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Dynamic Evaluation Method of Electric Power New Energy and River Basin Ecological Restoration

Tianjiao Dang[1]

[1]Chang'an University
Xi'an, Shaanxi (China)
E-mail: **2020016001@chd.edu.cn**

Abstract. The wide application of renewable energy can reduce the carbon emissions to the environment and the consumption of petrochemical resources, improve the improvement rate of the natural environment, and at the same time, ecological restoration can improve the ecology of the river basin and produce sustainable improvement of the environment together with renewable energy. In this paper, renewable energy is taken as the research object, and the ecological restoration method of the river basin is jointly evaluated to comprehensively evaluate the natural environment. First, the carbon neutrality data of ecological restoration and renewable energy in the river basin were collected, classified, collated and integrated, and the analysis indicators included CO2 emissions, plant coverage, soil and water conservation, and the cost of power generation. Then, the spatial regression model was used for data processing and calculation, and the ecological coefficient and carbon emission coefficient were determined in an iterative manner. Finally, the actual case is used for dynamic evaluation and analysis. The results show that the new power and watershed ecological restoration methods can improve the natural environment, improve the plant coverage rate and soil and water conservation rate, with an increase rate of 25~30%, reduce carbon dioxide emissions and power generation costs, and reduce the reduction rate of 10~30%, and at the same time, a good ecological environment will also react to new energy and expand the development space of new energy, with an expansion rate of 10%. Therefore, the method of electric power new energy and river basin ecological restoration can improve the natural environment, promote the development of electric power new energy, and optimize the overall structure of new energy.

Key words. Electric Power, New Energy, River Basin, Ecological Restoration, Dynamic Assessment.

1. Introduction

Achieving the goal of "dual carbon", reducing the adverse effects of climate, and maintaining climate balance are the main research directions in the field of new energy and ecological restoration. The results show that reducing greenhouse gas emissions and reducing global temperatures below "2°C" can significantly reduce the magnitude of climate change and the adverse impact on the ecological environment [1]. Similarly, ecosystems such as forests and grasslands will need to absorb carbon dioxide from the atmosphere to further improve the natural environment. The use of renewable energy can expand the coverage of forest systems and improve existing climate problems [2]. Some scholars have estimated the current carbon storage from the perspective of biomass and storage and found that the time for carbon neutrality will reach 100 years, and the carbon storage of forest systems is decreasing day by day, so it is necessary to reduce carbon emissions and improve the ecosystem. Some scholars have estimated the carbon storage of forest ecosystems in different regions and then introduced the Invest model to calculate, and found that renewable energy can theoretically reduce carbon emissions and improve the environment in the region. Some scholars believe that the joint analysis of power new energy and river basin ecological restoration [3], [4] and the introduction of intelligent algorithms to balance the relationship between the two and accelerate the implementation of the carbon neutrality strategy. However, in terms of theory, there are problems such as the wide distribution of new energy sources and the complexity of ecosystem assessment, which cannot be effectively analyzed. There are also scholars who overlap the problems of new energy and ecological restoration and conduct overlapping analyses to simplify the corresponding problems [5], [6], but the collected data are very different and have their own professional attributes, so it is impossible to carry out later calculations. Some scholars believe that the existing intelligent algorithms should be improved and integrated into the data standardization processing function and fusion function to balance the differences between new energy and ecosystems [7], explore the connection between the two, and better carry out dynamic assessment, while others believe that ecological restoration has its own cycle, and it is necessary to integrate time factors into intelligent methods to complete dynamic assessment [8], [9], and calculate the results to reduce subjective judgment. On the basis of the above research, this paper analyzes the power and new energy as the base point and combines the ecological restoration data of the river basin to make a comprehensive judgment of carbon neutrality. The data collection is mainly carried out through the coupling algorithm, and the differential data is normalized to form a standardized data set. Then, the main influencing factors and indicators are judged to form the primary process of the coupling algorithm. Finally, the relationship between new energy and ecological restoration is calculated, and the dynamic assessment results are output, with the aim of expanding the development of new energy and improving the ecological environment of the region

