

Low carbon transition and sustainable development path of tourism industry

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Abstract. The low carbon transition is as much a transformative technology shift as it represents a response to global environment challenges. The low carbon paradigm presents a new direction of change for tourism industry. However, the lack of theoretical frameworks on low carbon transformation in tourism industry context provides a significant knowledge gap. This paper firstly investigates the relationships between low carbon and sustainable development, followed by exploring the existing challenges of tourism sustainable development. At last, this paper presents a sustainable development path framework for low carbon transition of tourism industry, which include accelerating deployment of renewable energy, energy-saving green building construction, improving green growth investment, and adopting a sustainable consumption and production system, in order to promote energy and water efficiency, waste management, GHG emissions mitigation and eventually enhance its sustainability.

1. Introduction

The current fossil fuel-based energy system is at the root of global climate change. Currently, 82% of energy uses are still coming from fossil-fuel based sources while only 13% from renewable energy. Although there has some important improvements in resource efficiency, the overall use of resources continues to increase. For example, in 2010 the global per capita Ecological Footprint (EF) was 2.6 gha, which is higher than the per capita bio capacity of 1.7 gha. However, the sustainable development of humankind depends on a stable natural and ecological environment. It seeks to improve human development while maintain natural resources and ecosystem services for use by future generations.

Tourism sector is a significant component of the global economy, which ranks as the fourth largest economic sector after fuels, chemicals, and food. Currently, it accounts for 10% of GDP (direct, indirect and induced), 6% of the global exports, and one in 11 jobs. However, most energy use in tourism industry is still based on the traditional fossil fuels and this sector continues to emit increasing levels of greenhouse gas (GHG) emissions [1]. The tourism sector's current contribution to global GHG emissions accounts for 5% of global anthropogenic emissions (1302 Mt CO₂), which is expected to grow substantially under a business-as-usual (BAU) scenario [2]. The sustainability of tourism industry depends in part on new development patterns, like energy efficiency, renewable energy using, and energy-saving green building construction in tourism areas in reducing the GHG emissions. Thus, this research aims to investigate how to promote the sustainable development of tourism industry



through using the low carbon related development theory and technology. This paper will discuss the new idea of low carbon and green economy and their potential application in tourism industry, and further suggesting ways to promote sustainable development of tourism industry.

2. Low carbon transition and sustainable development challenges

The need to better coordinate sustainable development of the economy, society and environment has become a hot topic area in the world. For example, the construction of an ecological civilization is now a national strategy and top priority for China. However, the main challenge for China in constructing an ecological civilization lies in its efforts to cope with the tightening resource constraints, environmental pollution and ecosystem degradation. China needs to transform to a new model of consumption which is much more resource-efficient. Currently, the global economy is still based on resource-intensive consumption and production patterns. However, in a low carbon economy scenario, economic growth should be driven by public and private investments that improve resource and energy efficiency, reduce carbon emissions and environmental pollution, and prevent the loss of biodiversity and ecosystem services.

Tourism is one of the important economic sectors in the world. In 2015, international tourists have reached 1186 million while the international tourism receipts earned by destinations worldwide have increased to US\$ 1260 billion. According to the UNWTO, international arrivals are expected to reach 1.8 billion in 2030. However, like many other sectors, tourism sector still faces a multitude of significant sustainability-related challenges, like energy and GHG emissions, water consumption, waste management and loss of biological diversity. Table 1 presents an estimated global average number for direct energy use and emissions by different accommodation categories [3]. For example, tourism has become a main contributor of GHG emissions at the global scale because of the growth of energy consumption in tourism transport, accommodation and related activities and its dependency on fossil fuels. It is estimated that CO₂ emissions from tourism sector (excluding aviation) will grow at 2.5% per year until 2035. It contributes to climate change through emissions of GHG, including nitrous oxides (NO_x), hydrofluorocarbons (HFCs), methane (CH₄), sulfur hexafluoride (SF₆) and perfluorocarbons (PFCs). Tourism-related energy use and associated emissions of GHG emissions can be categorized into three sections: tourism transport, accommodation and tourism-related activities. Transport and accommodation are the most energy-intensive components, which accounts for the 75% and 21% of GHG emissions [4].

The tourism sector can play a significant role in meeting the UN's Millennium Development Goals (MDGs). In fact, many international organizations and governments have set up many policies to help reduce GHG emissions in the tourism context. For instance, the 10YFP Sustainable Tourism Programmed catalyzes changes in tourism operations. It supports transformation for sustainability through resource efficient and low-carbon planning, conserving ecosystems, and adapting to the reality of a changing climate.

