Research on Energy Saving and Emission Reduction System of Agricultural Project through Carbon Neutral Emission

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Abstract. The environmental challenges posed by greenhouse gas emissions from rural tourism are becoming increasingly severe. Market-based measures are one of the indispensable measures to fill the carbon emission gap of rural tourism. Scenic spots are important nodes in low-carbon or carbon-neutral tourism practices. Based on this research background, based on the perspective of carbon neutrality, the paper discusses the theoretical framework and carbon compensation mechanism for the estimation of net carbon emissions from rural tourism destinations, as well as the impact on the transportation, management and waste carbon emissions of tourist attractions and forest land, grassland, gardens, waters, and beaches. The carbon absorption of the country was measured, and the carbon source and carbon sink of the scenic area were comprehensively evaluated, and then the way to realize the carbon compensation of the traditional village-type rural tourism destination was found.

Keywords: Carbon neutrality, carbon emissions, agricultural hotels, rural tourism, energy saving and emission reduction.

1. Introduction

"Carbon emissions" is a general term or abbreviation for greenhouse gas (GHG) emissions. At present, greenhouse gas emissions recognized by the international community include the following six gas emissions: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hexafluoro carbons Sulphur (SF₆). Since the most important greenhouse gas emissions that affect climate change is carbon dioxide, when discussing greenhouse gas emissions, the term carbon emissions is often used as a representative, and "carbon emissions" or "carbon dioxide emissions" are used to refer to greenhouses for short gas emissions [1]. Any activity of human beings as small as the people’s cooking, as large as the country’s economic growth, will cause carbon emissions. Most scientists and governments recognize that greenhouse gases have already caused and will continue to bring disasters to the planet and mankind. Therefore, understanding the current status of carbon emissions and launching carbon reduction strategies have become an urgent task for all mankind.

The concept of carbon neutrality was conceived in the context of global warming. It refers to the calculation of the total amount of CO₂ emissions and the absorption of these emissions through tree planting and other methods to achieve the goal of zero carbon, that is, emissions. Do as many offset measures as possible to achieve balance, so carbon neutrality is a further development appeal than low-
carbon. The development of tourism has contributed to global carbon emissions. Research on how to reduce carbon emissions and increase carbon absorption to achieve the development goals of low-carbon and even carbon-neutral tourism is important for China to develop low-carbon tourism economy and seek sustainable development of tourism. Low-carbon tourism is a responsible and active choice made by the tourism industry in the face of global climate change. As an important part of the tourism industry, the rural tourism industry has also responded actively and is committed to exploring the construction of low-carbon rural tourism destinations. Low-carbon/carbon-neutral development of rural tourism destinations is also facing various pressures and many challenges [2]. For a long time, various tourism enterprises, including rural tourist destinations, have lacked extensive management and awareness of energy conservation and emission reduction. The ability of rural tourism operators to adopt new technologies and new energy sources is also relatively limited. Tourists' willingness to travel low-carbon and awareness of environmental protection still need to be improved. These have become obstacles to the low-carbon/carbon-neutral development of rural tourism destinations. Therefore, in the face of good development opportunities, how to truly implement "low carbon" and "carbon neutral" in the construction of rural tourism destinations remains to be studied.

2. Calculation of carbon emissions from agricultural hotel tourism

2.1. Carbon source estimation indicators

Carbon sources mainly include scenic transportation carbon emissions, tourist scenic management carbon emissions, and solid waste carbon emissions. Therefore, scenic carbon emissions can be divided into three parts for calculation, namely scenic transportation carbon emissions, scenic management carbon emissions, and solid waste carbon emissions. The method is:

$$E = E_T + E_M + E_W$$  \hspace{1cm} (1)

In the formula, $E_T$ is transportation carbon emissions. $E_M$ is for managing carbon emissions. $E_W$ are waste carbon emissions.

2.1.1. Measurement methods of transportation carbon emissions. Transportation carbon emissions are an important part of tourism carbon emissions. Tourism transportation includes the transportation between the source and destination and the transportation within the destination. The carbon emission standard emissions are obtained by calculating the total carbon emissions of various transportation methods. The calculation method is:

$$E_T = \sum_{i=1}^{n} E_{Ti}$$

$$E_{Ti} = B_{Ti} \times f_i \times k$$  \hspace{1cm} (2)

In the formula: $n$ is the type of transportation in the scenic spot. $i$, $j$ are the ordinal numbers of the type of vehicle and the type of energy, respectively. $B_{Ti}$ is the energy consumption of type $j$ by the $i$ vehicle. The correlation coefficient is shown in Table 1. $L_i$ is the mileage traveled by the $i$ vehicle. $N_i$ is the number of tourists who use the $i$ transportation.
### 2.1.2. Management carbon emission measurement method

