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Retraction

Retracted: New Power System Based on Renewable Energy in the Context of Dual Carbon

International Transactions on Electrical Energy Systems

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Ning, T. Yuan, and H. Wu, "New Power System Based on Renewable Energy in the Context of Dual Carbon," *International Transactions on Electrical Energy Systems*, vol. 2022, Article ID 6428791, 8 pages, 2022.

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Research Article

New Power System Based on Renewable Energy in the Context of Dual Carbon

Liang Ning,[1] Tianmeng Yuan,[1] and Haotian Wu [2]

[1]*Tangshan Power Supply Company State Grid Jibei Electric Power Co.Ltd, Tangshan 063000, China*
[2]*Shanghai Investigation, Design & Research Institute Co., Ltd, Shanghai 200335, China*

Correspondence should be addressed to Haotian Wu; 50201603@ncepu.edu.cn

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Energy is the basic driving force to promote the economic development of all countries in the world. In the face of the era of great changes unseen in a century, the world is actively deploying and developing renewable energy. However, these forms of new energy power generation are characterized by intermittency and randomness, and their unstable power characteristics and uncontrollable source capacity have negative consequences for the secure and stable operation of the electricity system. Therefore, once new energy sources are incorporated on a large scale, system reliability studies are required. The mission of the new electricity system with new resources as the main source is to adapt to the development of large-scale renewable energy and solve the three major problems of shortage of existing energy and power, pollution, and safety. In comparison to conventional electrical systems, the new power system is not a simple replacement but a revolution. Therefore, this paper studied a new type of power system based on renewable energy. Through experiments, it is concluded that the new electricity system with renewable energy sources is not only more environmentally friendly but also can save 10.5% of electricity costs and greatly improve the utilization rate of available energy.

1. Introduction

Renewable energy sources in modern society comprise solar energy, tidal energy, and wind energy. These new energy sources have many advantages over traditional fuels, such as being abundant, clean, renewable, and of course pollution-free. However, one of the main characteristics of this energy source is instability, and the power generation is often closely related to the weather, time period, or season and does not have the stability and adjustability of traditional power grids. Therefore, the full use of renewable energy is still difficult to replace the dependence on the traditional power grid, and there are some key problems to be solved. Coupled with the fact that few scholars have combined renewable energy with new power systems, the research in this field is very scarce and cannot provide a theoretical basis for other researchers. Based on this, it is very necessary to study the new power system based on renewable energy.

The research results on new power systems have been very rich. Since the modern power system is evolving into a sociotechnical system with huge complexity, Zhang introduced the entire operational model of electric power system dispatching, the methodology of top-level intelligent dispatching system design, parallel intelligent technology, and its dispatch application [1]. In the context of new power systems, rational capacity optimization of multiple power systems can reduce carbon emissions and improve system safety and stability, so Li proposed capability enhancement strategies based on situational awareness of wind-light-thermal power systems [2]. Farah A proposed a modified teaching-based optimization scheme for optimizing controllers based on power system stabilizers and static VAR compensators [3]. Kyesswa Schmurr introduced a new concurrent time-domain simulator for analyzing power system dynamics in massive networks using a high-performance computing environment [4]. For single-machine infinite power systems subject to the uncertainty of the system model, nonlinear time delay, and external unknown disturbances, Yanhong proposed a robust adaptive control method with reverse steps [5]. Yuan C proposed a new partition-based CBS method and a set of elasticity index-oriented indicators for multiple voltage elasticity indices [6]. Guo proposed a novel decentralized hierarchical optimization framework for addressing massive power economic dispatch problems systems without being limited by the number of generators. The global requirement supply restraint and the partial generating constraint were treated separately, which greatly reduced the complexity of the calculation [7]. In order to support medium voltage DC shipboard power systems, Khan proposed an energy storage management system based on fuzzy logic and realized its performance in an ESM system based on proportional integral control [8]. It can be seen from these studies that the research on the new power system has been very rich, and there are experts and scholars studying it in various aspects.