Table 1. Estimated energy use and CO₂ emissions by type of accommodation

Type of accommodation	Energy use per bed night (MJ)	CO ₂ emissions per guest-night (Mt)
Hotels	130	55.7
Campsites	50	7.9
Pensions	25	2.7
Self-catering	120	11.6
Holiday villages	90	1.8
Vacation homes	100	0.8
Estimated average	98	13.4

Source: Gossling (2002)

3. Sustainable development path based on low carbon theory and practice

There are many synergies between the low carbon transition and the pursuit of environmental goals, such as reducing water pollution and conserving biodiversity. Table 2 presents the examples of policy misalignments that undermine low-carbon investment [2]. This section presents some pragmatic low carbon development measures in order to build a sustainable roadmap of tourism sector.

Tabel 2. Facilitators and implications of investment in sustainable tourism strategic areas

Strategic area	Sustainability facilitator factors	Potential implications
Energy	<ul style="list-style-type: none"> - Increasing energy costs - Potential carbon surcharges - Progress of low-carbon technology - Low cost of enewable energy - Legislation on energy efficiency and low-carbon buildings 	<ul style="list-style-type: none"> - Low costs for tourism enterprises through energy efficiency - Investments in energy retrofist - New energy-efficient investment stock - More investments in energy efficient tourism products and services
Climate Change	<ul style="list-style-type: none"> - Costs of GHG emissions - Consumers' concern on footprint - Host government policies and priorities - Climate change impact on tourism attractions 	<ul style="list-style-type: none"> - Increased substitution of fuels toward electricity, particularly increased investment in solar collectors and alternative fuels for vehicles - Demand for carbon offsets and policies to compensate for residual emissions
Water	<ul style="list-style-type: none"> - Water scarcity - Price for water and conflicts - Expectations from the major tour operators 	<ul style="list-style-type: none"> - Reducing water costs from internal water efficiency - Investments in water saving technology in rooms, facilities and attractions - Increased use of water treatment systems at different levels
Waste	<ul style="list-style-type: none"> - Public opinion - Presser from major tour operators - Consumer demand for clean destination 	<ul style="list-style-type: none"> - Lower pollution and natural resource - Improved solid waste management - Lower sewage and clean-up fees - Investment in sanitary landfills and solid waster recycling capacity

Source: UNWTO and UNEP (2012)

3.1. Accelerating deployment of renewable energy to improve energy-efficiency

There is an emerging need to deployment of low carbon sustainable fuels in tourism sector in order to help promote energy and resource efficiency. In hotels there is considerable scope for additional investment in energy-efficient features and services, such as green building construction, efficient refrigeration, air conditioning and heating in order to reach lower energy profiles. Hotel owners and managers have recognized the need for change and have already made certain improvements in using renewable energies alongside the adoption of low carbon building technology. Meanwhile, tourism sector can cooperate with transport department in order to accelerate the decarbonisation of tourist transport through using cleaner fuels (e.g. biofuels, fuel cells) and more efficient vehicles, like electric cars.

3.2. Encouraging government support on low carbon technology

Government policy has s critical role in enhancing incentives for investigating in renewable energy use. In order to increase the adoption of renewable energies, the tourism sector policy makers should set appropriate market incentives to foster the adoption of next-generation biofuels. For example, time-bound subsidies can be given on the purchase of green tourism equipment that reduces waste and

improves energy and water efficiency [5]. In addition, governments can also use tax incentives and credits to promote private investment in green tourism.

3.3. Improving green growth investment to enhance environmental sustainability

A green economy substitutes clean energy and low-carbon technologies for fossil fuels. UNEP defines green growth as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be described as one which is low carbon, resource efficient and socially inclusive. Compared with the BAU development pattern, under a green economy scenario, tourism can make a more large contribution to economic growth, while significant environmental benefits include reductions in CO₂ emissions (52%), energy use (44%), and water consumption (18%) [5]. For example, tourism sector can drive the improvement of resource utilization efficiency through the introduction of new green technologies, developing more green products, and green taxes and subsidies [6].

3.4. Adopting a sustainable consumption and production system

Sustainable consumption and production (SCP) is a holistic approach to minimizing the negative environmental impacts from consumption and production systems. SCP advocates and encourages low-carbon and environment-friendly consumption that use fewer materials and less hazardous substances, which include choosing environment-friendly tourism products, encouraging moderate consumption, and adopting economic incentives for certified green tourism products. In addition, tourism sector can make full use of social media, NGOs, and academic institutions to promote the ideas and practices of SCP. Further, tourism sector should advocate the wide application of SCP indicators by local governments and tourism companies to promote transformation towards sustainable development.

4. Conclusion

In conclusion, the low carbon paradigm presents a new direction of change for tourism industry. By adopting and encouraging the low carbon technologies and the green investment, the tourism sector can make a great progress in energy and water efficiency, waste management, emissions mitigation and eventually enhance its sustainability.

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