2. Description of the Problem of New Power Generation and Ecological Restoration

A. The Relationship Between the Increase in the Utilization Rate of New Energy and Ecological Restoration

The Gaussian distribution should be used to determine the correlation between the relationship between new energy prestress and ecological restoration. Hypothesis 1: $\mathbf{S}$ is a collection of ecological data of the watershed, which can be expressed as:

$$\mathbf{S} = \left\{\left(x_n, y_n\right)\right\}_{n=1}^{N} \tag{1}$$

where are the x_n vegetation feature and the y_n water and soil features. N is the data collection point. There are disturbance factors such as weather, hydrology, and wind in the sample set, which affect ecological restoration and renewable energy utilization, so it is necessary to find a fusion function f to represent the mapping relationship between different nodes. In this study, the f difference function between renewable energy energy consumption and ecological restoration change at adjacent time nodes [10], [11]. If there is a reasonable match between renewable energy and ecological restoration, the results should obey the normal distribution σ and Gaussian distribution a, and the reduction of energy consumption is displayed in the form of area and calculated by likelihood function $P\left(\mathbf{Y}|\ \mathbf{X},\boldsymbol{\theta}\right)$, and the process is as follows:

$$P\left(\mathbf{Y}|\ \mathbf{X},\boldsymbol{\theta}\right) = \gamma \cdot \frac{\sum P\left(y_n, z_n|\ x_n, \boldsymbol{\theta}\right) \cdot e^{-\frac{\left\|y_n - f\left(x_n\right)\right\|^2}{2\sigma^2}}}{\sigma^2 + \alpha} \tag{2}$$

where is the γ proportion of new power and energy, which D is the dimension of ecological restoration; z_n It is the optimization of the new energy structure and is expressed in the form of a dichotomy. $\boldsymbol{\theta}$ is the integration coefficient of new energy and ecological restoration, and its correlation index is defined as:

$$\boldsymbol{\theta} = \left\{\mathbf{f}, \sigma^2, \gamma\right\} \tag{3}$$

f The degree of fusion of the fusion function can be expressed as:

$$P\left(x\right) \propto \lambda \cdot e^{-f} \tag{4}$$

In the formula, the degree coefficient $\lambda > 0$, the higher the depth of integration, the faster the ecological restoration, and the greater the evaluation result.
Iteratively process the natural estimates of new energy and ecological restoration to improve their rationality, i.e $\boldsymbol{\theta} \to \hat{\boldsymbol{\theta}}$.,

$$\hat{\boldsymbol{\theta}} = \mathrm{argmax} P\left(\boldsymbol{\theta}|\ \mathbf{X},\mathbf{Y}\right) \tag{5}$$

The energy consumption reduction function $E\left(\boldsymbol{\theta}\right)$ is

$$E\left(\boldsymbol{\theta}\right) = -\ln P\left(\mathbf{f}\right) - \sum_{n=1}^{N} \ln \hat{\boldsymbol{\theta}} \tag{6}$$

The maximum probability of the $\boldsymbol{\theta}$ minimum value of energy consumption is the $\hat{\boldsymbol{\theta}}$ degree to which the demand for new energy and ecological modification can be met. Therefore, it $E\left(\boldsymbol{\theta}\right)$ is an iterative algorithm, which gradually updates the expected value to obtain the best calculation probability, and its specific solution process is as follows.

