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Retraction

Retracted: Application of Multimedia Quality Evaluation Relying on Intelligent Robot Numerical Control Technology in New Energy Power Generation System

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets 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 own 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] R. Sun and X. Dang, "Application of Multimedia Quality Evaluation Relying on Intelligent Robot Numerical Control Technology in New Energy Power Generation System," *Journal of Robotics*, vol. 2023, Article ID 7480917, 11 pages, 2023.

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Research Article

Application of Multimedia Quality Evaluation Relying on Intelligent Robot Numerical Control Technology in New Energy Power Generation System

Ruijuan Sun [1] and Xiaoyuan Dang [2]

[1] *College of Engineering, Shanxi Agricultural University, Shanxi 030800, Jinzhong, China*
[2] *College of Mobile Telecommunications, Chongqing University of Posts and Telecommunications, Chongqing 401520, China*

Correspondence should be addressed to Ruijuan Sun; 160409133@stu.cuz.edu.cn

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New energy (NE) power generation technology has become an important means to solve the problems of global energy demand and environmental governance due to its sustainability and cleanliness. However, restricted by climate and other factors, the instability of its power generation capacity has a serious impact on the voltage multimedia quality evaluation of small microgrids, which even causes damage to important equipment. This paper proposed a multimedia quality evaluation method in the new energy power generation system relying on intelligent robot numerical control technology. According to the state characteristics of different units, the expanded representation models of conventional units, wind turbines, and photovoltaic units were established, respectively. Based on intelligent robot numerical control technology, a multimedia quality monitoring model of the new energy power generation system in random production simulation was established. The planned outage condition of the unit, which was ignored by the current stochastic simulation method, has been fully considered to ensure the rationality of the simulation of intelligent robot numerical control technology. The intelligent robot numerical control technology was used to explore the expected production power change of the unit and to improve the calculation speed and accuracy. In this paper, an appropriate wind and solar power generation model was constructed based on the output characteristics of wind and solar. Secondly, the influence of random faults between units on the subsequent loading rate was studied through probability calculation. The start-stop factors of conventional units were comprehensively analyzed. Then, the expected value of unit start-stop times was obtained. The average relative error of the expected value of the power shortage of the new energy electricity generation system (EGS) was 2.45%, and the error was lower than 2.98%. In the intelligent robot numerical control technology in this paper, the planned outage condition of the unit was considered, which showed the correctness and superiority of the multimedia quality evaluation of the proposed model.

1. Introduction

Since the completion of the construction of the power system in the late 19th century, with the advancement of technology, the voltage level, installed capacity, and geographical scope have been continuously increased. However, the links supporting the power system are still composed of electromagnetic conversion devices such as rotating devices and stationary devices. The working state is stable, and the characteristics are single. Energy is a necessary material guarantee for the development of human civilization and society. It is also an indispensable source of power for modern industrial progress. Centralized power generation, interconnected power grids, and long transmission distances highlight the shortcomings of transmission power systems, such as the inability to change dispatch strategies in time and the inability to flexibly respond to load changes. Based on the abovementioned reasons, the development of new energy power generation technology research and the optimal design of various types of power systems that combine new energy power generation with user-side needs are important in China's power grid. Under suitable weather conditions, the new energy power generation system can greatly improve the continuity and stability of the system power supply, which makes the entire power supply system more reliable. In this paper, the intelligent robot numerical control technology is applied to the new energy power generation system, which is more conducive to realizing the real-time monitoring of the new energy power generation system and improving the multimedia quality in the new energy power generation system.

When the new energy generator system is in a steady state, the intersection of static characteristics of generator group frequency determines the frequency of the system. Bao et al. put forward the idea of adapting power output to power demand [1]. Onuka et al. proposed a virtual inertial control system to reduce power system frequency fluctuations caused by renewable energy (RE) output fluctuations [2]. Jaiganesh et al. argued that the appropriate choice of renewable energy could greatly reduce the demand for fossil fuels, thereby increasing the sustainability of the electricity supply [3]. Guichi et al. developed an optimal control technique for hybrid power generation systems [4]. Meddad et al. explored the properties of piezoelectric patches using thermoelectric generators [5]. However, their proposed new energy generator system is not very stable. In this paper, intelligent robot numerical control technology was introduced to evaluate the bulk quality of multimedia phase change materials in new energy power generation systems.

The intelligent robot numerical control technology power generation microgrid has an "elasticity" effect in the face of electric energy fluctuation, which realizes the ability to suppress voltage fluctuation and power mismatch. Watanabe et al. compared the corresponding power outputs of these turbines. This dataset showed 23% annual mean wind speed and less turbulent intensity at offshore locations, resulting in a doubling of annual power generation [6]. Vereide et al. investigated the effects of surge storage tanks on governor stability, power control, and hydraulic transients in hydropower plants [7]. Roy and Rengarajan believed that distributed energy systems were gaining popularity recently because they could generate electricity with the lowest operating cost [8]. Rahmani-Andebili applied the concept of stochastic model predictive control to a problem for the first time to have a dynamic and adaptive future in optimization problems. Uncertainty and variability in renewable energy were addressed [9]. Magdy et al. believed that the interconnection between the digital and analog parts was usually achieved through sampling and control equipment [10]. However, their proposed intelligent robot numerical control technology has not been applied in practice.

