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Challenges Faced During the Development of New Energy in China and Possible Solutions

Dikun Chen

Department of Mechanical and Aerospace Engineering, University of Manchester, Manchester, United Kingdom
dikun_chen2006@163.com

Abstract. In the process of advancing the carbon neutrality roadmap, new energy sources occupy a pivotal role, primarily owing to their distinct advantages of low carbon emissions and renewable nature. Despite the new energy is undergoing rapid development, new energy still faces several challenges. These challenges are associated with large-scale power generation and consumption, as well as environmental problems. This article focuses on the challenges that are blocking the development of new energy in China. And this article tries to provide solutions to these problems, which include the construction of additional battery stations to deal with the problem of storage and distribution of energy, and also suggests combining new energy with other types of energy generation technologies, for example solar energy, wind energy and gas turbines to deal with the problem of large-scale power sent and consumption. For environmental problems, the research focuses on the importance of spreading accurate knowledge about nuclear energy. Misunderstanding and fears about nuclear power are common, so educating the public about its benefits and safety measures is crucial. The article also suggests publication of stricter laws and policies to ensure nuclear power plants have the highest safety standards.

Keywords: new energy, solar energy, wind energy, nuclear energy, China

1. Introduction

As a large country with a massive population and substantial electricity consumption, China recorded an annual electricity consumption of 9852.1 billion kilowatt-hours (kWh) in 2024 [1]. Electricity is playing an important role in humans society, and it is getting more and more important day by day. Nevertheless, while environmental issues have emerged as a public concern-with calls for substituting new energy for fossil fuels growing increasingly prominent-and new energy is already undergoing rapid global development, it still faces numerous challenges in its worldwide promotion. And this article focus on the challenges that occurred during the development of the new energy in China and tries to find possible solutions to these challenges occurred.

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2. Current development status of various types of new energy within China

China is rich in solar energy, received an estimated amount of 50*10^18 kJ per year [2] and at least 66.6% of land receiving at least 2200 hours of sunlight per year [3]. Also China is exploiting solar energy by a great amount, according to the stats released by the National Energy Administration, by the end of June 2025, China had achieved an installed capacity of 1.1 billion kW on Solar energy [4].

China is relatively rich is wind energy, with an average wind energy density of 100 watts per square meter across the country, with an estimated exploitable on land wind energy 253 million kW and estimated exploitable close sea wind energy 750 million kW, which sums up to 1 billion kW, which placed third in the world, just behind Russia and America [2]. According to the stats released by the National Energy Administration, by the end of June 2025 had achieved an installed capacity of 570 million kW on wind energy [4].

China is poor in nuclear energy, as the demonstrated reserves of uranium is relatively low, placing eleventh in the World. However, even with such a problem China's nuclear power plant still reaches an installed capacity of 60.91 million kW according to stats published by the National energy Administration [4].

3. Problem occurred during China's new energy development

3.1. Large scale power sent and consumption

Power plants generate electricity with high point and low point, which is the same for power consumption, but most of the time the high point of electricity generation does not match with the time of the high point of power consumption and the same for low point. Even though this problem exists for every type of power plants, it is more significant on solar energy and wind energy, as the generation from these two types of power plants are largely effected by the weather conditions.

For solar energy, the low point of electricity generation usually occurs at night, or on cloudy days, which is the time when the peak of power consumption comes. Which is a challenge for the power grid, because there is a gap between the power generated by the power plant and the power consumption.

And for wind energy, the power generated depends on how strong the wind is. When the wind is strong, wind turbines can generate electricity by a large amount, but when the wind is weak, the wind turbine almost generates no electricity. Solar energy has the same problem as solar energy.

3.2. Environmental problems

In the case of solar energy, solar panels must be installed across extensive sunlit areas to maximize both the efficiency of the panels and the power output of the solar power plant. It is important as the sunlight received by each panel directly effect how much electricity can be produced by each panel, which is crucial for a solar power plant. Also by placings the solar panels in a sunny, open area, the power plant can be easier to manage and maintain.

For example, an ideal solar power plant might be constructed in a desert region where the sky is clear for most of the year, and the land is flat and vast, allowing for the placement of thousands of solar panels in rows with 0.5m spacing and facing 39 degrees up [5]. This placement not only boosts the generation of electricity but also makes it easier to maintain as maintenance crews can easily access each panel for cleaning, repairs, or upgrades.

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Nevertheless, this remains an idealized scenario for solar power plants. In practice, land parcels that meet the criteria of being flat, extensive, and sunlit are scarce—making such sites both time-intensive and cost-prohibitive to identify. Even if the land that satisfies all those conditions are found, it might be far way from industrial centers, so the cost of installing solar panels will rise as the logistics cost rises, also being away from cities will cause an increase in the wages of the maintenance crew. And for some other conditions, there might be no suitable places to build solar power plant at all, because of various reasons.