First, construct the posterior function $Q\left(\boldsymbol{\theta}, \boldsymbol{\theta}^{\mathrm{old}}\right)$, and its computation process:

$$Q\left(\boldsymbol{\theta}, \boldsymbol{\theta}^{\mathrm{old}}\right) = \sum_{i=1}^{N} P\left(z_i = 1|\ x_i, y_i, \boldsymbol{\theta}^{\mathrm{old}}\right) \left\|y_i - \mathbf{f}\left(x_i\right)\right\|^2 \tag{7}$$

In the formula $\boldsymbol{\theta}^{\mathrm{old}}$, the probability constraint is $z_n = 1$ $\boldsymbol{\theta}^{\mathrm{old}}$ 0, and the value is 0, and different probabilities need to be calculated, and the optimization probability of the indicators such as power flow, voltage, current, forest, carbon dioxide, and water and soil is found, which is calculated as follows:

$$P_n = 2\pi \cdot \sigma^2 \cdot \gamma \cdot e^{-\frac{\left\|y_n - f\left(x_n\right)\right\|^2}{2\sigma^2}} \cdot \frac{a}{1 + \left(1 - \gamma\right)} \tag{8}$$

P_n The larger it is, the larger the watershed, and the larger the ecological restoration effect of Hsinchu.

The probability of new power is solved as follows $\boldsymbol{\theta}^{\mathrm{new}}$, and the proportions are adjusted as follows:

$$\sigma^i = \frac{\left(\Delta\mathbf{Y} - \mathbf{V}\right)^T \times tr\left(\vec{\mathbf{P}}\right)\left(\Delta\mathbf{Y} - \mathbf{V}\right)}{D_i} \tag{9}$$

Among them, the calculation of the critical probability coefficient is as follows:

$$\gamma = \frac{tr\left(\mathbf{P}\right)}{N} \tag{10}$$

where, $\mathbf{V} = \left(\mathbf{f}\left(x_1\right)^{\mathrm{T}}, \cdots, \mathbf{f}\left(x_N\right)^{\mathrm{T}}\right)^{\mathrm{T}}$, $\mathbf{P} = \mathbf{P} \otimes \mathbf{I}$, $\mathbf{P} = \mathrm{vol}\left(P_1, \cdots, P_N\right)$, $\otimes$ represents the internal integration of new energy sources such as wind power and photovoltaic, and gradually obtains the optimal combination result. The final fusion result is shown below.

$$\varepsilon\left(\mathbf{f}, x\right) = \frac{1}{\sigma^2} \sum_{i=1}^{N} P\left(z_i = \mathbf{f}\left(x_i\right)|\ x_i, y_i, \boldsymbol{\theta}^{\mathrm{old}}\right) \tag{11}$$

B. The Reaction Effect of Ecological Environment Improvement on New Power Sources

A good ecological environment can enhance the illumination and wind speed of the region, and give full play to the potential energy of hydropower, so as to promote the development of new energy. At the same time, the development of new energy will also affect the ecological restoration of the river basin. Therefore, the accuracy and robustness of the fusion between the two should be analyzed. It can better reveal the actual situation of new energy and ecological restoration, and provide support for the development strategy of new energy, so it is necessary to construct a reaction method of the ecological environment to new power and new energy. Hypothesis 3:

It is recorded Δt as the data collection interval to calculate the improvement of the ecological environment $\mathbf{R}(t+\Delta t)$ and the development of new energy $\mathbf{v}(t+\Delta t)$, and the specific calculation is as follows:

$$\mathbf{R}(\Delta t)=\left[\left(\mathbf{R}(t)\rightarrow\sum \mathrm{Exp}\left(\tilde{\boldsymbol{\omega}}(t)+\mathbf{b}^i(t)+\boldsymbol{\eta}^i(t)\right)\right)\right] \quad (12)$$

The new energy development function, is calculated as follows:

$$\mathbf{v}(\Delta t)=\sum \mathbf{R}(t)\left(\tilde{\mathbf{a}}(t)-\mathbf{b}^i(t)-\boldsymbol{\eta}^i(t)\right)\Delta t \quad (13)$$

where $\mathbf{R}$ and $\mathbf{v}$ are $\mathbf{P}$ the power flow, voltage, and power, respectively $\mathbf{g}$, which are the ecological improvement rate, $\tilde{\boldsymbol{\omega}}$ the restoration coefficient, $\tilde{\mathbf{a}}$ the basin range, $\mathbf{b}^i$ the improvement speed, and $\boldsymbol{\eta}^i$ the growth rate of the proportion of new energy.