Since the development of renewable energy is very fast, many people have studied it. Samadi focused on load planning and capacity trading in systems with a high proportion of renewable energy, using approximate dynamic programming to schedule the operation of different systems [9]. Since renewable energy projects were seen as a resource for surrounding regional communities to develop, Cebotari was committed to studying the role of renewable energy interaction with host communities in the creation and development [10]. Panwar proposed that renewable energy technologies were recognized as clean energy, and the optimal utilization of these resources would minimize the environmental impact and reduce the generation of secondary waste [11]. Zeng presented a fresh isolated multiport DC-DC converter for simultaneous power management of multiple renewable energy sources, which can be of different types and capacities [12]. Kocak employed panel cointegration and heterogeneous causal analysis methods to explore the impact of renewable energy on economic growth in the Black Sea and Balkan countries. He found that the establishment of a consumption system of renewable energy had a significant impact on economic growth, and there was a two-way causal relationship with the overall panel economic growth [13]. Rahman presented the impact of CO_2 on the environment and mitigation strategies to reduce this impact. The possibility of production using carbon dioxide as a feedstock was discussed in detail, demonstrating the importance of renewable energy as a future global energy source [14]. Since the use of renewable energy to power cellular base stations is one of the long-term strategies to achieve green networks and reduce operating costs, Hassan proposed a new integrated architecture for cellular networks and smart grids powered by renewable energy. The proposed architecture was designed based on the classification and analysis of existing proposals, the requirements of smart grids, renewable energy systems, and cellular networks [15]. It can be seen that the concept of renewable energy has attracted the attention of many scholars, and the research on renewable energy has been very mature.

It is evident that research on renewable energy and new power systems has been very rich. However, few people have combined the two to study, so that the research on the new power system of renewable energy cannot be further deepened. Based on this situation, this paper studied the new power system of renewable energy.

2. Evaluation of the New Energy Power System

2.1. Evolution of the Power System. In the context of the "dual carbon" goal, the old power system can no longer meet carbon emission requirements, so it is urgent to establish a new power system. The new power system advocates measures to replace nonrenewable energy and vigorously develop renewable resources such as wind energy, solar energy, and geothermal energy [16]. The new electrical system with new energy as the mainstay can adapt to the development of large-scale renewable energy and address the existing energy sources and electricity development [17]. The establishment of a new energy system is a dynamic evolution process, as shown in Figure 1.

In the construction of the new electrical system, it is not necessary to adapt new energy to the power grid but to adapt the power grid to new energy, so that the power grid can return to the position of using energy means. In turn, the power system can achieve the fundamental goal of better meeting the energy demand of the economy and society. The construction of a new electricity system with renewable energy as the main source cannot simply continue the previous thinking of the large power grid, because the efficiency of pursuing a large and comprehensive electricity grid to realize the new electricity system is very low [18]. When a new power system is constructed, in addition to improving the ability of the grid to capture and control a high percentage of renewable energy, it is also necessary to improve the technical means such as local power grids and smart microgrids to reduce the difficulty of promoting the utilization of wind and solar energy. Innovative ideas such as "low carbonization, digitization, and decentralization" have been adopted to get rid of the dependence on traditional large power grids and large power plants and clarify paths and goals. The reform of the power grid system is promoted, and the development of new power grids is a significant path [19]. Therefore, in the evolution of the new power system, it is necessary to first divide the evolution process into three stages according to the proportion of renewable energy and then use corresponding strategies to build a new power system and achieve the "dual carbon" goal. The three stages of the evolution process are as follows:

(1) In the first stage, the percentage of electricity generated from renewable energy sources reaches 25%, and the proportion exceeds thermal power for the first time, reaching a relative majority status, that is, the form that accounts for the largest proportion of all types of power generation.