The operation and management of tourist attractions lies in the effective open utilization of tourism resources, standardizing the main activities of tourism operations, and providing tourists with satisfactory tourism products. The main content includes opening the use of tourist resources in the scenic area, engaging in daily operations, resource protection, environmental maintenance, and scenic safety management. Service quality management, tourist management and other matters, to maintain the normal operation of the scenic spot, and realize the economic, social and environmental benefits of the scenic spot management [3]. The carbon emission calculation data of the scenic spot management comes from the first-hand data obtained from the field survey of the scenic spot, and the calculation formula is:

\[
E_M = \sum_{i=1}^{n} E_{Mi} \\
E_{Mi} = \sum_{j=1}^{m} B_{Mj} \times f_j \times k
\]

In the formula: \(n\) is the number of scenic management departments. \(m\) is the type of energy. \(B_{Mj}\) is the energy consumption of type \(j\) by the management department \(i\). \(f_j, k\) is the conversion coefficient of energy standard coal and the emission coefficient of standard coal respectively.

### 2.1.3. Carbon emissions from solid waste

Waste carbon emissions in the scenic area are mainly solid waste carbon emissions, which are composed of solid waste left by tourists and household garbage of residents in the scenic area. The "harmless treatment" of tourism waste in China mainly includes landfill, composting and incineration. There are three methods, among which landfill is the main treatment method. According to the research and calculations of relevant scholars, the energy consumption coefficient of solid waste landfill treatment in China is 231.3324 kW·h/t. The calculation formula is:

\[
E_w = W \times r_w \times f \times k
\]

In the formula: \(W\) is the amount of solid waste. \(r_w\) is the energy consumption per unit of solid waste treatment. \(f\) is the conversion coefficient of standard coal for electric energy. \(k\) is the standard coal conversion coefficient.

### 2.2. Carbon sink estimation indicators

Ecosystems with carbon absorption capacity in scenic areas are mainly terrestrial vegetation ecosystems and water wetland ecosystems.

#### 2.2.1. Carbon absorption of vegetation photosynthesis

In terrestrial ecosystems, natural vegetation converts atmospheric carbon dioxide into biomass through photosynthesis and fixes it, partially buried underground or stored in the soil in the form of organic matter. Land use types such as woodlands,
grasslands, gardens, etc., can be Carbon dioxide is fixed. The calculation formula for the absorption of carbon dioxide by vegetation photosynthesis is as follows:

\[ F = \sum c_i \times area_i \]  \hspace{1cm} (5)

In the formula, \( F \) represents the total carbon absorption of green vegetation photosynthesis, \( c_i \) represents the carbon absorption coefficient of the \( i \)-th planting cover, and \( area_i \) represents the area.

2.2.2. Carbon absorption in waters and wetlands. The absorption of carbon by waters mainly includes carbon sequestration in waters and carbon absorption by dry and wet precipitation in waters. Therefore, the calculation formula is as follows:

\[ F = c_w \times area_w + c_s \times area_s \]  \hspace{1cm} (6)

In the formula, \( c_w, c_s \) represents the carbon sequestration rate of rivers, lakes and beaches, and the distribution is 0.56t/(hm²·a) and 2.356t/(hm²·a), and \( area_w, area_s \) represents the area of rivers, lakes and beaches.

2.3. Classification of carbon neutralization results
The paper studies the gradient development path of low-carbon tourism, and proposes that the development of low-carbon tourism destinations should be based on a hierarchical relationship, that is, "low-carbon tourism destinations-low-carbon tourism destinations-carbon neutral tourism destinations-negative carbon tourism. "Destination" development path (Figure 1).

![Figure 1. Gradient map of low-carbonization levels in tourist destinations](image-url)
In the picture above, eco-friendly tourism is an important way to achieve sustainable tourism development. It emphasizes the responsibility of tourism development and is an environmentally friendly tourism method. Eco-tourism, green tourism, circular tourism, alternative tourism, cultural tourism, etc. are all eco-environmental protection the carrier for the effective realization of tourist destinations. Low-carbon tourism destination refers to the comprehensive implementation of the concept of low-carbon tourism development within a certain regional space, with low-carbon tourism attractions and related low-carbon tourism service facilities, and the ability to achieve low-carbon operations, low-carbon management, and low-carbon or a regional tourism system with zero carbon emissions. A carbon neutral tourism destination refers to a regional tourism system that compensates for carbon emissions from tourism activities in terms of biological carbon sequestration. It is also called "zero carbon" emissions [4]. It is not without CO2 emissions, but uses natural methods such as tree planting to compensate people. CO2 emitted. "Negative carbon" emissions are a development model with a higher level than "zero carbon" emissions, and it also needs to be achieved by reducing carbon emissions and carbon compensation. "Zero-carbon" or "negative carbon" emissions are the ideal goal of low-carbon development for tourism companies or destinations, and they can be achieved. Reducing carbon-neutral tourism destinations is more conducive to establishing a good image of tourism destinations. Many tourist destinations are planning to become carbon-neutral tourist destinations.