C. Selection of the Integration Point of Electric Power New Energy and Ecological Modification

The fusion range is calculated from the area of the fusion point, and the i change of current, voltage, and power flow j from time to moment is $\Delta\mathbf{R}_{ij}$, $\Delta\mathbf{v}_{ij}$. $\Delta\mathbf{P}_{ij}$ The i assessment point of ecological restoration j from moment to $\mathbf{p}_i$ moment is and $\mathbf{p}_j$, and the ecological restoration point is recorded at the same time, and its sitting mark is O_i and O_j , and the calculation formula is as follows.

The time improvements are:

$$set(\mathbf{O}_i)=\sum\frac{s_i\rightarrow\mathbf{p}_i}{\mathbf{K}} \quad (14)$$

The improvements to the optimization depth are:

$$set(O_j)=\sum\frac{s_j\rightarrow p_j}{K} \quad (15)$$

where is the $\mathbf{K}$ internal reference matrix of new energy and ecological restoration, s_i and the s_j depth values of vegetation and soil p_i in the ecological assessment index, respectively p_j . In order to improve the accuracy of the evaluation, it is necessary to perform a secondary calculation on each index and analyze its deviation characteristics. Hypothesis 4: $\mathbf{p}_j$ deviation from $\mathbf{p}'_j$ existence, the deviation value is Δd_I , and the calculation formula is:

$$\Delta d_I=\left|\mathbf{p}_j-\mathbf{p}'_j\right| \quad (16)$$

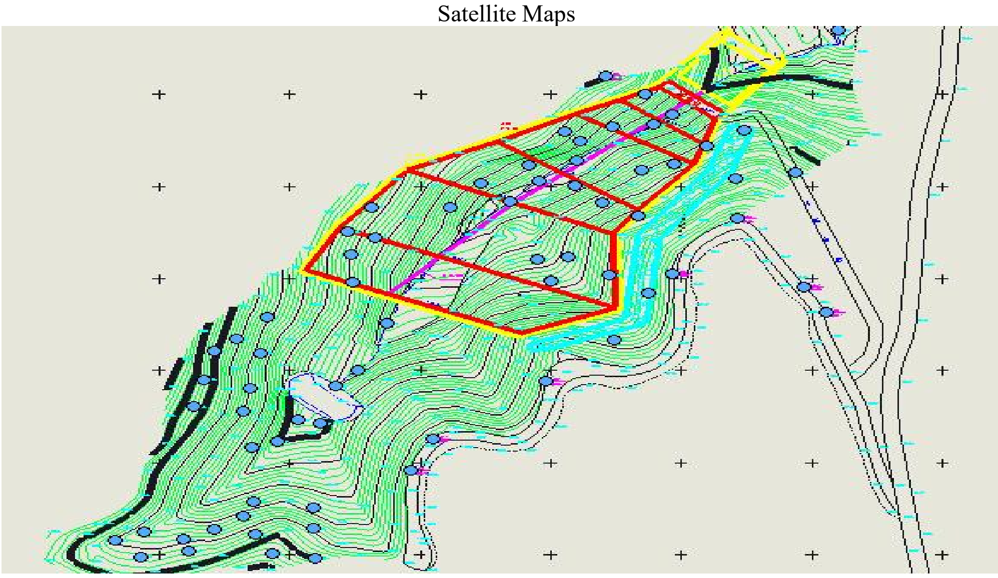
In summary, the dynamic assessment process between power new energy and river basin ecological restoration is a coupling relationship, and the two affect each other. However, the purpose of electric power new energy and ecological restoration is the initial point, and its purpose is to improve the environment of vegetation and soil, and increase the proportion of wind power, hydropower and other energy sources, to achieve a good ecological environment, promote the sustainable development of society, and expand the use of new energy. In the process of evaluation, it is also necessary to introduce evaluation parameters, calculate the probability of the occurrence of each index, and improve the situation, so as to form a continuous dynamic evaluation.

