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Research on the Path of Reducing the Carbon Footprint of Sports Events under the "Double Carbon" Target

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Abstract: *With the"Dual-carbon" target, eco-environmental issues and sustainable development has attracted worldwide attention. Carbon footprint is one of the most important indicators for humans to measure the impact on the environment. The introduction of carbon footprint into the field of sports events will provide an important theoretical basis and scientific support for the sustainable development of sports events. This paper aims to summarize the main sources of the carbon footprint of sports events, and the measures are taken by various countries to reduce the carbon footprint of sports events, to put forward relevant paths to reduce the carbon footprint of sports events.*

Keywords: *"Dual Carbon" Goal; Sports Events; Carbon Footprint; Path*

1. Introduction

Since the Industrial Revolution, with the rapid development of the economy and society, the relationship between man and nature has become increasingly prominent, especially global warming. To this end, countries around the world have taken a variety of energy-saving measures to slow down the global warming process, and to achieve a harmonious coexistence between man and nature. Among them, there are worldwide consensus legal texts such as the Kyoto Protocol and Paris Agreements, developed country policy texts including the French Paris urbaine climate, air, and Energy Plan (2016) [1], the US hydrogen strategic transformation [2] and the Chinese State Council's guidance on accelerating the establishment and improvement of a green, low-carbon and circular economic system. The world is very concerned about carbon emissions and is committed to reducing its carbon footprint. The issue of sport and climate is an issue of wide concern to countries all over the world. The sustainable development of sports is explicitly Olympic Charter in the international sports charter and the International Sports Charter, the European Charter on Sports and physical education also proposes that sports organizations should pay attention to the issues related to sports development and carbon footprint. Sports events are an important point to promote economic and social development, and they are responsible for global warming. Reducing the carbon footprint of sports events is an essential part of achieving high-quality and sustainable sports development, especially in sports events. However, the world's attention to reducing the carbon footprint of sports events is not enough. If we can further increase the attention to the carbon footprint of sports events, it will promote the level of sports development in the world.

2. Analysis of the benefits of reducing the carbon footprint of sports events

2.1 Environmental benefits of reducing the carbon footprint of sports events

Reducing the carbon footprint of sports events can provide a healthy environment and promote people's health, many human epidemics are climate-related, and a warming climate can significantly increase both morbidity and mortality [3], and reducing the carbon footprint of sports is an important means of addressing the problem of climate warming, this will undoubtedly improve the climate and provide a better environment for people to live, which is also in line with the concept of sports for health. At the same time, reducing the carbon footprint of sporting events can reduce fossil fuel use and conserve natural resources. The use of fossil fuels, one of the most common sources of energy in China's stadium industry, is an important reason for the increased carbon footprint. Reducing the use of fossil fuels will protect both non-renewable resources and the environment. For example, the main venues for the Beijing

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Winter Olympics are powered by solar and wind energy, while four venues, including the national speed skating stadium and the Capital Stadium, are pioneering the use of carbon dioxide ice-making technology, almost Zero carbon emissions, which avoids the use of non-renewable energy sources such as fossil fuels. Finally, reducing the carbon footprint of sporting events can contribute to climate change and reduce the occurrence of extreme weather events. As we all know, climate warming is mainly caused by excessive greenhouse gas emissions. Sports events are a big gathering of people, with many athletes, spectators, referees, and volunteers, the amount of greenhouse gases produced during this period is incalculable, and a reduction in the carbon footprint of sports would undoubtedly reduce greenhouse gas emissions and slow climate warming.

2.2 Economic benefits of reducing the carbon footprint of sports events

On the one hand, reducing the carbon footprint of sporting events can promote economic development in sports and other related areas. The carbon footprint is an important indicator of the success of sports events. A reasonable reduction of the carbon footprint will improve the quality of sports events and attract more people to watch them, thus boosting consumer demand and promoting economic growth. On the other hand, reducing the carbon footprint of sporting events can reduce related costs and extend usage time. In ice and snow sports, for example, short-track speed skating and figure skating are stadiums on artificial ice rinks, where people congregate to increase their carbon emissions, the application of carbon dioxide ice-making technology makes the carbon dioxide can be used in ice-making, which avoids the disadvantage of a large amount of carbon produced by traditional ice-making technology, realizes the rational use of carbon and reduces the cost of ice-making Cross-country skiing, ski jumping, and other sports are all conducted using naturally-formed venues. Many competitors and spectators will produce a large amount of carbon, accelerating the melting of ice and snow, and reducing the time spent in using the venues, reducing the carbon footprint will slow the rate of melting and prolong the use of the site.