(2) In the second stage, renewable energy power generation accounts for more than 50% and reaches an

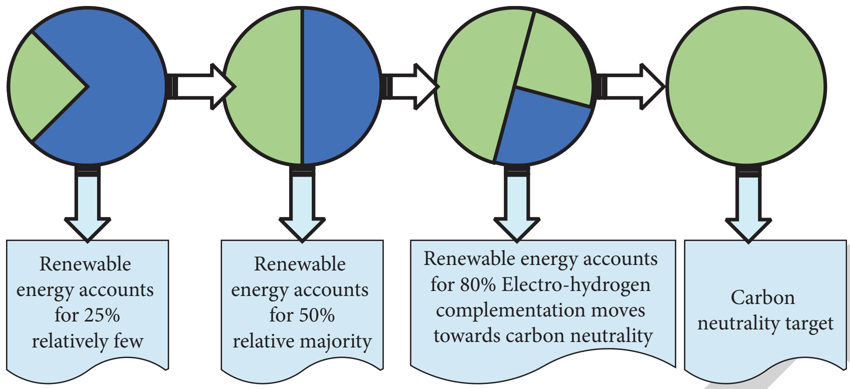

Figure 1: Three levels of evolution of the new power system.

absolute position, which can ensure the safe and stable operation of the new power grid.

(3) In the third stage, renewable energy power generation accounts for more than 80%, and the dominant position is significant. The traditional forms of power generation are only used as supplements and subordinates to achieve carbon neutrality goals with other means such as hydrogen-electricity complementarity, bioenergy and carbon capture and storage, and afforestation. New energy is deeply coupled with the energy consumption methods of other industries such as industry and transportation, and new formats such as "New Energy +" and Energy Internet are highly perfected, which strongly support the future social energy vision of electrification, low carbonization, digitization, intelligence, and interaction.

No matter what stage of the renewable energy ban process, the following two issues need to be fully paid attention to and properly addressed:

(1) Targeted policy support: In the first stage of the evolution process, it is necessary to adopt targeted support policies such as wind-solar-fire-storage integration, photovoltaic county-wide development, and partition wall electricity sales. At the same time, in a higher development stage in the future, the development model and support policies of new energy also need to be constantly iterated and optimized according to the changes in the technology and cost characteristics of new energy development.

(2) It is necessary to take into account social energy affordability, safety constraints, and economic costs. The construction of a new power system cannot be achieved overnight, and it needs to fully communicate and coordinate with social energy consumption. The new power system must achieve "three balances," namely, power balance, energy balance, and cost balance, and the cost balance among them needs to be fully communicated and coordinated with social energy demand. New power systems in different stages need to fully consider the cost of new systems, the cost of existing thermal power, and the cost of low-carbon energy consumption at the corresponding social development stage.

2.2. Triangular Relationship between Energy, Economy, and Environment. The path of energy development is nothing more than two paths, old and new. The old road is the road that others have tried and achieved results on, such as the energy development road of industrialized countries. The transition from coal to oil and gas, and from oil and gas to renewable energy, is a new path for improvement [20]. The new and old roads have different impacts on the ecological environment and economy. The specific triangular relationship between energy, economy, and environment is shown in Figure 2.

The social system is likened to a triangle, that is, the triangular operation process of the economy, environment, and energy in society, as shown in Figure 2. The current economic and social system is a sloping inverted triangle. Fossil fuel-based power systems support economic growth and environmental development [21]. If current trends continue, this inverted triangle could collapse at any time, leading to both economic and environmental reversals. Therefore, it is necessary to correct this inverted triangle and form a new right triangle. The modern energy system and the modern economic system, as the two bottom corners of the regular triangle, provide strong support for the development of ecological civilization, while the top corner of the regular triangle is the ecologically civilized society. The idea of this right triangle is to promote the sound development of an ecologically civilized society based on economy and energy, and it is a sustainable triangular relationship.