3. Case Study of New Power Generation and Ecological Restoration of River Basins

A. Brief Introduction to the Research Subject

Taking Central China as the research object, the main research contents include, wind power, photovoltaic power generation, hydropower generation, etc., the generator is 1200KW, the average wind power is 3~5, the average drop of water flow is 20m, and the light intensity is 102mH/m2. The evaluation indicators include cost, new energy carbon emissions, soil and water conservation, vegetation growth, etc., and the schematic diagram of the research objects is as follows.

Satellite Maps



CAD Mapping Maps

Figure 1. Schematic Diagram of the Test Area

In Figure 1, we selected Central China, which has obvious regional characteristics and ecological diversity, as the research object, and analyzed the distribution of new energy sources, such as hydropower generation and wind power.

B. The Relationship Between New Power and Ecological Restoration

In order to better conduct research on new power sources and test their relationship with ecological modification, the specific results are as follows.

Table 1. Relationship Between New Power and Ecological Restoration [Unit: %]

Index	Self Entropy	Correlation Entropy	Lift Rate
Vegetation	0.9794	0.0206	26.49
Water and Soil	1.0000	0.00001	0.02
Carbon Emissions	0.9430	0.0570	73.49
Environmental Remediation Costs	0.2322	0.0251	11.254
The Increase in New Energy	1.0000	0.00001	0.001

The results in Table 1 show that the restoration of vegetation water and soil carbon emissions is obvious, the relationship between water and soil and new energy increase is strong, and the increase rate of new energy and ecological restoration is high, among which the reduction rate of carbon emissions is the highest at 73.49%, and the improvement rate of vegetation is 26. 49% The relationship between electric power, new energy and ecological restoration is positively correlated, and vegetation and carbon emissions are two important influencing indicators, in the process of increasing the proportion of new energy, the area of vegetation can be effectively increased and expanded, and the corresponding carbon emissions can be reduced. The repair time is relatively long, so there is no significant improvement in terms of values. The correlation analysis between new energy and ecological restoration was carried out and periodically judged. Comparing the relationship between power new energy and ecological restoration, it is found that there is a positive development between the two, with 25 days as the study interval, and the changing trend is shown in Figure 2.