In the new energy power system represented by photovoltaic power stations and wind farms, it is necessary to conduct a detailed simulation of the output of photovoltaic power stations and wind farms in order to calculate the relative economics and reliability. In this way, the combination of conventional units is reasonably arranged to meet the needs of actual dispatching so as to make full use of renewable solar and wind energy and reduce environmental pollution and power generation costs. Reasonable evaluation indicators are established. The peak-shaving problem brought by the grid connection of new energy to conventional units and the impact on the low-carbon benefit of the system are evaluated. On the one hand, the integration of new energy into the grid greatly reduces the carbon emissions of the system. On the other hand, it is inevitable that the conventional units are frequently started and stopped due to their own randomness. Excessive start-stop operation of conventional units increases additional coal consumption and reduces the low-carbon benefit of the system. When the load is 25% of the rated load (6 s), the output current of the load terminal is 0.66 A. The method in this paper reduces CO_2 emissions by about 60,000 t.

2. Application of the Multimedia Quality Evaluation Method

2.1. Application of Intelligent Robot Numerical Control Technology in the New Energy Power Generation System. In the traditional electricity generation system, the transient characteristics of electromagnetic conversion devices such as synchronous motors in the time scale corresponding to the primary frequency modulation determine the electromagnetic transient process of the electricity generation system. The core content of electricity generation system transient analysis and electricity generation system steady-state analysis of the traditional electricity generation system is formed. In the whole process of the electricity generation system being gradually assimilated by the amount of power electronic equipment, transient characteristics of the ubiquitous power electronic equipment and the traditional electromagnetic conversion equipment are obviously different. The transient component current quickly saturates the transformer core. The secondary current of the transformer is distorted, which may cause the protection to fail or reduce the reliability and accuracy of the relay protection. When the equipment is disturbed and a transient event occurs, the power electronic equipment needs to rely on the corresponding control and protection circuit to ensure the safety of the equipment. During stable operation, the power flow in the electricity generation system becomes a bidirectional flow (the steady-state distribution of voltage (each node) and power (active power, reactive power) (each branch)) due to the power electronic equipment, which is very different from the transmission route of energy from the power generation end to the consumer end of the traditional electricity generation system. Therefore, the controlled transient characteristics of power electronic equipment and the steady-state characteristics of bidirectional energy flow have changed the traditional operation mode of the EGS in which the direction of the power flow is fixed and the transient characteristics are stable. It affects the security and stability of the traditional operating state of the EGS [11]. The typical structure of the NE hybrid EGS is shown in Figure 1.

At present, the main way to develop and apply new energy is still distributed or lumped grid-connected power generation (it refers to the connection between the

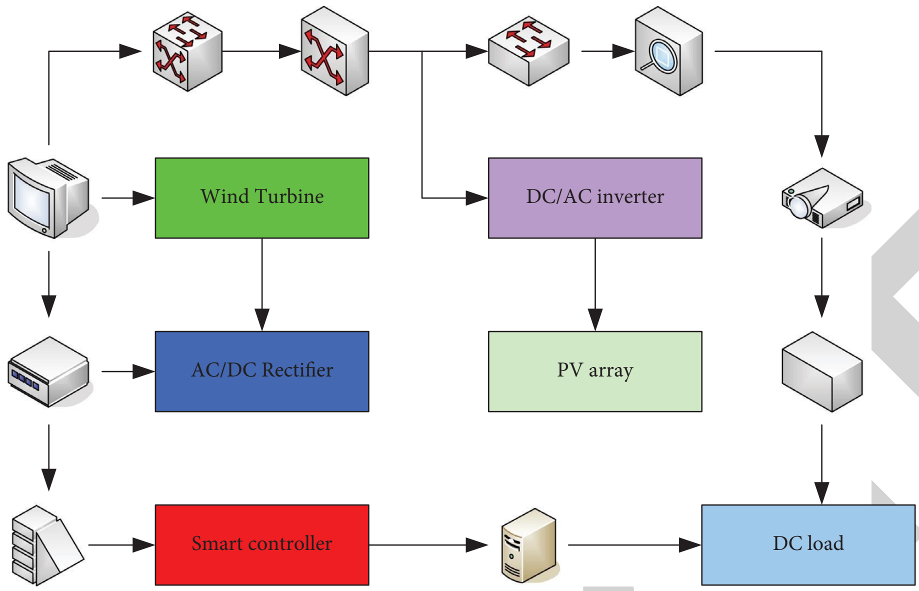

Figure 1: Typical structure of NE hybrid EGS.

transmission line of the generator set and the transmission network). However, a large amount of renewable energy is distributed in remote areas. The construction sites of wind farms and photovoltaic power stations are relatively remote, which are mostly scattered in remote areas. It needs to be transmitted to the remote user side through the power grid to complete the consumption and use of electric energy. In order to transmit the generated electric energy, the equivalent grid impedance (the obstruction of current flow in circuits with resistance, inductance, and capacitance) formed by the transformers in the transmission and distribution network and the distribution parameters that cannot be ignored in the long-distance transmission line may cause the failure of the damping strategy of the grid-connected inverter itself. Thus, the resonance between the grid-connected power generation system and the grid is induced. Such grids are also called weak grids [12]. Due to the existence of grid impedance, the grid becomes weak. At the same time, the grid impedance value is not stable. On the other hand, a large number of grid-connected inverters integrated into the power grid, as the interface device between the new energy and the power grid, are coupled with each other to form a complex high-order nonlinear time-varying system. This is very easy to form a coupled resonance (which can transmit relatively large power, reaching the kW level, and is sensitive to distance. The increase of distance seriously affects the transmission efficiency) with the grid impedance, thereby causing the power system to become unstable. The existence of weak grid impedance and grid-connected power generation system constitute harmonic interaction, which further exacerbates the resonance. It may cause harmonic amplification at the grid connection point, resulting in overvoltage, overcurrent, and other undesirable situations, resulting in power quality problems. It even causes the grid-connected inverter to disconnect from the grid due to faults and endangers the safe and stable operation of the power system.