2.3. New Energy System. The systemic transformation of the energy and power sector is interrelated with the systemic transformation of the economy and society, which is mainly manifested in the construction of a power system centered on new energy. The construction of a new energy system must follow the general policy of "four revolutions and one cooperation." The modern energy system is constructed, and finally, a new energy system dominated by renewable energy is formed. Therefore, it is necessary to discuss a new energy

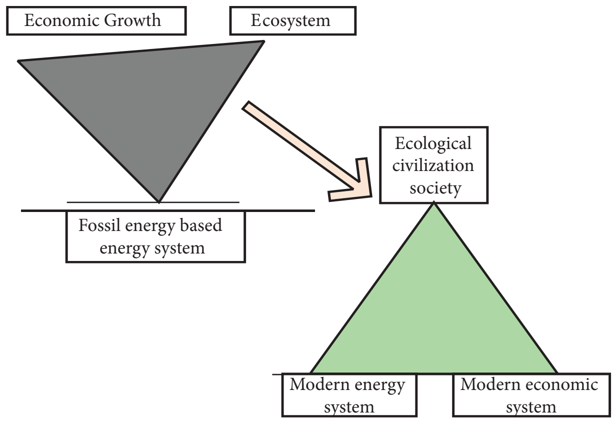

FIGURE 2: Triangle of energy, economy, and environment.

system on the basis of a detailed understanding of the existing energy system. In order to appreciate the distinction between current energy electricity systems and new electricity systems based on renewable energy sources, this paper conducts a detailed study of the two, as shown in Figure 3.

There are five main characteristics of modern energy power systems: large systems, centralized, top-down, closed, and supply-based. The characteristic of renewable energy development is that it can be centralized, decentralized, or distributed, and renewable energy can come from far and near. However, fragmentation problems caused by conflicting interests between provinces and companies, as well as large-scale systems and centralization problems caused by focusing on the supply side and ignoring consumer interests, have seriously hindered the development of renewable energy. It is no longer suitable for the current renewable energy-oriented energy power system.

The future renewable energy power system also has five main characteristics: modular, distributed, bottom-up, open, and consumer-oriented. Bottom-up has a market color, multiple modules can efficiently and quickly form a large system, and distributed or decentralized can also achieve centralized energy supply. The open system for remote electricity sales and facing consumers is the embodiment of the demand concept of environmental priority and green development [22]. Renewable energy is the most suitable energy power system in the future, especially the new energy power system dominated by fluctuating energy such as wind and rain. To this end, it is urgent to transform the current energy power system into a new type of energy power system in the future, in order to achieve pollution-free power supply in colleges and universities.

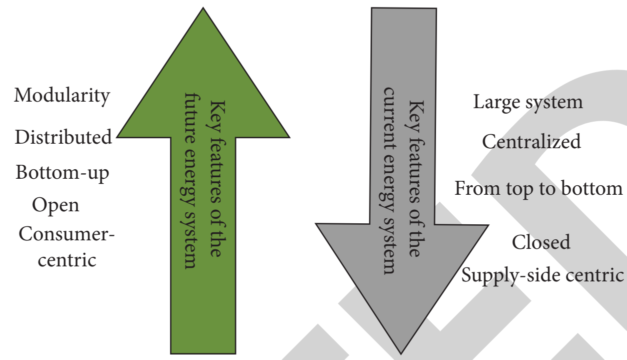

FIGURE 3: Difference between the current power system and the new energy power system.

3. Algorithms Based on Renewable Energy

3.1. Wind Energy Algorithm. Although wind energy and solar energy belong to the same primary energy, tracing the origin of wind energy would find that it can also be called "secondary energy," because the heat radiated by the sun causes temperature differences in different parts of the earth's surface, causing airflow, thereby generating wind. Wind energy is often characterized by randomness and low energy density. Therefore, in order to effectively utilize wind energy, wind speed needs to be estimated.