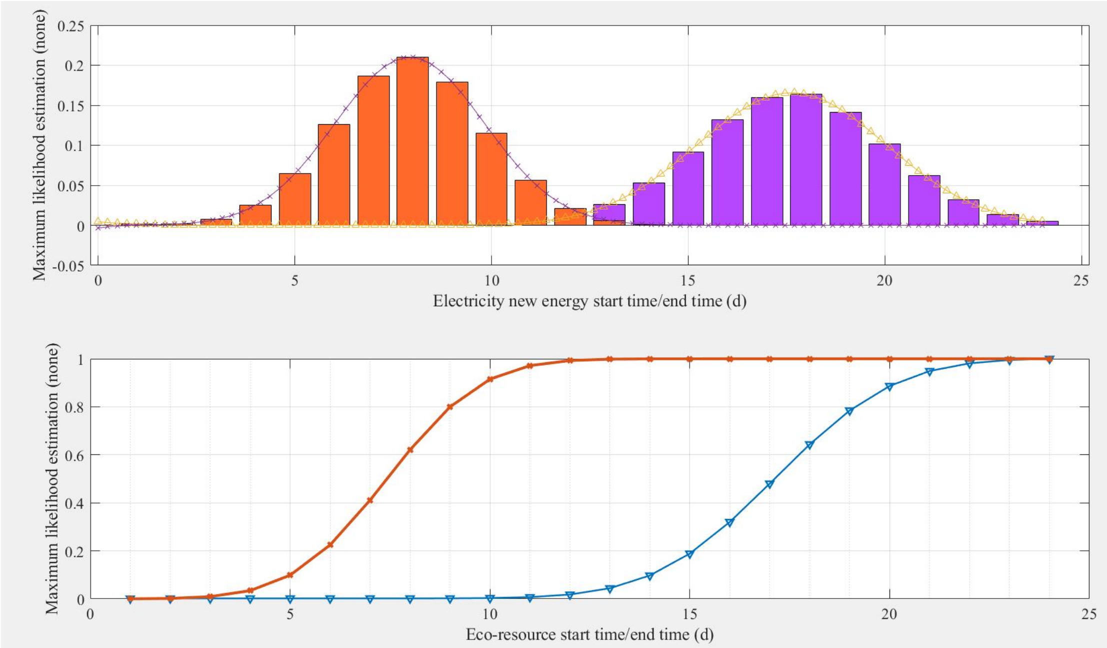


Figure 2. The Relationship Between New Power Sources and Ecological Modification

Through the comparison results, it is found that there is a positive correlation between the change of energy and the change of ecological restoration, and there is a large delay between the change of new energy and the change of ecological restoration, mainly because the development of new energy is in the first and the ecological restoration is later, and the time interval is relatively long, about 10~12 months. It can be seen that new energy can promote ecological restoration and have a significant impact on the ecological environment of regions and regions. The increase in the amount of new energy can reduce the damage to vegetation and land resources. Increase the vegetation coverage in the area. Deepening ecological populations. The results show that the ecological restoration will show an upward trend in about 10 days, the carbon emissions of new energy will be reduced in 6 days, and the impact on the surrounding environment will be reduced. Voltage and power flow of new energy. There was no change in volatility either. It shows a normal distribution trend, indicating that the increase in renewable energy does not have a significant impact on the thermal power grid. And it will have a significant effect on the improvement of the surrounding environment. It also indirectly proves that there is a good coupling relationship between new power and ecological restoration.

C. The Feedback Effect of Ecological Restoration on New Power Sources

Since the development of new energy will have an impact on the ecological environment, the ecological environment will also react to new energy, so the coupling relationship between the two should be deeply excavated, and the feedback effect of ecological restoration on new power and new energy should be analyzed, and the specific results are shown in Figure 3.