Considering that the voltage source should be stable without load and the ideal voltage source with load, the stability of the system can only consider the function on the right, which is defined as $H(s)$ [13].

$$H(s) = \frac{Z_s(s)}{1 + Z_l(s)}. \tag{1}$$

Impedance adapters (which adjust the wavelength of the transmission line by changing the impedance) require virtual impedance at high frequencies. Therefore, its filter must have a wide passband for middle and high frequencies. However, at the same time, it must have a sufficient suppression effect on high-frequency switching ripple. The filter of the impedance adapter needs to be designed according to the following two principles. One is to meet the requirements of the cutoff frequency, which ensures that the impedance adapter can have virtual resistance characteristics in the high frequency band. At the same time, higher frequency switching harmonics do not leak. Second, the dynamic response is required to be fast enough, which can quickly track the present harmonic level of the grid-connected access point, as well as a stable virtual resistance (it can be set arbitrarily, and its temperature characteristics can also be set). The relationship between output and input voltage can be expressed as follows [14]:

$$G_{LC}(s) = \frac{1}{L_1 C s^2}. \tag{2}$$

The empirical formula for the output power of photovoltaic panels is as follows:

$$Cs = \sigma E. \tag{3}$$

In the formula, Cs represents the output power of the photovoltaic cell [15].

The unpredictability of light intensity with climate determines that photovoltaic output is also random. However, different from the regular characteristics of wind speed distribution, the light has the characteristics of "nocturnal and diurnal." Sunlight is generally only possible during the day. The light intensity is at its maximum at noon. The light intensity is weak in the early morning and evening, and there is no sunlight at night. The one-day change of visible light intensity is more consistent with the one-day change of load.

Therefore, unlike the randomness of wind power output, which has antipeak-shaving characteristics, the grid-connected photovoltaic power generation has a relatively stable output. Conventional energy units do not reduce the economics of their own operation by absorbing the volatility of photovoltaic output. It can be seen that the environmental friendliness of photovoltaic power generation is more prominent. For the photovoltaic power generation system, the randomness of its output comes from the randomness of the weather on the one hand and the failure of its own components on the other hand. In the modeling of photovoltaic power generation output, the influence of photovoltaic array and inverter faults is mainly considered. The series-parallel combination of photovoltaic components is as follows. A photovoltaic array consists of n strings of photovoltaic cells in parallel. The working states of each string of photovoltaic cells are independent of each other and are connected to an inverter in parallel without any influence. As long as the inverter works normally, the derating capacity (when the system is in a derating operation state, the transmission capacity of the system is reduced due to equipment or other nonscheduling reasons) of the system depends on the working state of the n-series photovoltaic panel group. Then, assuming that the failure rate of each string of photovoltaic cells is P_1 and the failure rate of the inverter is P_2, the rate of the i-th derating operating state of the photovoltaic inverter group is as follows [16, 17]:

$$P_{S,i} = C_n^i P_1 \left(1 - P_2\right). \tag{4}$$

The basic requirement for the design of an independent new energy hybrid power generation system is to meet the power load in the area covered by the power generation system and the needs of reliable operation of the power generation system. The capacity and operation control strategy of each component of the system is determined. Wind power generation and photovoltaic array output can meet the requirements of most electricity loads, which minimizes the number of diesel generator starts, that is, to calculate the total photovoltaic cell capacity, wind turbine power, and battery capacity required for the hybrid power generation system to work reliably throughout the year. At the same time, attention should also be paid to the relationship between the coordination system reliability and its economy. It is necessary to minimize the power generation cost of the hybrid system while meeting the maximum reliability [18].

2.2. Multimedia Quality Evaluation Platform Relying on Intelligent Robot Numerical Control Technology. The configuration of rotating reserve capacity can ensure the reliability of system operation. However, the size of the spare capacity is the key to choosing between two contradictory indicators of system economy and reliability. Therefore, the configuration of the size of the reserve capacity can be combined with the operation risk analysis theory and the forecast error of wind power generation. A set of backup risk theory strategies considering the influence of wind power forecast errors on system operation reliability are formulated. Its multimedia quality evaluation is as follows [19]:

When the predicted power value of wind power is lower than the actual value of wind power, it means that wind power is underestimated, which results in those wind power resources that cannot be fully absorbed. At this time, it is necessary to increase the negative spinning reserve of the system on the basis of the original planned negative spinning reserve [20]. Negative spinning reserves are added to the model to underestimate costs.

The purpose of introducing robots is to improve efficiency, so the bottleneck process can be considered first. Generally, the process with a longer processing time is the bottleneck process. The use of robots can reduce auxiliary time, thereby shortening the production cycle of the entire power generation process. The robot itself is a kind of automation equipment, and the equipment integrated with it should also have an automatic working mode. It is equipped with automatic fixtures and can provide feedback working status signals to the outside world so that the best performance of the two can be exerted. After the robot model is determined, the parameters such as the allowed maximum speed and maximum acceleration of each axis have been determined. The running time in a single cycle mainly depends on the posture and movement distance of the robot end. The evaluation of the movement distance in the operation space refers to the minimum sum of the distances moved by the end of the robot in a single cycle. In practical applications, the end of the robot can choose a variety of moving methods between the target points of the operation. The actual moving distance is difficult to determine. According to the principle of "the shortest line segment between two points," this indicator is replaced by the sum of the Euclidean distances between the target points visited by the robot in turn. Its mathematical expression is as follows [21, 22]:

$$\min D = \sum_{i,j=1}^{m} D_{ij}. \tag{5}$$

Based on the evaluation function with the smallest movement distance in the joint space, its mathematical expression is as follows:

$$\min F = \sum_{i=1,j=i+1}^{m-1} \sum_{k=1}^{n} \left[q_{ik} - q_{jk}\right]. \tag{6}$$

In the formula, m is the number of equipment (that is, job target points) that the robot needs to access in one cycle.

