

Research on the Economic Benefits of Low-Carbon Tourism in Different Regions of China under Climate Change

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Abstract. Increasing carbon emissions from tourism had significantly impacted both the environment and the economy. This paper explored strategies for promoting low-carbon tourism in China by analyzing regional differences, government policies, and economic benefits associated with sustainable travel. Through case studies of Shanghai, Sanya, and Xinjiang Uygur Autonomous Region, this research highlighted diverse approaches to reducing tourism-related carbon emissions. Shanghai focused on establishing a green transport system to develop a tourism sub-centre, Sanya prioritized clean energy solutions to enhance transportation infrastructure, and Xinjiang implemented strict vehicle emission controls while expanding clean energy development. By comparing these distinct regional strategies, this study provided valuable insights into the challenges and opportunities of low-carbon tourism in China. The findings aimed to enhance public awareness and inform future policy planning, contributing to the sustainable development of the tourism industry. This research underscored the importance of tailored regional policies in achieving China's long-term environmental and economic sustainability goals.

Keywords: Low-Carbon Tourism, regional differences, government policies, sustainable travel, Economic Benefits.

1. Introduction

Climate change has already been a non-negligible part in reaching the road of global sustainable development, and tourism accounts for around 8.8% of global greenhouse gas emissions (Sun et al. 2024), which will not only have a serious impact on the global ecological environment, but also have far-reaching impacts on the economic development of various countries. Tourism is also developing as an important economic growth point in China in recent years, and China is actively researching and promoting a low-carbon development model for tourism. This strategy has not only helped China significantly in reducing greenhouse gas emissions, but has also brought about significant progress in low-carbon tourism in different parts of the country, boosting economic development.

Tourism's main impact on the climate is mainly through the large amount of greenhouse gases produced by fossil fuels, coal and natural gas that generate electricity for transport, catering, hospitality, and other recreational activities, and is the most recognised driver of global warming (Irfan et al., 2023). In addition, the overuse or destruction of non-renewable resources by tourism development has also caused great damage to China's environment. Therefore, low-carbon tourism is mainly carried out by reducing energy consumption, using clean energy or renewable energy in production, promoting environmentally friendly travelling methods, and enhancing travellers' low-carbon awareness. The economic benefits of low carbon travel are mainly reflected in the reduction of energy consumption, the reduction of costs for enterprises, the recognition of low carbon travel by residents who are more aware of environmental protection, the increase in consumption by attracting more tourists after the ecological environment has been improved, and the increase in jobs brought about by the development of low carbon tourism.

Therefore, in order to boost the development of low-carbon travel in China, strong support from government policies and the demand driven by the general increase in environmental awareness are indispensable. In recent years, China has emphasised the measurement of carbon emissions in the tourism industry, low-carbon practices and development measures, and carbon neutrality in major conferences and documents such as "Promoting the Development of Green Tourism and Contributing to the Construction of an Ecological Civilisation", in order to push forward the development of green tourism. With the tourism industry being boosted after the New Crown Epidemic and the popularity

of environmental awareness in recent years, the public's recognition of and demand for low-carbon travel has been continuously raised.

China, as a huge market share in the world tourism industry, has a diverse range of destinations at different levels. These include cities of different sizes, such as metropolises, medium-sized cities, island cities, townships and autonomous regions. In addition, geographic, human and natural differences attract tourists and consumers with different needs, leading to differentiated carbon and environmental policies to promote sustainable development in different regions (Jia et al., 2019). There have been many analyses of low-carbon travel policies and their impacts in different regions, but there is a lack of analysis of the differences in low-carbon tourism policies in different regions of China and a lack of research on the causes and effects of these policies. Therefore, this paper utilized the cities of Shanghai, Sanya, and Xinjiang Uygur Autonomous Region as case studies to analyse the differences in low-carbon tourism policies due to their geographical location and development, as well as the economic benefits that these policies have had on the region. The analysis assessed the economic benefits of these policies for the region. This analysis revealed the role of local governments, tourist demand, and businesses in promoting low-carbon tourism, so that low-carbon tourism and economic benefits are mutually reinforcing according to the appropriate strategies in each region.