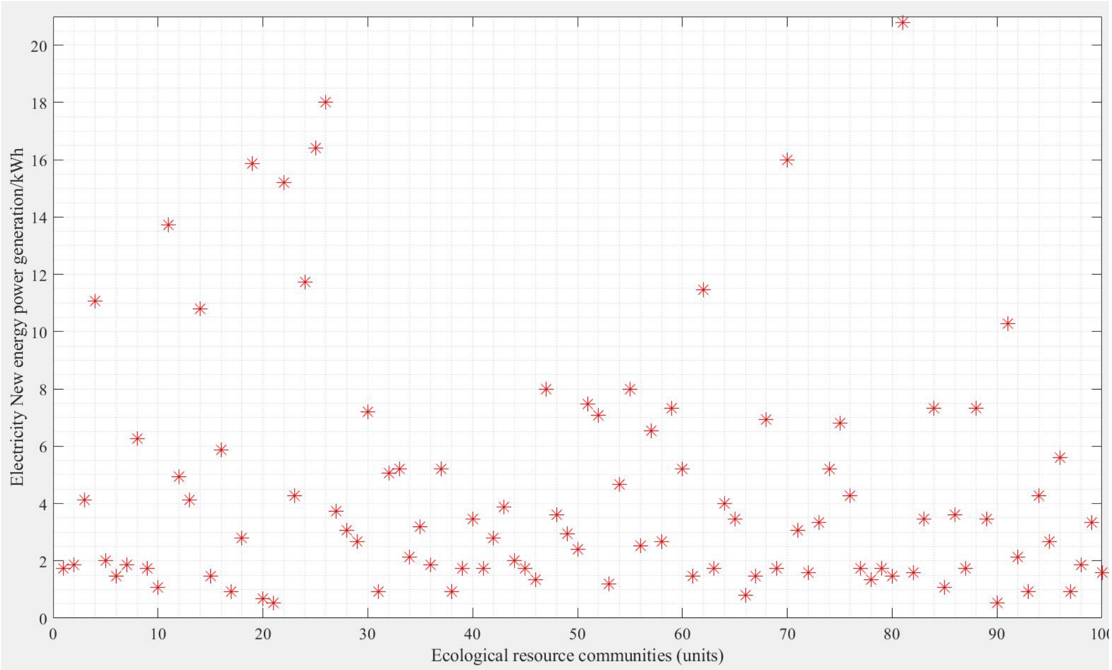


Figure 3. Relationship Between New Power Sources and Ecological Populations

The power flow voltage of the new power source itself remains stable, and the power supply of the entire power grid is relatively stable. Among them, there is a coupling relationship between ecological restoration and power and new energy. The promotion effect of ecological restoration on new energy is mainly reflected in the population aspect of ecological restoration, and the vegetation type will have an impact on the power wind direction and current in the new energy, prolong the sunshine time in the region, and increase the solar energy conversion rate of the photovoltaic matrix. In addition, the effective ecological restoration energy is enough to increase the wind speed in the region, avoid extreme weather, prolong the occurrence of good weather, and provide support for wind power generation. Therefore, ecological restoration has a promoting effect on the regional environment and indirectly affects photovoltaic power generation and wind power generation in new energy sources. In addition, soil and water conservation will also reduce the occurrence of natural disasters such as flash floods, so as to provide more hydropower potential energy, laying a good foundation for hydropower generation in the region. Since there is a continuous and dynamic process between new energy and ecological restoration, it is necessary to analyze it continuously. In order to better study the impact of ecological restoration on new power sources, a 100-day comparative analysis of the two was carried out to judge the change of their increase amount, and it was found that the increase between the two was linear, but the increase rate was constantly changing, as shown in the figure below.

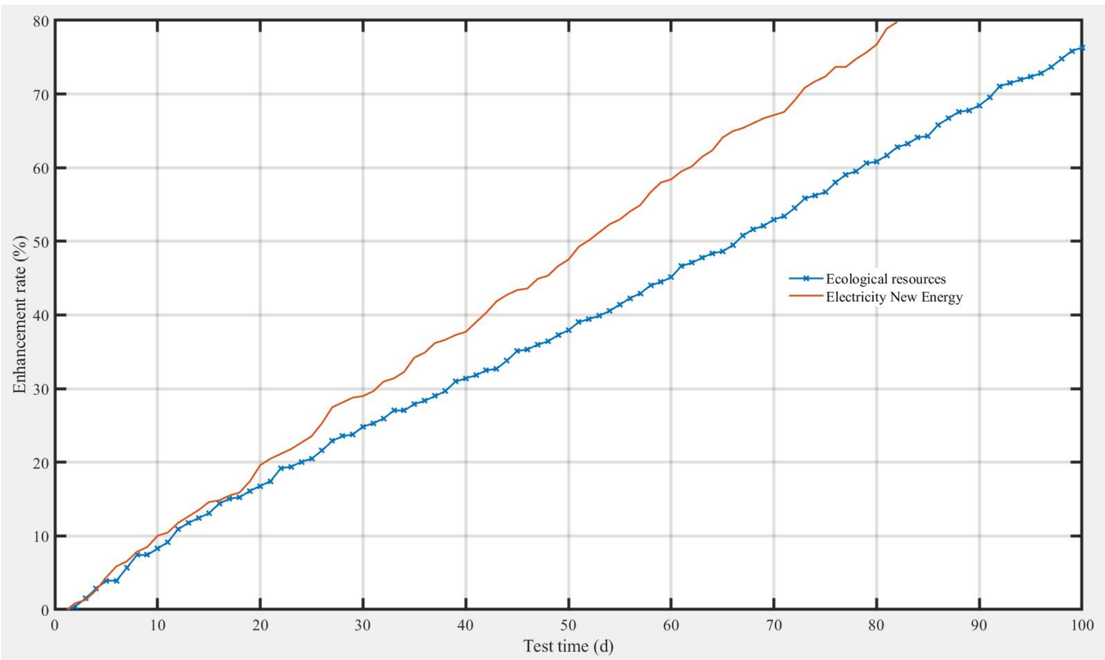


Figure 4. Comparison of the Increase of Ecological Restoration and New Power Sources

