufficient light conditions and enough land, which is a great advantage for the Spanish government to develop clean energy. The Spanish government attaches great
importance to the solar energy industry. With its own excellent conditions, the country vigorously develops solar energy. In its heyday, it even occupied half of the global market. The government implemented subsidies on the application of solar energy to promote its development and promote the application of solar energy industry in Europe. The design of solar bus station in Spain is simple, which can not only supply power all day, but also update bus arrival information in real time [6].

3.2. Domestic application status
Since the founding of the people's Republic of China 70 years ago, China has made continuous progress in all aspects, and the consumption of resources is also growing. China has become the first energy consumption country in the world, so energy development has become an important national research project. China's development of clean energy has been decades of history, initially only the application of heat energy, and later slowly developed into water energy, solar power and other results.

In transportation infrastructure, solar energy is most widely used in railway. The substitution of solar energy for diesel and kerosene greatly reduces the harm to the environment and the economic cost, and can also provide heat for the station. Along the railway, such as communication power stations, passenger stations and other places, solar energy is applied to ensure the signal coverage in some remote areas. In the highway tunnel, most of the tunnels have chosen to replace the traditional high pressure sodium lamp with LED lamp, which has the advantages of energy saving, environmental protection, low loss and so on. The application of solar energy is a more extensive and representative energy in many clean energy. The application of solar energy is the first step of the gradual popularization of clean energy in people's lives [7].

3.3. Practical significance of the application of clean energy in basic means of transportation
The general application of clean energy is an inevitable trend. Whether in politics or economy, the application of clean energy in transportation infrastructure is of great significance.

(1) Opportunities and challenges: weak countries have no diplomacy. The strength of a country depends on its degree of openness and exchange. Clean energy not only plays a role in environmental protection, but also is the key to make the country further international. Opportunities and challenges are increasing China's position in the world.

(2) Promoting economic transformation: new technologies provide new impetus and development space for the application of clean energy in future transportation infrastructure. Now China is in an important period of economic transformation, we should vigorously promote the construction of ecological civilization and promote the sustainable development of the country. The application of clean energy not only reduces the environmental pollution, but also indirectly accelerates the pace of national economic transformation.

(3) To solve the problem of survival: with the growth of China's population, traditional energy is not enough to support people's living needs, and it is likely to be exhausted in the next few decades. Nowadays, clean energy has stepped onto the stage of history and become an important part of world energy consumption.

(4) Alleviating environmental pollution: one of the important reasons for countries to develop clean energy is to reduce environmental pollution. It is found that traditional energy will release carbon dioxide into the atmosphere at the same time. Excessive carbon dioxide release has led to global warming. With the rapid development of society, the number of motor vehicles has increased, and the number of transportation infrastructure has also increased. The popularization of clean energy in transportation infrastructure will effectively alleviate environmental pollution and maintain ecological balance.

3.4. Advantages and disadvantages of clean energy in transportation infrastructure
The application of clean energy in transportation infrastructure has the advantages of energy conservation and environmental protection, policy support and technical support, but also has the problems of unstable performance, high application cost and international security impact [8].
(1) Energy saving and environmental protection: clean energy not only does not need people to destroy the ecological balance to obtain, but also has zero pollution to the environment and absolute security. Most of the clean energy is renewable energy, which can be continuously reused and the development process is relatively convenient. Wind energy facilities can also play the role of ecological protection; solar energy is also one of the cleanest energy sources.

(2) Policy support: China attaches great importance to the development of clean energy, and transportation infrastructure is one of the industries that use clean energy more. In recent years, the strategy of sustainable development has been put forward. Governments at all levels have issued relevant policies to vigorously guide the development and application of clean energy.

(3) Technical support: after years of in-depth exploration and research, China's technology for the application of clean energy in transportation infrastructure has been continuously improved, which has driven the development of related industries, and the industrial system is relatively perfect, and has made many brilliant achievements.

(4) Performance instability: the application of solar energy is limited by the light conditions. Under the influence of external factors such as season, weather, terrain and altitude, the energy is very unstable. However, for the transportation infrastructure, it is very important to supply power at any time and maintain stability. Therefore, it is urgent for the country to strengthen the attention to solving the problem of solar energy savings.

(5) High application cost: compared with traditional wind power and hydropower, the development cost of solar energy, hydrogen energy and other energy is very high, and the application rate of solar energy in people's life is very high. Now the economy has become one of the factors limiting the further promotion of solar energy.

(6) International influence [5]: when individual capitalist countries want to monopolize the market, international political and economic factors may affect the development of clean energy. There are uncertainties in the cooperation and expansion of the clean energy market, which may even affect international security issues.