2. Overview of low-carbon tourism and policies in typical regions of China

2.1. Super metropolis (Shanghai as an example)

As the economic centre of China, Shanghai's tourism industry is largely based on the words "urban", "bustling" and "high-rise", attracting more than 300 million visitors by 2023, but this has also led to congestion in the vicinity of scenic spots and high levels of energy consumption and waste generation. However, this has led to congestion in the vicinity of scenic spots, high energy consumption and high waste generation in scenic spots. Shanghai's tourism network has a web of centres of concentration, but too much concentration in the centre leads to high consumption and high energy consumption. However, as a super metropolis, Shanghai's urban construction has been built with the aim of low carbon and environmental protection, so the city is trying to reduce energy consumption and pollution in the city centre while locating more low carbon travel destinations in the surrounding areas.

The Shanghai 2021-2023 Three-Year Action Plan for Ecological Environment Protection and Construction promoted green travel, green hotels and restaurants, and low carbon living. Shanghai has been building a green transport network that includes metro, high-speed rail, shared bikes and other public transport facilities, and has enacted a policy on waste separation and recycling that supports green innovative technologies and smart mobility (Cheng & Ren, 2024). On the other hand, Shanghai has built a number of low-carbon tourism sub-centres, such as Disneyland in Pudong, which is the first Disneyland in the world to use the quadruple-connected technology of cooling, heating, and electricity compressed air to save energy and reduce carbon emissions through technology. Low-carbon parks based on the concept of low-carbon or "near-zero-carbon", where more old industrial sites have been transformed into low-carbon tourist attractions, also combine cultural and low-carbon tourism (Fang et al., 2024).

2.2. Seaside cities (Sanya as an example)

Sanya is one of China's most famous coastal destinations, popular with Chinese tourists for its unique location and beautiful waters. In 2023, Hainan Province received 90 million domestic and international tourists, with a total tourism revenue of more than \$18.1 billion. The huge amount of greenhouse gases and other pollutants emitted by the transport, hotel, and catering industries each year has caused serious ecological pollution and threatened the long-term development of the tourism industry. In addition, the large number of high-end hotel chains in the coastal area of Sanya and the Sanya International Duty Free City attract a large number of "holiday" tourists (Ma et al., 2022), who often prioritise their own comfort and thus reduce their willingness to engage in low-carbon tourism.

The Hainan Provincial People's Government issued the Hainan Provincial Carbon Peak Implementation Programme in 2022, which proposes to reach an initial low-carbon green clean energy system by 2025, control the total amount of carbon carbon emissions, and gradually shift to clean energy (Tang et al., 2024). By the end of 2023, Sanya had completed two centralised power generation projects totalling 160 MW, and issued the Implementing Rules for Accelerating the Development of Assembly Simply in Sanya to encourage the implementation of building energy efficiency through incentives. The centralised cooling project in Haitang Bay, Sanya, provides centralised cooling for hotels and other businesses, which improves energy supply efficiency and reduces cooling costs. In terms of transport, the cross-sea passage of the Qiongzhou Strait is still under planning as of now, but the transport system between Sanya City and the neighbouring tourist islands, such as Wuzhizhou Island, has been improved with direct tourist routes.

2.3. Western region (Xinjiang uyghur autonomous region as an example)

Xinjiang is the most extensive provincial administrative region in China, accounting for one-sixth of China's total land area, with a total population of only 1.84 per cent of the country's population, making it a sparsely populated region. Since the charging facility network of new energy trams has not yet been fully completed, and the issue of the range of today's trams still causes anxiety to most tourists, self-driving tours in Xinjiang are still dominated by traditional oil vehicles today. The diverse landscapes, magnificent scenery and unique ethnic customs are important factors in the development of tourism in Xinjiang. According to Ctrip's 2023 May Day Holiday Tourism Forecast Report, more than 74% of May Day holiday trips are long-haul trips, thus increasing carbon emissions in Xinjiang.