From the analysis results in Figure 4, it can be seen that there is a positive change process between new energy and ecological restoration. The development speed of new energy is relatively fast, and the development time of ecological restoration is relatively lagging behind, but both maintain a linear relationship, indicating that the changes between the two are relatively stable. Among them, the development rate of new energy has shown a linear upward trend, which also indirectly proves that ecological restoration can increase the proportion of new energy, thereby reducing the damage to the surrounding environment. In the analysis of the results, it is found that there is no large fluctuation between the two, indicating that the new energy can still maintain the stability of basic parameters such as voltage and power flow under the condition of increasing the proportion of its own power generation, and there are no abnormal parameters, as shown in the following table.

Table 2. The Role of Ecological Environment in Promoting New Power Sources

Range	Index	New Energy → Ecology	Ecology → New Energy	Phase Coupling	Sort the Results
New Energy	Voltage	4.463	4.361	0.494	5
	Current	2.634	4.343	0.623	4
	Tidal Current	5.914	1.905	0.244	2
Ecological Restoration	Sunshine	5.481	2.914	0.347	1
	Wind Velocity	2.197	5.167	0.702	3
	Stream	5.048	2.695	0.348	6

From the data analysis in Table 2, it can be seen that the interaction between the ecological environment and the new power source is ideal, and the coupling degree between the two is more than 0.4. Among them, the improvement rate of insolation is the highest, followed by the current and wind speed, and finally, the improvement of water flow. This result further proves that soil erosion is a key part of ecological restoration, which requires long-term new energy development to be improved, and its improvement is relatively slow.

4. Conclusion

Thermal power generation has a great impact on the surrounding environment, especially the impact of vegetation, water and soil, such as mining, transportation, timber cutting, etc., which affect the construction of the surrounding environment. From the perspective of new energy, this paper analyzes the restoration of the ecological environment in the basin, especially the vegetation, water and soil. In this paper, the dynamic evaluation equation of new energy and ecological restoration is constructed by using mathematical research methods, and the indicators such as tidal current, voltage and electric energy are described, and the vegetation, water and soil indexes in ecological restoration are judged. The results show that new energy can reduce carbon oxide emissions, reduce vegetation destruction in the watershed, and have a long-term impact on soil and water conservation, with the increase of the proportion of new energy, its tidal voltage, and current do not change greatly, but the effect on vegetation in ecological restoration is more obvious, and the general effect time is about 20 days, and the new energy mainly reduces carbon dioxide emissions, and its effective reduction degree reaches 70%. Above, and can promote growth, the promotion rate reaches 20%. At the same time, ecological restoration will also have an indirect effect on new energy, mainly to extend the sunshine time of photovoltaic power generation, followed by the increase of wind power generation, and finally hydropower generation, with an overall improvement rate of more than 20%, which indicates that ecological restoration will increase the power generation of new energy, optimize the existing structure of new energy, and enhance the sustainable development ability of power grid and power system. The research in this paper also has its own shortcomings, mainly because the qualitative analysis of the data in the process of collecting information on the development of new energy does not use massive quantitative analysis, so it will have a certain impact on the research results, but the derivation function in this study can make up for the above shortcomings, so in the future, the correlation analysis of ecological restoration based on the actual data of new energy, such as power flow, voltage and current, etc., will be carried out, and the correlation between the two in the practical layer will be analyzed.

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