2.3 Social benefits of reducing the carbon footprint of sports events

First, reducing the carbon footprint of sports events can bring about a good domestic response. The success of reducing the carbon footprint of sports events will be a major publicity campaign to raise awareness of the need to reduce the carbon footprint, at the same time, it will also have great reference significance for our sports events and even the sports industry to reduce the carbon footprint of sports. Second, it can lead to a good international response. International sporting events are the world's calling card for the host country, and its success in reducing the carbon footprint of sports is one of its highlights. For example, China paid great attention to reducing its carbon footprint in the process of hosting the Beijing Winter Olympics, thus establishing a national image of low-carbon Winter Olympics.

3. The organization of sports events and carbon footprint

The environment is one of the three pillars of the modern Olympic spirit. In response, countries around the world are paying special attention to sports and the environment. The US National National Hockey League Council (NHL) released its sustainable development report (SR) in 2014, highlighting issues such as the carbon footprint, water, and energy, this led to numerous awards and an invitation to the COP21 un climate change talks in Paris in December 2015, making him a green leader in the sports industry [4]. As environmental and climate issues become more acute, more and more sports organizations see the development of international certification standards as a way to address environmental sustainability challenges. In response, NAESS [5] argues that these standards are useful for some sports organizations, but that the commercial context and the "Market economy" run by their suppliers may hinder the diversity of solutions needed to reduce the carbon footprint of sports.

4. Hosting sports events and carbon footprints

Large-scale sports events are an important source of sports carbon footprint. Pereira et al [6] suggested that large sporting events have a large carbon footprint, with activity participants and tourists making the greatest contribution to return transport between the country of origin and the host country. In response, he argues that choosing a host country with the lowest carbon footprint in international transport without affecting major tourist flows is key. Pereira et al [7] then assessed the carbon footprint of English Premier League (EPL-RRB- clubs and found that in the 2016-2017 sets EPL.EPL clubs produced about 1,134 tonnes of Carbon dioxide equivalent, with 61% of the carbon footprint generated by travel traffic, it is

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proposed that the current corporate travel and procurement practices of Premier League clubs be carefully reviewed to further optimize travel itineraries, and a"Green" certificate of the accommodation provider to sign the proposal. Cooper et al.[8] studied the U.S. men's basketball championship (NCAA) and concluded that cancellations due to covid-19 cost the local economy one million dollars in lost tourism revenue, it also deprives travelers fans of the opportunity to make pilgrimages to the arena, but has a much smaller carbon footprint than the previous year. Castaigne et al [9] studied the carbon dioxide footprint of one person during marathon training and racing and found that marathon runners emit 4.3 tons of CO2 equivalent, the transatlantic flight to New York is equivalent to 3.5 tonnes of CO2, or 83% of the average French citizen's annual carbon footprint, or about 11 tonnes of CO2 a year. Chard et al [10] conducted interviews with the parents of underage "Representatives" of ice hockey player teams in Ontario, Canada, using Carbon Zero and Planet Air to calculate the environmental impact of sports, it found that A and AAA teams traveled 44,036 km and 33,477 km, respectively, on the road, 200,000 tonnes of CO2. It can be seen that football, basketball, marathons, ice hockey, and other large-scale sports events will produce a large carbon footprint. So what about the carbon footprint of hosting small sporting events? Dolf et al [11] analyzed the carbon footprint of audience and team travel at sporting events held at the University of Columbia and found that the per capita carbon footprint of the audience was smaller than that of the team, but the overall carbon footprint was larger, although only 4% of the audience travels by air, the carbon footprint is 52% of the total audience. In response, Triantafyllidis et al [12] made a similar argument, arguing that modes of transport affect the CO2 emissions per spectator and stadium location, and in particular that location on and off campus influences the mode of transport chosen by the spectator. It can be seen that the choice of transport mode has an important impact on the carbon footprint.