Based on the layout evaluation function with the shortest robot movement time in the cycle, its mathematical expression is as follows [23]:

$$\min T = \sum_{i,j=1}^{m} b_{ij} + b_{d0} d_0. \tag{7}$$

The high-energy load has the characteristics of interruptible, transferable, continuous adjustment, rapid adjustment, and group switching. It has the advantages of large power load capacity, strong adjustment ability, and good peak shaving and valley filling. According to the electricity consumption rules of different users, the electricity consumption time of various users is arranged and organized reasonably and in a planned way. The high energy load is used to make up for the insufficiency of conventional power sources in regulating the fluctuation of large-scale wind and solar farms. The adjustment range can reach 30%–100% of the production load capacity. It is the best choice to change the wind power consumption level with suppressed wind power output fluctuation to realize the adjustment of the output fluctuation of the wind and solar power plant group through the coordinated optimization of the high load energy load and the conventional power supply. When evaluating the multimedia quality in the NE power generation system, the mathematical model of the adjustable load is as follows [24]:

$$P_{Ld\_i}^{t} = P_{Ld\_i}^{t-1} - x_i^t. \tag{8}$$

At present, with the vigorous development of energy storage technology, especially the increasingly mature energy storage technologies such as batteries, compressed air, and pumped storage, more and more energy storage systems have been applied in power systems with new energy characteristics. Through the charging and discharging characteristics of the energy storage system itself, the system fluctuations caused by new energy power generation can be suppressed. However, the energy storage system itself is relatively expensive. If the location and capacity configuration are unreasonable, it would not only cause waste of resources but also increase the unnecessary investment of the system. The specific objective function of multimedia quality evaluation in the new energy power generation system is as follows:

$$\begin{aligned} \min f_1 &= \sum_{i=1}^{6} b_i \cdot \cos t_i, \\ \min f_2 &= \sum_{k=1}^{n} V_k^{\text{spec}} / V_k^{\max}. \end{aligned} \tag{9}$$

In the formula, n is the total number of system nodes. The first objective function needs to consider the total cost of running. The system voltage fluctuates wildly as the output of the wind farm changes. Therefore, the node voltage of the new energy power generation system is improved by using the second objective function.

The multimedia quality evaluation platform relying on intelligent robot numerical control technology is shown in Figure 2. The interaction of the robot with the lathe is more complicated because the robot itself is located inside the lathe and has many moving parts. The interior space of the lathe is also irregular. It is very complicated and even difficult to perform interference detection directly on each geometry that constitutes a new energy power generation equipment. New energy power generation equipment with complex shapes is usually surrounded by a simple enclosure. If the simple bounding volume is detached, the device must be detached. To realize the multimedia status monitoring and control of the new energy power generation system, the signal lines are directly drawn from both ends of the indicator lights or buttons of the operation panel. It is transferred to the input and output terminals of the system controller through the intermediate relay (which are often used to transmit signals and control multiple circuits simultaneously and can also be used to directly control small-capacity motors or other electrical actuators). Using this method, the input and output of the system controller and the indicator lights or buttons of the operation panel are activated, which forms a "parallel" form of multimedia quality feedback and control for the new energy power generation system.

With the continuous improvement and upgrading of the CNC system, drive device, and main structure, the production efficiency (feed speed, machining accuracy, and so on) of CNC machine tools continues to be improved. However, the operating processes connected to it, such as workpiece loading and unloading and logistics transportation, have not grown at a matching rate. Robots and CNC machine tools are integrated into flexible manufacturing cells/systems, which can play advantages of accurate robot movements, sustainable work, and precise repeatability. This removes the constraints on the overall productivity improvement of the CNC machine work cell. The introduction of robots in the production workshop generally follows the following steps:

(1) *Feasibility Analysis*. On the basis of on-site investigation of the production workshop and reference to similar cases, the technical feasibility and advancement are analyzed. From the perspective of capital input and output, the possibility and rationality of introducing robot numerical control technology are considered. Combined with the site environment, the feasibility of project implementation is considered.

(2) *Detailed Design and Production Line Planning of Robotic Work Cells*. It includes new energy power generation system planning, layout design, auxiliary equipment selection, control system design, engineering construction plan, and so on.

(3) *Physical Construction and Trial Operation*. According to the design scheme, the installation and debugging of hardware and software are completed and the trial operation is started. In response to the problems that have arisen, they are improved. Multimedia quality assessments are carried out, and managers and operators are trained.