The Weibull distribution is the most commonly used model for representing wind speed. The general form of the Weibull distribution is as follows:

$$G(n) = 1 - e^{-(n/b)m},$$
$$G(n) = \frac{k}{b}\left(\frac{n}{b}\right)^{m-1} e^{-(n/b)m}. \tag{1}$$

Among them, m is the shape parameter of the Weibull distribution, which represents the inclination of the Weibull distribution, usually between 2 and 3; the parameter b is a scale parameter, which reflects the average wind speed. Generally speaking, the value is slightly larger than the average wind speed. For wind speed, the larger the value of the shape parameter is, the smaller the place where the wind speed exists, the lower the intensity of change, the smaller the value of the proportional parameter reflecting the average wind speed, and the smaller the value range of the wind speed, the higher the probability of the corresponding value.

Weibull's shape and scale values can generally be calculated from the mean wind speed n_i and the corresponding standard deviation ω:

$$n_i = \int_o^{\infty} ng(n) = \frac{1}{J}\sum_{j=1}^{1} n_j G(n_j),$$
$$\omega = \sqrt{\int_o^{\infty} (n-n_i)^2 g(n)dn} = \sqrt{\frac{1}{J-1}\sum_{j=1}^{j}(n_j-n_i)^2 g(n_j)}, m = \left(\frac{\omega}{n_i}\right)^{-1.086}, b = \frac{n_i}{\tau(1+(1/m))}. \tag{2}$$

The distribution function of a random variable $G(x)$ is assumed to be a monotonically increasing continuous function, and the random variable is $W \sim W(0,1)$, the distribution function of a random variable $G^{-1}(W)$ is $G(x)$, and $G^{-1}(x)$ is the inverse function of $G(x)$. Therefore, if the random variable X with $G(x)$ as the distribution function is generated, it only needs to generate $W \sim W(0,1)$ and $X = G^{-1}(W)$. This method of generating sample values is called the inverse transform method. According to this method, to obtain the sampling value of wind speed, it is necessary to first obtain the inverse function of its distribution function:

$$G(n) = W = 1 - e^{-(n/b)^m} \longrightarrow n = -b[\ln(1-W)]^{1/m}. \quad (3)$$

Because when $W \sim W(0,1)$, there is also $1 - W \sim W(0,1)$, and the equation is as follows:

$$n = -b[\ln W]^{1/m}. \quad (4)$$

A random sample of hourly wind speeds can be generated from the formula. Since it does not have the time-dependent characteristics and information of wind speed, it is only suitable for nonsequential Monte Carlo methods.

3.2. Solar Modeling Algorithm. The core element of a solar energy system is the photovoltaic cell, and dozens of photovoltaic cells are connected in series, which can be combined into one or more photovoltaic modules in series. Photovoltaic systems are tied to solar inverters because inverters connect the power generated by the photovoltaic system to the grid, but ideal photovoltaic cell designs do not take into account the effects of internal series and parallel resistances. A photovoltaic system consists of one or more photovoltaic panels. For photovoltaic systems, the position of solar radiation is very important, and the tilt angle affects the power output of the photovoltaic panel, so the tilt angle of the photovoltaic panel is used as the decision variable of the system [23].

$$\delta = \theta \text{sim}\left(360^o \times \frac{284 + x}{365}\right), \quad (5)$$

$$\sinh = \sin\varphi \sin\delta + \cos\varphi \cos\delta \cos\tau, \quad (6)$$

$$\tau = \frac{360}{24}(12 - \text{lt}). \quad (7)$$

Solar radiation incident on the sloped photovoltaic generator is calculated according to Formula (5). Among them, h and δ represent the elevation angle of the sun and the latitude angle of the sun, respectively. φ is the inclination of the Earth's axis relative to the plane of the Earth's orbit, x is the number of days in a year, and φ and τ are the geographic latitude and inclination angle, respectively. The effective part of solar radiation perpendicular to the inclined plane photovoltaic generator is given by the following formula:

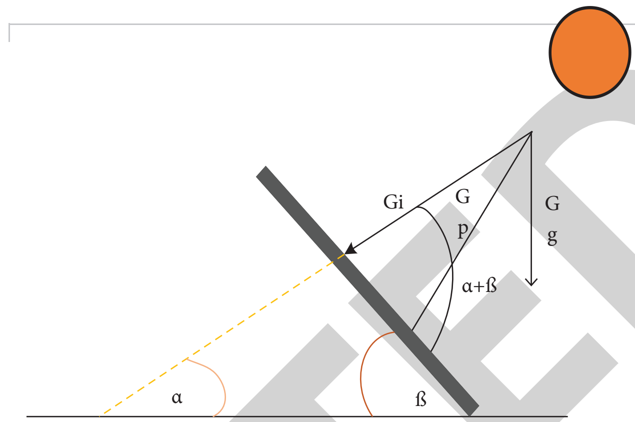

Figure 4: Solar radiation diagram.

$$G_P = G_i \sin(\alpha + \beta). \quad (8)$$

In (8), G_P and G_i are the horizontal and vertical degrees of solar radiation incident on the inclined photovoltaic generator, respectively, and the maximum output power of the inclined photovoltaic at t can be computed through the following formula:

$$\begin{aligned} F_C(f) &= F_a(f) + \frac{NOCF - 20}{800} G_P(f,\beta), \\ I_{SC}(f) &= \left[I_{SC,sfc} + K_i(F_c(f) - 25)\right]\frac{G_P(f,\beta)}{1000}, \\ V_{oc}(f) &= V_{oc,sfc} - K_V \times F_c(f), \\ P_M(f,\beta) &= N_S \cdot N_p \cdot V_{oc} f \cdot I_{sc}(f,\beta) \cdot TT(f). \end{aligned} \quad (9)$$

Among them, $F_c(f)$ represents the temperature of the solar photovoltaic panel in f, $F_a(f)$ is the temperature of the surrounding environment of the f device, sfc and V_{OC} represent the short-circuit current and open-circuit voltage of the photovoltaic cell under normal experimental conditions, respectively, and K_i represents the relevant temperature coefficient. $p_m(f,\beta)$ is the photovoltaic array output power, and $TT(f)$ is a numerical value related to the characteristics of the photovoltaic cell. The schematic diagram of solar radiation is shown in Figure 4.

4. Experiment Based on Renewable Energy

In an effort to emphasize the excellence of new electricity systems grounded in renewable energy sources, this paper focuses on the original power system using raw coal, crude oil, and other raw resources. An experimental study was conducted to compare the traditional power system using conventional renewable resources such as hydraulic resources and the new power system using fresh sources of renewable energy, in the form of solar, wind, and geothermal energy.

4.1. Experimental Process. Three regions A, B, and C were selected for this experiment. Because of backward economic

Table 1: Residents' satisfaction with the three power systems.

Project satisfaction number Power systems	Original power system	Traditional power system	New power system
Power supply	35	82	183
Degree of security	24	87	189
Experience feelings	45	92	163

development, energy extraction and processing technologies are relatively backward, and the power system in region A is relatively backward. The power generation energy used in region A is mostly oil, coal, and other highly polluting primary energy sources, and the proportion of new power systems of renewable energy in this region is relatively small. The economic development of regions B and C is relatively good, and technologies for energy mining and processing are relatively mature. Therefore, the power generation systems in these two regions are relatively advanced, and most of the power generation resources used are conventional renewable resources, while the proportion of new power systems with renewable energy is relatively larger than that in region A. This experiment plans to continue to use the local original power system in region A. Region B continues to use the traditional power system based on conventional renewable resources, and a new type of power system with renewable resources is introduced in region C. After a five-month experiment, the advantages and disadvantages of the three power systems are analyzed by comparing air quality, power generation, and power generation costs in each region before and after the experiment.

Before the experiment, a questionnaire was conducted on the residents of three regions A, B, and C to find out whether they were satisfied with the power supply, safety level, and usage experience of the three power systems. 100 people were selected from each region, a total of 300 people. The results are shown in Table 1.