5. Sports events and carbon footprints

The carbon footprint of different sports activities will also be different, while the development of sports activities will lead to the development of other industries, services, manufacturing, and other industries to increase the carbon footprint. In the field of sporting events, Wicker [13] investigated the regular activities, sports tourism, and one-day holidays of adult active participants in 20 sports in Germany using an online survey; It found that the average annual carbon footprint was 844kg of CO2, that individual exercise produced higher emissions than team exercise, that outdoor exercise participants had the highest levels of emissions, and that environmental awareness significantly reduced the carbon footprint in the individual sport, however, it was not found in team sports, ball games and outdoor sports, and the duration of activities, club membership, weekly exercise time, performance level and income were positively correlated with the annual carbon footprint, and gender is not significant. Subsequently, Wicker et al [14] conducted a nationwide online survey of adult skiers and boarders living in Germany, the results of which showed that the average annual carbon footprint of active sports tourists was 431.6 kg CO2e per year; The boarders' carbon footprint was higher than that of adult skiers. Income and snow days had a significant positive effect on annual snowfall, while environmental awareness had a negligible effect. In the field of sporting goods manufacturing, Shadia et al [15] evaluated the carbon footprint (CFP) of polyester sportswear through a life cycle analysis and found that the polyester production phase was the most energy-consuming component causing negative environmental impacts, this is followed by the use phase and the spinning phase, where the production of synthetic fibers produces a large carbon footprint. In the area of individual attitudes and sports carbon footprints, Wicker et al [16] investigated the subjective well-being of members of German sports clubs and found that environmental actions in sports have a positive impact on the well-being of club members; Individuals with a high carbon footprint when participating in a training course reported lower well-being, but this effect overlapped with pro-environmental actions in sports, members who rated the quality of their environment as high scored higher on the happiness scale. Saayman et al [17] studied the willingness of sports participants to pay to offset their carbon footprint by linking willingness to pay to attitudes or beliefs about existing initiatives (green perspectives), the results show that socio-demographic variables and correct attitudes towards the environment are statements of willingness to pay for climate change mitigation. It can be seen that the field of sports events and sporting goods manufacturing is one of the important sources of the carbon footprint of sports events, and individual environmental awareness plays a significant role in reducing the carbon footprint.

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6. Ways to reduce the carbon footprint of sports events

6.1 Based on the development of the status quo, the construction of the carbon footprint of sports events evaluation system

The carbon footprint of sports events is the key to achieving sustainable development of sports events. At present, the world has not formed a good carbon footprint evaluation system for sports events, and the author believes that the carbon footprint evaluation system for sports events can be constructed from the following two aspects. On the one hand, based on the life cycle theory, improve the evaluation methodology of the carbon footprint of sports events. The life cycle theory is one of the main methods to assess the carbon footprint. The life cycle of a sporting event is the period between the successful bid and the official event and after the event. By monitoring and detecting the carbon footprint in the life cycle of sports events, the database of carbon footprint in the life cycle of sports events is established to support the evaluation of carbon footprint in sports events. On the other hand, adhere to the ISO20121:2012 standard, accelerate the implementation of the standard, popularization, and improvement. The ISO 20121:2012 standard is the international standard "Sustainable management system for large-scale events-requirements and guidelines for use" published by the organization in 2012, both the 2012 Rio Olympics and the 2018 Formula E Championship have been certified for their remarkable efforts to reduce their carbon footprint. Although this standard has achieved some success in reducing the carbon footprint of sports events and promoting the sustainable development of sports events, its main targets include large-scale conventions and exhibitions, sports events, social activities, etc., not only for the development of sports events and for the guidance of small and medium-sized sports events is not strong. Based on this standard, we can work out the evaluation standard of the carbon footprint of small-sized sports events in the world.