3. Multimedia Quality Evaluation Results

New energy power generation has many advantages, but it also has its own unique constraints. Wind and solar energy are taken directly from nature. Therefore, new energy is greatly affected by natural factors such as season and climate, which makes it more uncertain than conventional power generation. The uncertainty of photovoltaic power

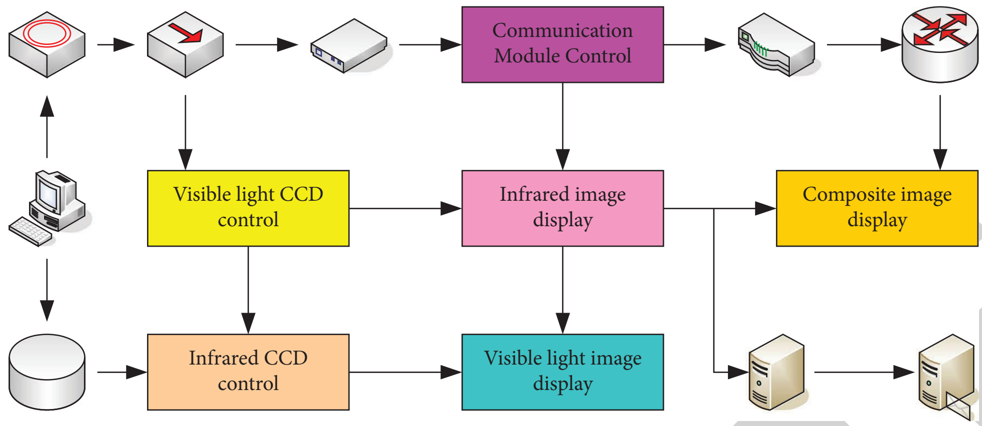

Figure 2: Multimedia quality evaluation platform relying on intelligent robot numerical control technology.

generation is mainly manifested in the randomness of the light intensity and the ambiguity of the components of the photovoltaic system. The integration of NE into the grid is bound to change the output mode of traditional energy power generation, which makes the power generation output more random and uncontrollable. It has become an important restrictive factor affecting the safe, stable, economical, and efficient operation of new energy power generation systems.

The relative errors of the generating units GE1, GE2, and GE3 are about 0%, 0.83%, and 2.45%, respectively. In the multimedia quality evaluation, the average relative error of the expected value of the power shortage of the NE EGS is 2.45% and the errors are all within 2.98%. The effects of different methods on power generation are shown in Table 1.

To illustrate the effectiveness of the intelligent robot numerical control technology in this paper and evaluate the effect of new energy grid connection on the power system, the simulation results of each scenario are shown in Table 2 (Scenario 1: new energy units are directly added to the system to cooperate with the original units. Scenario 2: new energy units of equal capacity based on intelligent robot numerical control technology are used to replace conventional units. Scenario 3: new energy units are simply added to the original system). By comparing the simulation results of scenario 1 and scenario 3, it is found that scenario 3 simply adds new energy to the original system. Its wind power generation is 128177 MW, and photovoltaic power generation is 31631 MW. This shows that although the output power of wind turbines and photovoltaic generators is intermittent and fluctuating, there is still a considerable confidence capacity. At the same time, the reliability indicators of the system in scenario 3, that is, the probability of insufficient power and the expected value of insufficient power, are both lower than those in scenario 1. This shows that the new energy unit directly added to the system can cooperate with the original unit to participate in the load balance, which effectively improves the reliability level of the multimedia new energy system. However, the new energy injection changes the energy structure of the system. The randomness and uncontrollability of its output power greatly affect the economy of some conventional thermal power generating units. Direct connection of NE to the grid makes a significant contribution to the system load balance and reliability. However, this is premised on sacrificing the economy of the operation of conventional thermal power generating units. Therefore, the integration of new energy into the grid needs to balance the interests of traditional energy units. The formulation of effective incentive measures and management mechanisms can not only ensure the economy of traditional energy but also actively consume new energy, thus greatly improving the efficiency of energy conservation and emission reduction of the power system.

Comparing the simulation results of scenario 1 and scenario 2, it is found that scenario 2 replaces conventional units with new energy units of equal capacity based on intelligent robot numerical control technology. Its wind power generation capacity is 128,001 MW, and photovoltaic power generation capacity is 31,522 MW. The total power generation of new energy replacing conventional units is 159,523 (the sum of the two) MW. According to statistics, the load of the NE electricity generation system based on intelligent robot numerical control technology is 1300731 MW in one month. The new energy power generation system based on intelligent robot numerical control technology has contributed nearly 12.3% of the power generation instead of conventional units. This further shows that the development of new energy power generation has practical significance to replace the consumption of fossil fuels. However, comparing the reliability indicators of the systems in scenario 1 and scenario 3, it is found that the probability of insufficient power and the expected value of insufficient power in scenario 3 have nearly tripled. This shows that the great influence of climate cannot guarantee full power generation at every moment.

Comparing the simulation results of scenario 2 and scenario 3, it is found that the wind power generation and photovoltaic power generation of scenario 2 are slightly smaller than those of scenario 3. This is because, under the policy of encouraging the full purchase of clean energy, the general situation is to give priority to the dispatch of clean energy power generation. However, since scenario 2 is directly connected to the new energy unit based on intelligent robot numerical control technology on the basis of the

Table 1: Effects of different methods on power generation.

Different units	Relying on intelligent robotic control technology (kW·h)	Traditional methods (kW·h)	Insufficient battery relative error (%)
GE1	780	780	2.2
GE2	476	480	2.6
GE3	99.5	102	2.55

Table 2: Simulation results for each scenario.

Scenes	Wind power generation volume (MW)	Photovoltaic power generation (MW)	Probability of loss of load (%)	Expected loss of electricity (MW)	Unit capacity start and stop frequency
Scene 1	0	0	0.091	70.003	10.072
Scene 2	128001	31522	0.048	40.221	12.893
Scene 3	128177	31631	0.272	210.464	12.166

original system, that is, there are 2 more conventional units compared to scenario 3. Therefore, the choice of the grid-connected form of new energy generating units is crucial to the system peak regulation, the rationality of dispatching of conventional units, and the multimedia quality evaluation of new energy consumption.