Nuclear power plants, face environmental problems not only from Earth itself, but also from residents living nearby the nuclear power plant, there are two research shown that the public have concerns and feel unsafe about nuclear power stations [6,7], one of the research shown that only 21.9% residents living nearby a nuclear power plant support the building of nuclear power plant, and only 42.3% of residents think nuclear power station is safe [6]. The majority concern comes form the Chernobyl disaster in 1986 and the Fukushima incident in 2011, which deeply damaged public trust in those nuclear power plants. Other parts of the concern comes from the fear of radiation from the nuclear power plant and nuclear waste.

Furthermore, regarding challenges inherent to the Earth's natural systems, the operation of nuclear power plants itself requires substantial volumes of water for cooling processes-an demand that may significantly disrupt local groundwater systems, potentially triggering issues such as land subsidence or posing threats to endangered fish species. Also the process of mining uranium might cause land erosion, uncontrolled cuts of the forest, and contamination of nearby lands and water.

The environmental risks associated with nuclear waste storage are equally undeniable. In the event of improper nuclear waste management, leaks may occur—posing severe damage and long-term contamination to surrounding soil, water bodies, and human health.

And the most severe problem is the accident of the nuclear power plant itself, like the Chernobyl disaster in 1986 or the Fukushima incident in 2011, both spread radioactive powder into the air causing pollution in a vast area.Furthermore, such accidents have exerted significant impacts on local ecosystems-inflicting harm to numerous species and leading to the accumulation of radioactive elements in the organisms of affected species [8].

4. Suggestion on developing new energy

4.1. Large scale power sent and consumption

In order to solve the significant challenges brought by the large scale power sent and consumption to new energy, a variety of methods can be used. The first method that is the construction of energy storage systems in a large scale, usually in the form of a large amount of batteries. These batteries serve as a critical part in managing the problem of new energy like solar energy and wind energy that have unstable power outputs. During periods of high level power generation, which is the time that the sun is shining brightly or the wind is blowing strongly, these energy sources can produce an excess of electricity that might be wasted if not stored.

For instance, consider a solar power plant situated in a desert region-an area where sunlight is available for the majority of the day. During midday hours, the electricity generated by the solar panels exceeds the local electricity demand. If the excess electricity was not stored properly, this excess electricity would be lost. However, if a large battery station were built with solar power plant, the excesses electricity can be captured and stored in batteries. And the batteries can then release the stored energy back into the grid when generation of electricity do not match up with the

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consumption of electricity, such as during the night or a cloudy day, thus it ensures a steady power supply.

Additionally, the construction of battery energy storage stations can be integrated with smart grid technologies enabling the optimization of electricity distribution and allowing these stations to maximize their energy storage and discharge capacity. Smart grids use sensors, meters, and all sorts of device to monitor and manage the flow of electricity real time, ensuring that the stored energy is distributed to where it is needed most. This can significantly improve the overall efficiency of the power system, and ensure everywhere gets a stable power supply.

Another approach involves the integration of new energy with other energy sources—such as gas turbines. Taking solar power plants as an example, during cloudy periods or nighttime hours (when solar power generation is at a low ebb), gas turbines can serve as a supplementary power source to bridge the gap between the electricity output of solar panels and the actual electricity demand. By doing this the supply of the electricity can be stable during any conditions, and this method can also work with the smart grid technologies which also boost the entire systems' efficiency even more.

4.2. Environmental problems

The environmental concerns associated with nuclear power plants have garnered widespread attention globally And in order to lessen the concern caused by nuclear power plant, various action has to be taken.

The first measure involves disseminating knowledge about nuclear power plants to the general public-educating them on how nuclear power plants operate and how safety protocols prevent the occurrence of disasters. The the public and erase their uncorrect thought about the nuclear power plant and understand how safe the power plant is.

Second stricter law and policies has to be published by the government about nuclear power stations, which can also lessen the concerns of the public about the nuclear power station. By doing this the public can be know that their government are putting safety measures on the nuclear power station.

Thirdly, governments should release information regarding the implementation of nuclear power plant accident containment measures, This not only enhances public confidence but also demonstrates to the public that governments possess the capability and resolve to protect them from such disasters

5. Conclusion

China's power demand ranks first in the world. In order to make up for the power demand, a great amount of power plants have been built. However, traditional fossil fuel power plants produce a large amount of carbon emissions, which is in contradiction with the policy of developing a low-carbon emission economy. Therefore, China is committed to developing new energy sources in an effort to achieve the carbon neutrality goal in 2060. Even if there are many challenges in the advancement of new energy, they can be solved in various ways. However, the references used in this paper are limited, and there is no empirical research. I hope that further research can include more references and some empirical studies.

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