The Xinjiang Uygur Autonomous Region Highway Industry Green and Low-Carbon Development Implementation Programme plans to reduce carbon emissions from vehicle turnover in 2025 to 90 per cent of the 2020 level and to build more charging facilities for new energy vehicles. Setting up vehicle environmental passes to reduce passing vehicles, banning drone flights in most areas from July 2025, and providing free electric-vehicle feeders at some scenic spots to reduce the number of self-driven vehicles driving into core areas.

Currently, the main high speed railway in Xinjiang is the Xinlan Line, which connects the cities of Urumqi, Turpan and Hami, greatly increasing the convenience of low-carbon travel in Xinjiang. Currently, the Xinjiang government is planning to build high speed rail lines from Urumqi to Kashgar, Yining, Horgos, and Kuitun to provide more complete low carbon travel routes, but construction will take longer due to the need to prioritise safety considerations due to the strong winds in some parts of Xinjiang (Liu et al., 2022).

Xinjiang has a major advantage in terms of energy, but fossil energy still accounts for the bulk of the energy used in Xinjiang, but Xinjiang's geographic advantage allows it to produce large amounts of clean energy, especially solar and wind energy (Deng et al., 2022). With a time difference of about three hours from the east part of China, it is possible to use solar energy to generate peak power, and in terms of wind energy, Xinjiang has more than 37 per cent of China's wind energy reserves, so it has been more successful in the energy transition process, allowing the service sector related to the tourism industry to reduce its consumption of fossil energy.

3. Low-carbon tourism revenue generation analysis

3.1. Analysis of Shanghai

The promotion of green travel, hotels and restaurants, as well as waste segregation policies have improved the health of Shanghai's ecosystems and the well-being of the population (Yang et al., 2023), laying the groundwork for Shanghai's development into a 'green city', and promoting low-carbon travel by directly contributing to the city's carbonation. Better transport facilities increase the willingness of tourists to travel in public, thus reducing carbon emissions. Green and innovative technologies improve the efficiency of urban resource reuse. Better smart travel technology provides tourists with low-carbon travel routes and improves the quality of travel. Decentralize tourism sub-

centres share the tourism pressure in the central area of Shanghai, providing more fun for tourists while increasing the resilience of Shanghai's low-carbon tourism industry.

The development of green tourism has led to the green transformation of related industries and high quality economic development, such as green hotels, green restaurants, etc., which contributes to the economic development of reducing energy consumption. 2024 International Low Carbon Smart Mobility Expo in Shanghai brought together nearly 200 companies and more than 40 automobile brands, which led to the consumption of new energy vehicles. In addition, the emergence of jobs derived from low-carbon travel, the construction of low-carbon travel systems and low-carbon tourism systems, and new occupations such as smart tour guides, green travel planners, green product designers and other occupations are providing more jobs in Shanghai.

3.2. Analysis of Sanya

Sanya's low-carbon tourism policy focuses on reducing carbon emissions by gradually reducing the share of fossil fuels in production through the construction of a clean energy system. Progress in low-carbon tourism is promoted through the carbonation of the building system, the construction of a green transport network, and the green transformation of the hotel industry and other services related to tourism. A more convenient public transport system in Sanya and links between tourist attractions provide convenience and comfort, attracting more tourists and making them more receptive to green travel.

Energy saving and emission reduction in tourism-related services plays an important role in reducing emissions in Sanya, a city where tourism is the main economic growth point, reducing the industry's consumption of energy and providing a greener service experience for tourists without diminishing their experience. The greener concept attracts more tourists who wish to have a "high-end green" experience, driving consumption upgrades.

3.3. Analysis of Xinjiang

Xinjiang is currently promoting its own green transformation, mainly in terms of transport and energy transition. It is encouraging new energy vehicles by building more new energy charging devices, improving the railway system to increase public transport facilities to reduce carbon emissions, and attracting more tourists. In addition, more travellers are attracted to Xinjiang's low-carbon tourism industry as it is promoted.