Comparing the start-stop frequency indicators per unit capacity of scenarios 1, 2, and 3, it is found that the start-stop frequency per unit capacity of the system is greater than the random production simulation results of the new energy power generation system without the use of intelligent robot numerical control technology, whether it is simply adding wind turbines and photovoltaic generators or replacing conventional units with new energy units. The increase in the start-stop frequency index of unit capacity indicates that more peak-shaving units are needed to balance the intermittent and fluctuating output of new energy units. On the one hand, the frequent start and stop of these thermal power units can easily damage the equipment. On the other hand, excessive start-stop operation also consumes additional fossil fuel, which has a certain positive impact on the low-carbon benefit of the system. Therefore, the integration of NE into the grid greatly affects the economics of conventional units. The grid-connected power of new energy cannot be increased without limit. It is necessary to balance the relevant interests, in order to mobilize the enthusiasm of the relevant stakeholders to consume new energy, to maximize the environmental benefits and economic benefits.

Comparing the simulation results, it is found that the total fuel cost and the total environmental cost of the system are reduced in scenarios 2 and 3 with the NE power generation system based on the intelligent robot numerical control technology compared with scenario 1 without the NE power generation system based on the intelligent robot numerical control technology. At the same time, the CO_2 emission of the system is reduced by about 60,000 tons. This shows that new energy sources such as wind farms and photovoltaic farms can effectively reduce the carbon emissions of the power system, thereby reducing the fuel cost of the system. It also improves environmental benefits and low-carbon benefits, which is of great significance to the realization of low-carbon electricity in the system. However, on the other hand, it also shows that the power generation of conventional thermal power is replaced. The economic benefits of thermal power plants are being challenged. Scenario 3 increases the power shortage cost of the system when the new energy unit replaces the thermal power of the same capacity. Therefore, new energy has a certain confidence capacity. For conventional units with higher reliability than the same capacity, the reliability index of the NE electricity generation system with intelligent robot numerical control technology needs to be known before determining the penetration rate and grid connection scale of new energy. The economic indicators of different scenarios and the CO_2 emissions of the system are shown in Figure 3.

Conventional units participate in peak shaving more frequently, which consumes higher costs. It cannot be ignored in the economic evaluation of power supply with new energy. Therefore, how to include both conventional indicators and comprehensive analysis of new energy grid-connected benefits in the power system production simulation results, as well as low-carbon benefit indicators that reflect the dynamic start and stop of new energy units that rely on robotic numerical control technology, is crucial. Figure 4 shows the change in the expected power production of conventional units before and after simply adding a new energy power generation system. The grid-connected wind farms and photovoltaic farms have different capacities to replace units at different load positions. For example, for the units that undertake the base load, the power output is basically unchanged; that is, new energy cannot replace the power generation of such units, such as the No. 3 and No. 9 base-load units. The output change of the waist-loaded unit is also relatively small. The reduction ratio is about 9% to 23%, such as the No. 8 and No. 6 waist-loaded units. The replacement rate of peak load units is the largest. For example, the replacement ratio of No. 1 and No. 5 units is over 74%. This reduces the peak-shaving capacity of the system and is not conducive to system peak shaving. This is why, units under peak load generally require good peak-shaving

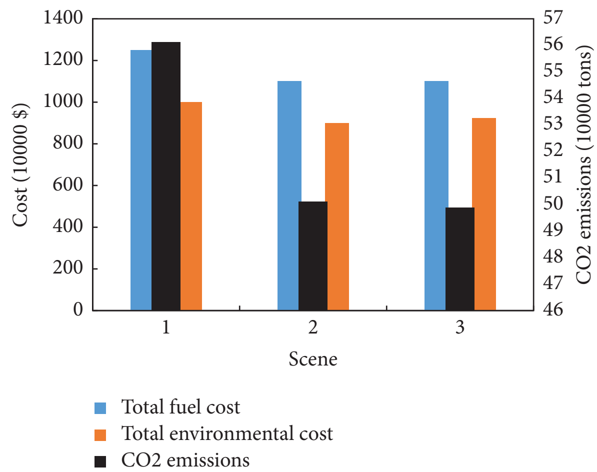

FIGURE 3: Economic metrics and system CO_2 emissions for different scenarios.

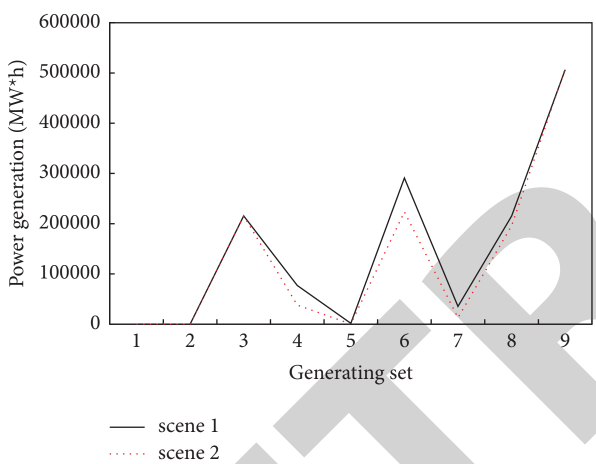

FIGURE 4: Changes in the expected electricity production of conventional units before and after simply adding a new energy power generation system.

performance, which can quickly start and stop, or transfer to hot standby. On the other hand, this also means that due to coping with the volatility and intermittency of NE, peak-load units spend more on start-stop operations.