3.5. Suggestions on the application of clean energy in transportation infrastructure
Although the application of clean energy in transportation infrastructure has achieved initial success, some aspects are still not perfect, which has affected the popularization of clean energy in transportation infrastructure. The application of clean energy can be improved at the management and technical levels.

(1) Strengthen innovation research: the state should pay close attention to the technological innovation of transportation infrastructure and strengthen the research on key technologies. We should encourage the development of the application of clean energy in transportation infrastructure, promote the research of advanced technology, and give priority to the development of the application of clean energy in transportation infrastructure.

(2) Development of management plan [9]: fully implementing the national plan and strengthening the application of clean energy in transportation infrastructure are effective measures to alleviate the current situation of environmental pollution. The application regulations of clean energy in transportation infrastructure should be strictly implemented. We should improve the existing transport infrastructure using clean energy, and build appropriate transport infrastructure at the same time. Strengthen the supervision and management of the safety problems in the industrial application of clean energy, and actively do a good job in the audit and supervision of traffic infrastructure safety.

(3) Consider overall consideration: International Trade and environmental protection. With the increasing pollution of ecological environment, sustainable development of environment should be the first priority, followed by international trade development strategy. All countries should make practical plans [10] to keep environmental protection and economic development going hand in hand.

(4) Accelerate the promotion and application: in the overall planning of the city, we should promote the infrastructure such as public charging stations, so that clean energy can actively participate in the planning and construction of urban regional transportation infrastructure, and give preferential policies to clean energy vehicles.
4. Forecast of the development prospect of clean energy in the future transportation infrastructure

The popularization of clean energy has become a development trend, and there are more possibilities for the application of transportation infrastructure in the future.

4.1. Possible challenges in the application of clean energy in transportation infrastructure

In order to make the technology of clean energy application in transportation infrastructure more mature, there are always different challenges on the way, which are mainly manifested in the following aspects: related industries can not keep up, lack of awareness of energy, immature development technology, etc. [11].

1) Related industries can not keep up: the wide application of clean energy will change the traditional single structure management mode. The application of a variety of clean energy will not only bring convenience, but also breed new industrial modes. The large amount of data that needs to be manipulated in the process has higher operational requirements and integration capabilities for the Internet of things, Internet and other advanced management industries.

2) Lack of awareness of energy: most people lack awareness of the application of clean energy in transportation infrastructure. In the rapid development of transportation infrastructure, a good development atmosphere is very important. The lack of public infrastructure will affect clean energy in the development of transportation infrastructure. Even some policy makers do not realize the importance of clean energy in transportation infrastructure, which is very unfavorable to the development of clean energy in transportation infrastructure.

3) Immature development technology: nowadays, solar energy, wind energy and geothermal energy are widely used in transportation infrastructure. Compared with these, most clean energy has not enough mature development and utilization technology. Economic development is one of the important factors limiting the further development of most clean energy, so the country should develop economy while developing clean energy.

4.2. Development trend of clean energy application in transportation infrastructure

In recent years, clean energy has been widely used in transportation infrastructure. The consumption growth rate of clean energy is increasing, which has become the main part of energy consumption and an indispensable part of national resources. In the future, the economic development model based on clean energy may be formed [12].

After entering the 21st century, the application of clean energy in transportation infrastructure has attracted great attention all over the world. The United States plans to invest a lot of money in clean energy development. In the near future, developed countries may choose clean energy as one of the main sources of heating in winter. The UK plans to reduce greenhouse gas emissions by 60% from 1990 levels by 2050 [13]. To achieve this goal, we need to reduce CO2 concentration by two to three times faster than in previous years [14].

China's consumption of clean energy is huge, and its investment has ranked first in the world for many years. The application of clean energy in transportation infrastructure has also made remarkable achievements. Although the scale of clean energy in transportation infrastructure industry has not yet formed recently, the development of clean energy in the industry has gradually changed from plan to practical application. The government also plans to subsidize the application of clean energy in transportation infrastructure and strengthen the research and development of energy technology. From the perspective of global development situation, China's investment in the application of clean energy in transportation infrastructure conforms to the trend of the times and is an inevitable requirement in the future.

5. Conclusion

At present, the problems of energy crisis and environmental degradation are becoming more and more serious in the world, and the emergence of clean energy is to deal with these problems. The
Transportation infrastructure industry should improve the shortage of clean energy application as soon as possible, comprehensively promote the application of clean energy in transportation infrastructure, and provide strong support for the construction of beautiful motherland and the realization of environmental protection. The focus of transportation infrastructure construction should be around the development of a strict planning system for the use of clean energy, and the efficient promotion of the application of clean energy in transportation infrastructure. Through continuous efforts from all walks of life, the problem of environmental pollution will be alleviated accordingly.

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