This study is based on the difference between carbon sinks and carbon sources. A negative difference means partial carbon neutrality, and a positive difference means complete carbon neutrality. Since the difference between carbon sinks and carbon sources in rural areas in Nantong is about 0.01, the range is defined as 0.01 and divided into different levels to distinguish the level of carbon balance in Nantong. The final carbon neutralization evaluation results are divided into four levels. From low to high, they are the first level (the difference is less than -0.01), the second level (the difference is between -0.01 and 0), and the third level (the difference is between -0.01 and 0). The difference is between 0 and 0.01), the fourth layer (the difference is greater than 0.01) is shown in Table 2:

| Project name         | Evaluation standard                              | Evaluation results                |
|----------------------|--------------------------------------------------|-----------------------------------|
| Level one            | Carbon sink-carbon source<-0.01                  | Level 4 carbon neutral            |
| Second floor         | -0.01≤carbon sink-carbon source<0                | Level 3 carbon neutral            |
| The third floor      | 0≤Carbon sink-carbon source≤0.01                 | Secondary carbon neutral          |
| Fourth floor         | Carbon sink-carbon source>0.01                   | First-level carbon neutral        |

3. Analysis of the system structure and elements of rural tourism destinations

3.1. System theory and tourism system
Tourism system is the application of system theory in the field of tourism. This formulation aims to emphasize that the natural, environmental, social, economic, and cultural elements of tourism development should be considered comprehensively, as a whole, and comprehensively. From the perspective of geographical space, the tourism system can be divided into a tourist source system, a tourist destination system, and a tourist channel system connecting the tourist source and destination (Figure 2). Tourist source is the usual environment of tourists, and travel begins and ends here, including system elements such as local tourism market, domestic tourism market, foreign tourism market and its market environment [5]. A tourist destination is a place that attracts tourists to stay and visit here for a short time. It includes system elements such as tourist attractions, tourist service facilities, and tourist products. The tourist channel connects the tourist source area and the destination area. It mainly refers to the tourist transportation service facilities. The characteristics and efficiency of the tourist channel influence and change the scale and direction of the tourist flow. It is the bridge of the entire system. From the perspective of the overall tourism system to explore the basic theory of net carbon emission estimation in rural tourism destinations, a more comprehensive and scientific structure can be obtained.
3.2. System structure of rural tourism destinations

The rural tourist destination system is also composed of the above three closely related parts: the rural tourist destination attraction subsystem, the rural tourist destination service subsystem and the rural tourist destination support subsystem (Figure 3). Moreover, the rural tourist destination system is an open system. It is affected by the external environment and exchanges materials and energy frequently with elements outside the system [6]. Therefore, it is also a dynamically developing system. The various components of the rural tourism system have different functions in the system, but they are closely related and interact with each other. They play the role of providing services in the rural tourism system to tourists, providing rural tourism products and rural tourism services, standardizing and guiding Tourism management activities and tourist behaviour to achieve the sustainable development of rural tourism. In addition, it is obvious that the rural tourist destination system is also an open system. There are material, energy, information, and personnel exchanges with the external environment. It is not only affected and restricted by the environment, but also exerts influence on nature, economy, society, and culture. The role and influence are then input into the system as a new element, and it is also a dynamically developing system.
4. Empirical research

From the perspective of the carbon emission structure, the total carbon emissions of the scenic area traffic are 425.26t, accounting for 79.25% of the total carbon emissions of the scenic area, and it is the largest carbon source. Among them, the internal traffic carbon emissions of the scenic spot dominate the traffic carbon emissions of the scenic spot, with a total carbon emission of 246.71t, accounting for 58.01% of the total traffic carbon emissions. The total carbon emissions from external traffic in the scenic area are 178.55t, accounting for 41.99% of the total carbon emissions from traffic. As in scenic areas, ferry and speedboat cruises have become the main means of transportation to the main scenic area, and the relatively high frequency of ship dispatches makes the internal traffic of the scenic area become a problem [7]. The main source of carbon emissions. In addition, the scenic area is in the interior of the city and is an integral part of the city. It is an urban scenic spot. It bears part of the traffic pressure of the city. The flow and speed of cars are relatively high. There is too much traffic and the noise and noise caused by it. Exhaust gas pollution produces a large amount of carbon emissions, which will have a certain impact on the environment of the scenic spot and the safety of tourists. The carbon emission of scenic spots management reaches 99.37t, second only to the total carbon emissions of traffic. The carbon emissions of solid waste are the least, only It accounts for 2.23% of the total. From the perspective of carbon sink structure, woodland vegetation has a strong carbon sequestration capacity. Its annual carbon sequestration is 167.78t, accounting for 33.52% of the total carbon sink. In addition, the sequestration of tidal flats and waters the amount of carbon is also relatively large.

5. Conclusion

As a key link in the interest chain of social development and energy conservation and emission reduction, the role of rural energy conservation and emission reduction cannot be ignored. Carry out systematic research on the theoretical system of carbon source and carbon sink in rural tourism destinations, the boundary of carbon emission estimation system, the estimation method of net carbon emission, and the conceptual model of carbon neutral tourism destination. This thesis adopts positivism research thinking, and chooses rural tourism as the representative to study in depth the realization mechanism of land carbon compensation.

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