With the continuous increase of the scale of NE power generation and the capacity of a single unit, the randomness and uncertainty of its own output also have a positive impact on the operation of the power system. The uncontrollable output of new energy sources affected by the environment and climate makes them not have the good dispatchability of conventional units. The output characteristics of different NE are different, which requires the selection of different distribution models as the multimedia quality evaluation and estimation scheme. The error of the predicted output of different distribution models is also different. This is obviously complicated by the use of forced outage rates to characterize random failure states for conventional units. Taking wind farms as an example, the wind turbine output should also consider the correlation of different wind farms when necessary, which is sometimes affected by wind direction and wake effects. The photovoltaic power generation needs to consider the component failure rate of the photovoltaic array. Therefore, it is particularly important to fully consider the natural environmental factors and distribution characteristics that affect new energy and to construct a new energy source that conforms to its respective output characteristics.

Due to the differences in the spatial locations of wind farms 1, 2, and 3, their respective outputs are affected by the wake effect of wind energy, the geographical dispersion effect of wind farms, and different climates, which lead to different output fluctuations of the three wind farms. However, with the increase of the coverage area and the number of wind farm groups, the irrelevance of the spatial position makes the output of each subwind farm also show irrelevant characteristics. Therefore, to a certain extent, the fluctuations of each subwind farm in the wind farm group cancel each other out, which shows the complementary characteristics of the wind farm group. It can alleviate the influence of wind power output fluctuation and intermittent so as to achieve the effect of reducing the total output fluctuation of the wind farm group. The output fluctuation of the wind farm is shown in Figure 5.

The simulation model of the solar photovoltaic power generation system based on the intelligent robot numerical control technology is built on the MATLAB (matrix and laboratory) simulation platform. Simulation experiments of 3000 W photovoltaic cells are carried out in the afternoon session. The light intensity of solar photovoltaic cells has dropped from 1000 W/m^2 to 500 W/m^2. The weather changes from noon to afternoon in autumn are simulated. Figure 6 shows the output voltage waveform of 3 solar cell arrays in series (3000 W). When the light intensity decreases, the solar output voltage also decreases. The output voltage waveform of the solar cell array is easily affected by environmental factors, which may easily lead to the defect that the power supply to the load is unstable. Therefore, it is necessary to establish an energy storage system that uses a bidirectional converter to control charge and discharge. Energy conversion of the energy storage system is realized through the robot numerical control technology of controlling the nonlinear bidirectional converter. The bidirectional flow of energy is completed, thereby realizing the instantaneous power balance and voltage stability control of the clean energy power generation system.

Figure 7 shows the output current and voltage waveforms when the load is 25% of the rated load. When the load is 25% of the rated load (6 s), the output current of the load terminal is 0.66 A and the output voltage is 99.34 V. Eventually, a steady state can be achieved, which satisfies the multimedia quality design requirements.

The reliability indicators under different system basic configurations are shown in Figure 8. The reliability of adding energy storage to power generation systems with different new energy sources is higher than that of not installing energy storage. Under the same installed capacity, the reliability of light/diesel/storage system is higher than that of wind/light/diesel/storage and wind/diesel/storage

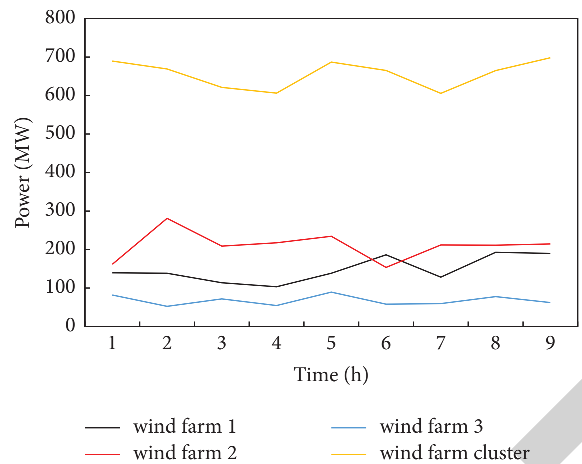

Figure 5: Output fluctuations of wind farms.

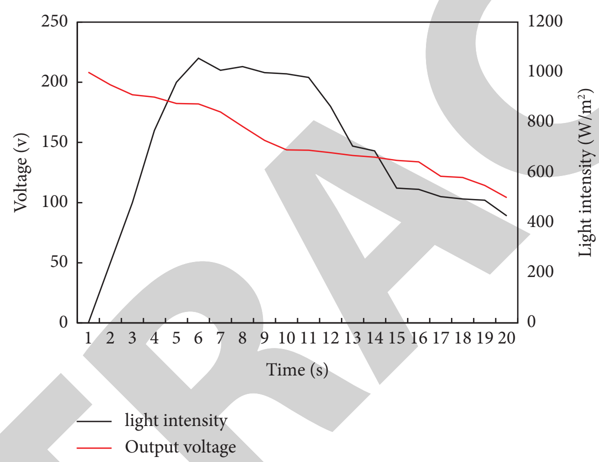

Figure 6: Output voltage waveform of 3 solar cell arrays in series (3000 W).