It can be seen from Table 1 that although there are people who choose these three power systems, very few people choose the original power system. Especially in terms of safety, there are only 24 people, accounting for less than one-tenth of the total. It can be seen that the security level of the original power system is worrying. In addition, less than one-sixth of the people are satisfied with the power supply and usage experience of the original power system, which shows that the original power system is very backward and cannot meet the needs of residents. The number of people who choose traditional electricity systems on the basis of renewable energy is relatively large, but the proportion is less than one-third. However, the majority of residents choose the new electricity systems on the basis of renewable energy, more than half of the total number. Especially in terms of security, it is trusted by most people. According to these survey results, it can be seen that the new electrical systems that use renewable energy sources are superior to primary and traditional systems in terms of electricity supply, security, and use experience and can better meet people's needs.

4.2. Experimental Data. In order to ensure the reliability of the experiment, the specific conditions of air quality, power generation, and power generation cost in three regions A, B, and C were collected before the start of the experiment. The total score of air quality, power generation, and power generation cost in these three regions was assumed to be 100 points. The higher the score, the better the air quality. Conversely, the worse the air quality is, the less power is generated and the lower the cost of power generation, as shown in Figure 5.

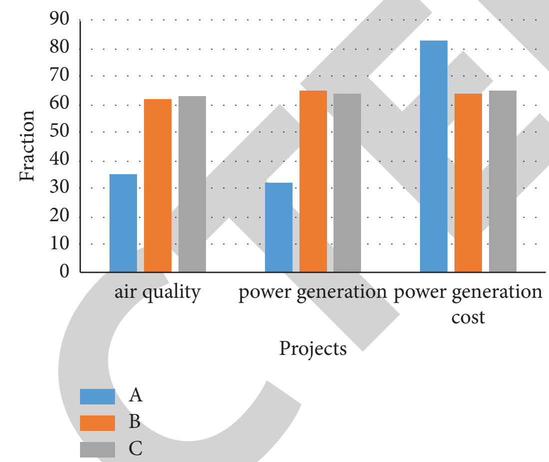

Figure 5: Comparison of air quality, power generation, and power generation costs in three regions.

It can be seen from Figure 5 that the air quality in region A dominated by the original power system is very poor, with only more than 30 points, which is far from the passing line. The power generation in this area also fails to meet people's requirements and cannot meet people's needs at all. In addition, the cost of power generation in region A is particularly high. In regions B and C dominated by the traditional power system, the air quality is relatively better, but it has only just reached the passing line. The air quality is not particularly high, and the power generation is relatively sufficient compared to that in region A, which can meet the needs of most people. However, the cost of electricity in these two areas is still relatively high, and power consumption still exists.

5. Evaluation of Experimental Results

5.1. Experimental Results. In order to conduct a more detailed study of the experimental results and increase the reliability of the results, during the five-month experiment, this paper collected the monthly changes in air quality, power generation, and power generation cost in three regions A, B, and C. In order to compare with the data before the experiment, a total of six months of data on air quality, power generation and power generation cost in these three regions are collected, of which the first month is the air

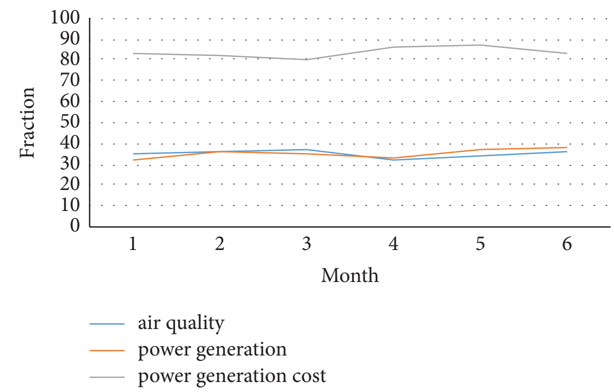

Figure 6: Changes in monthly air quality, power generation, and power generation costs in region A.