Recently, the ice and snow industry in Altay has become popular on the Internet, and the green transformation of Xinjiang's medium- and high-end tourism industry and sports tourism industry has been developed. The General Mountain Ski Resort and the Cocotocai International Ski Resort have been set up as the core of the tourism industry, promoting the "Pure Land of Kanas, Snow Capital of Altay" brand, which attracted 38 million visitors in 2024, an increase of 27 per cent compared to 2023, and generated 33.5 billion yuan in tourism revenue. At the same time, it creates a large number of related jobs, such as ski resort staff, ski instructors, hotel catering and other jobs.

4. Low-carbon tourism for economic development strategy

Shanghai can closely integrate urban carbonation with low carbon tourism development, as Shanghai is one of the main destinations for 'metropolitan' tourism, and the development of the city is the main attraction for tourists, and the low carbon development of the city itself is in fact the construction of low carbon tourism. Therefore, Shanghai's green and low-carbon lifestyle, travelling and consumption patterns will strongly influence tourists, deepen their understanding and recognition of low-carbon travel, and thus bring green economic benefits. Therefore, the future direction of Shanghai's low-carbon tourism development should be committed to the green construction of the city itself, thus influencing tourists.

For Sanya, a seaside tourist city where tourism has long been an important pillar of the industry, the promotion of low carbon in the main tourist areas, linking the cooling system and sewage system

between different hotels to achieve functional uniformity and standardisation will not only increase the efficiency of the energy transition to reduce carbon emissions, but also be more conducive to the overall planning of the city's low carbon tourism industry. As there are off-peak and snow seasons in Xinjiang, a large influx of tourists during the peak or snow seasons, but insufficient reception in the region, leads to excess energy use during this period, which defeats the purpose of low-carbon tourism. At the same time, a large influx of tourists can cause permanent damage to the fragile local ecosystem. Therefore, increasing the capacity of tourist resorts will be a key priority for the long-term development of low-carbon tourism in Xinjiang.

In addition to differentiated policies for different regions, building a green and complete transport network will greatly increase the willingness and convenience of tourists to low-carbon tourism, thus promoting the high-quality development of the low-carbon economy. Promoting a green energy transition will be the most fundamental and effective policy to promote the economic benefits of low-carbon tourism, as a large number of new jobs will be created and carbon emissions will be reduced.

5. Conclusion

By studying and analyzing the economy of low-carbon tourism in various regions of China, it can be concluded that China is actively promoting the low-carbon tourism model and adopting differentiated policies in different regions for more precise development. Shanghai has built its urban infrastructure around the concept of "green metropolis" by constructing a green transport network, promoting green mobility and lifestyles, and creating a tourism sub-centre to improve the health index of the ecosystem and drive the economic development of related industries to create jobs. Sanya reduces carbon emissions by building a clean energy system and promoting energy efficiency in buildings, and develops high-end green services to drive consumption upgrades. Xinjiang promotes local low-carbon tourism and economic development by improving public transport facilities and reducing carbon emissions from oil-vehicle turnover, developing clean energy with advantages, and promoting the low-carbon massification of the ice and snow industry.

The above three regional studies showed that the development of low-carbon tourism is closely related to the economic benefits it generates. In the future, promoting the green transformation of Shanghai, carbonizing the main tourist areas in Sanya and increasing the capacity of the tourist areas in Xinjiang will be targeted to promote the development of a low-carbon tourism economy. Improving the low-carbon travel network and promoting the national energy transition will be the most effective and fundamental strategies to promote the development of a low-carbon tourism economy in recent years.

This research compared the development of low-carbon tourism and its economic benefits in different regions of China by analysing samples from three different regions, the significance of which is to enable readers to understand the current state of development of low-carbon tourism in different regions, to promote comparative research on policy analysis, and to help the development of low-carbon tourism-related industries. Compared to the western region, the super first-tier cities and coastal tourist cities have been ahead of their time in the development of low-carbon tourism and have enjoyed greater economic benefits, while the western region still needs more time and policy support. Today, the global focus on low carbon tourism is increasing, and through local government documents and policies, each region will be able to develop in a more targeted manner.

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