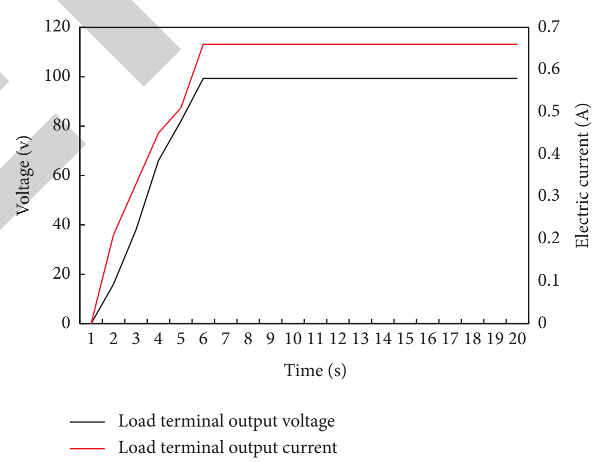

Figure 7: Output current and voltage waveforms at 25% of the rated load.

system. This is due to the uncertainty and randomness of wind speed, which makes the reliability of the system with wind power generation lower than that without a wind power generation system. In the wind power generation system, the reliability of the wind/light/diesel/storage power generation system is higher than that of the wind/diesel/storage power generation system. Therefore, the reliability of the wind/light/diesel/storage system with photovoltaic power generation is higher than that of the wind/diesel/storage power generation system without photovoltaic power generation. However, in the absence of light at night, diesel engines are basically used to generate electricity. The

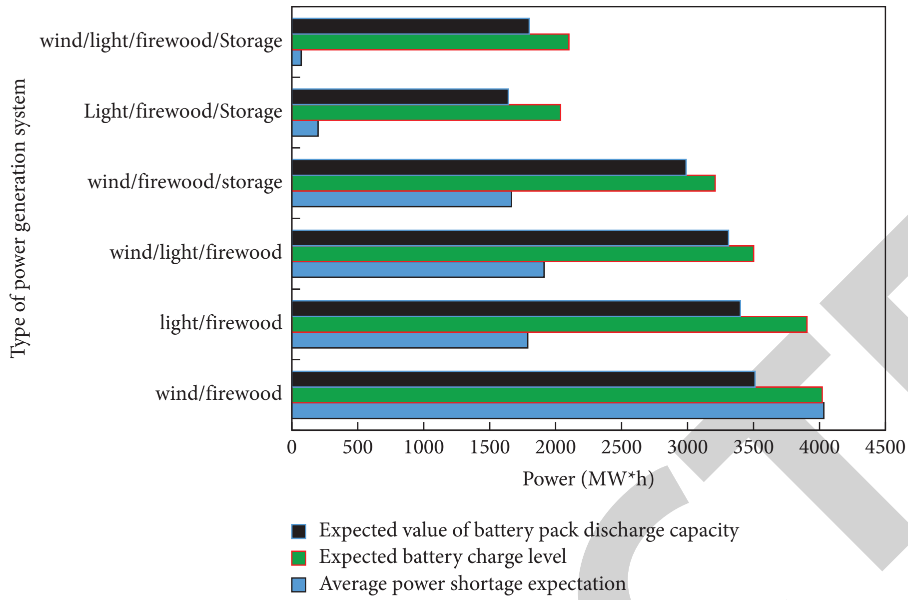

Figure 8: Reliability metrics for different system basic configurations.

consumption of diesel oil is more, and the cost is higher. Therefore, it is not used as a research object. Considering the complementary factors between economy and environmental protection and photovoltaic and wind power generation, the reliability of wind/solar/diesel/storage system is the best.

The development of NE and the reduction of excessive use of fossil energy have become urgent problems for countries to solve. Especially in recent years, global warming and more environmental pollution problems have restricted the healthy development of human beings. The vigorous development of RE is a very important part in developing a low-carbon economy, alleviating energy supply pressure, implementing energy development strategies of various countries, and improving the living environment of human beings. In the new energy power system represented by photovoltaic power stations and wind farms, output simulation is required in order to calculate the relative economics and reliability. In this way, the combination of conventional units is rationally arranged and the actual dispatching needs are met, thereby making more full use of renewable solar and wind energy, which reduces environmental pollution and power generation costs. The influence of the random characteristics of NE sources on the thermal power units of the system should also be considered. By establishing reasonable evaluation indicators, the peak-shaving problem brought by the grid connection of NE to conventional units and the impact on the low-carbon benefit of the system are evaluated.

4. Conclusion

With its sustainability and cleanliness, new energy power generation technology has become an important means to solve the problems of global energy demand and environmental governance. Among them, wind power generation projects and photovoltaic power generation projects have been vigorously promoted all over the world. In view of the lack of assessment of the impact of the new energy grid connection on the power system, this paper evaluated the multimedia quality and low-carbon benefit indicators of the new energy power system from both positive and negative aspects. On the one hand, the NE power generation system relying on intelligent robot numerical control technology has greatly reduced the carbon emissions of the system. On the other hand, the excessive start-stop operation of conventional units has increased the extra coal consumption to reduce the low-carbon benefit of the NE power generation system, which has improved the quality of multimedia evaluation in the environment of the NE power generation system. For large power grids, due to its large structure and high energy capacity, it has a certain ability to regulate voltage fluctuations, which has strong integration for a new energy power generation system with an appropriate proportion. However, in the microgrid, its simple structure and small energy capacity make it to not have good self-regulation ability. When a large number of new energy systems are incorporated into it, it would cause serious voltage fluctuations in the microdot grid system. The large voltage quality fluctuations in the microgrid may also hinder the normal operation of important equipment on the load side, which may seriously cause failure. With the development of multimedia new energy, factors such as climate have caused instability and intermittent problems in power output. In future works, it is necessary to consider the factors that bring trouble to the efficient utilization of new energy power, including some problems that are difficult to predict, difficult to control, difficult to schedule, and system fluctuations.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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