6.2 Draw lessons from international experience, sum up the method to reduce the carbon footprint of sports events

Reducing the carbon footprint of sporting events is an important part of promoting the high-quality development of sporting events and, for the time being, the exploration of ways to reduce the carbon footprint of sports events in the world is still insufficient. In this regard, we can huddle together to warm up, and learn from international successful experiences, summed up for the world's countries to reduce the carbon footprint of sports events. First of all, we can use the facility location problem (FLP) model to select the best location for sports events. The choice of the venue is not only the beginning of the success of the event but also the first step to reducing the carbon footprint of the event and achieving carbon neutrality. Second, the long-term benefits of reducing the carbon footprint of sporting events can be achieved by increasing stadium vegetation cover. Increasing vegetation cover is an important way to reduce carbon footprint. Plants absorb CO2 and convert it into O2 through photosynthesis, thus reducing the number of greenhouse gases in the air. In response, increased stadium vegetation coverage could reduce the CO2 produced by hosting sporting events and achieve the goal of having a smaller carbon footprint from sporting events. Finally, improve the use of clean energy, build green venues, and green transport sports events. Stadiums and transport are two of the biggest contributors to the carbon footprint of sporting events, and both use fossil fuels. We should speed up the transformation of our stadium, increase the use of clean energy, and use Green Transport for the transfer of people involved in sports events, this will reduce the carbon footprint of both the stadium and Sports Transport.

6.3 Use technology to help reduce the carbon footprint of sporting events

Science and technology are important methods to solve the problem of the carbon footprint of sports events. At present, the application of science and technology is not deep and concrete enough in the process of solving the problems related to the carbon footprint of sports events. In this regard, the author believes that the following three aspects of science and technology can be used to reduce the carbon footprint of sports events in the process. First of all, the carbon footprint of different types of sports events in different parts of the carbon footprint measurement tool. Carbon footprint measurement tools mainly take the form of calculators, through the input of relevant data to clarify the whole process of carbon footprint, thus targeted to solve the issue of the carbon footprint of sports events. At present, carbon footprint measurement tools are various and applied in many fields, but in the field of sports events, their use is less, therefore, it is very important and necessary to introduce the carbon footprint measurement tool into the field of sports events. Secondly, the promotion of carbon dioxide conversion technology to achieve waste-to-treasure scientific use. The increase in carbon dioxide emissions is one of the important

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factors contributing to global warming, and it also accounts for a large part of carbon dioxide emissions in the field of sports. Although carbon dioxide has brought a lot of adverse effects, it is the best choice if it can be put to use through science and technology. In the 2022 Beijing Winter Olympic Games, our country took the lead in using carbon dioxide ice-making technology to realize the conversion of carbon dioxide from waste to treasure and promoted the realization of carbon neutrality in the Winter Olympic Games, therefore, the application of carbon dioxide ice-making technology in the field of ice and snow events will greatly promote the generation of the carbon footprint of ice and snow events. Chinese scientists have successfully 2021 carbon dioxide into starch, showing that it can be reused through science and technology, therefore, our country should accelerate the application of carbon dioxide reuse technology to the field of sports events, and promote the realization of carbon neutrality in sports events. Finally, the use of information network technology, the realization of sports events"Stay Indoors.". The carbon footprint of spectator traffic is a large part of the carbon footprint of large sporting events. Using 5G and VR technology to make it possible for spectators to watch the event from their homes, reducing the need for travel and thus reducing their carbon footprint. This means in the"Home" at the same time, and the current environment can also prevent contact between people, and reduce the spread of covid-19.

7. Conclusion

To sum up, we analyzed the environmental, economic, and social benefits of reducing the carbon footprint of sporting events. Then it expounds on the relationship between large-scale sports events, small-scale sports events, and sports activities and carbon footprint, the organization of sports events will have a large carbon footprint and the extent of the carbon footprint of various sports activities. Finally, the paper International sporting events the ways to reduce the carbon footprint of sports events. Reducing the carbon footprint of sports events is a good means to promote the world environment, and the implementation of effective methods to reduce the carbon footprint of sports events will promote the high-quality and sustainable development of world sports events, to create a good environment for the people of the world to participate and watch the game.

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