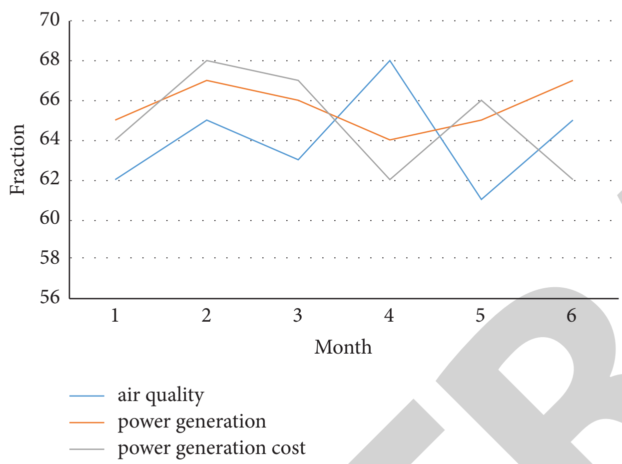

Figure 7: Changes in monthly air quality, power generation, and power generation costs in region B.

quality, power generation and power generation cost in the region before the experiment. The comparison results are shown in Figure 6, Figure 7, and Figure 8.

According to Figures 6–8, it can be seen that the air quality, power generation, and power generation cost in region A fluctuated only slightly during the five-month experiment. The air quality was still very poor. There has also been no improvement in the amount of electricity generated and the cost of electricity generation. Although the range of up and down fluctuations in region B is larger than that in region A, air quality, power generation, and power generation costs in this area have not changed compared with those before the experiment. However, in region A, where a new power system based on renewable energy was introduced, the changes in these six months were very obvious, and the air quality was in a state of skyrocketing. In the sixth month, the air quality score reached more than 90 points. In addition, the increase in power generation was also very obvious. Although the cost of power generation was relatively high in the first two months, from the third month, after the power generation system matured, the cost began to plummet. By the sixth month, the cost of generating electricity was 13 cents lower than before the experiment.

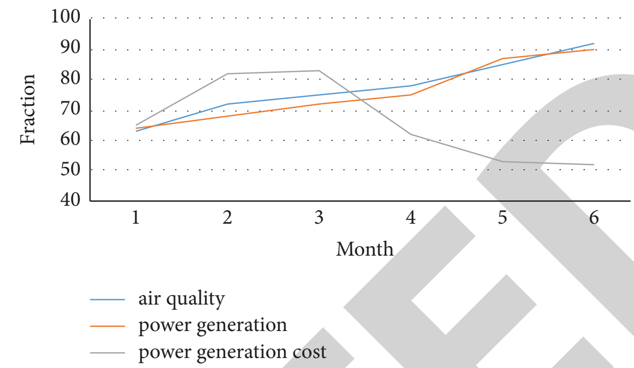

Figure 8: Changes in monthly air quality, power generation, and power generation costs in region C.

5.2. Experiment Summary. According to the experimental results of this paper, it can be concluded that the new electricity system based on renewable energy has absolute advantages in comparison with the conventional electricity system and the original electricity system. It can not only reduce air pollution and improve air quality to a great extent but also create a greener and healthier living environment for people. It can also increase power generation and ensure residents' electricity demand and can save power generation costs, reducing residents' electricity burden and greatly improving people's quality of life. The advanced, sustainable, and practical nature of the new power system based on renewable energy has been demonstrated.

6. Conclusion

This paper mainly conducted a series of research studies on the new electrical systems that were based on renewable energy. The new power system based on renewable energy had huge development potential and broad development prospects. It was a very critical step in the realization of sustainable development goals. The new power system based on renewable energy is the focus of attention, but there are still many bottlenecks in its technological and industrial development that restrict its development. In order for the new power system based on renewable energy to play its advantages and functions, the active support of the government, the continuous efforts of industry and research institutions, and other sectors of society are needed.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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