

PROCEEDINGS OF THE  
INTERNATIONAL CARBON NEUTRALITY TRAINEESHIP PROGRAM  
Volume.02, Number.1, 2024, 44-48

## The Potential of Public Transport to Reduce Carbon Emissions in Urban Areas - A Singapore-Based Study

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### Abstract

The transportation industry as an important source of global carbon emissions has been confirmed by many authorities. This paper studies the impact of public transport on achieving carbon neutrality. After summarizing the literature review process, we have gained a lot. Some suggestions are as follows: use systematic search after screening, analysis, comparison, comprehensive extraction and summary of research methods, findings and conclusions. Based on the data of Singapore from 2004 to 2014: Public transport has a strong correlation with carbon emissions. When the indicators of public transport rise and urban carbon emissions and other pollution indicators show a downward trend, however, when the city faces the goal of carbon neutrality, there are still challenges in knowledge and data gap, funding, technology and cultural habits. Therefore, this paper puts forward suggestions to increase investment and support for public transport, formulate policies and promote technological innovation.

**Keywords:** Carbon neutrality, public transport, carbon emission, transportation industry, urban construction.

At present, the world is facing increasingly serious environmental problems caused by climate change and greenhouse gas emissions. Numerous scientific studies have shown that excessive greenhouse gas emissions will cause global temperatures to rise, triggering severe consequences such as extreme weather events, rising sea levels and ecosystem collapse. Carbon neutrality refers to the goal of reducing net carbon emissions to zero and achieving climate change mitigation by reducing and offsetting emissions. Its significance is to mitigate global climate change. Carbon neutrality advocates stabilizing the accumulation of greenhouse gases in the atmosphere below a safe level by reducing carbon emissions and taking measures to compensate for the remaining emissions, so as to avoid further exacerbating the impact of climate change.

The public transport sector's role in making the world carbon neutral is too important to ignore. As one of the major sources of global greenhouse gas emissions, the transport sector must take proactive measures to reduce its environmental impact. Authorities such as the International Energy Agency have identified the transport sector as a significant source of global carbon emissions. The transportation sector contributes about 23% of global energy-

related carbon emissions, according to the IEA. In its report, the UNFCCC recognizes the significant impact of the transport sector on carbon emissions: the transport sector accounts for about 14% of total global CO<sub>2</sub> emissions. Research by the International Transport Forum shows that the transport sector is one of the biggest growth sectors in global greenhouse gas emissions, with carbon emissions from the transport sector projected to grow by nearly 60 percent by 2050.

With the acceleration of global urbanization and the increasing threat of climate change, reducing urban carbon emissions has become an urgent task. As an important part of urban transport system, public transport plays an important role in achieving carbon neutrality. Public transport can not only provide people with sustainable means of travel, reduce the need for personal car use, and reduce the total carbon emissions of the transport sector; It can also reduce reliance on limited resources by encouraging people to choose public transport, reducing carbon emissions while improving transport efficiency. This helps to improve urban air quality, reduce traffic noise and improve citizens' quality of life, while driving urban planning and development in a more sustainable direction.

This paper first introduces the background and significance of carbon neutrality, as well as the importance of the transportation industry in carbon emissions. Secondly, combined with specific urban development data, it demonstrates the main problems and challenges faced by the transportation industry to achieve the goal of carbon neutrality, and puts forward solutions and suggestions. Finally, the main findings of the study are summarized and the importance and significance of the transport industry in the context of carbon neutrality are highlighted. The paper comprehensively explores the role and challenges of public transport in carbon neutrality, providing valuable insights and suggestions for sustainable transport development.

## **1. Method**

### **1.1. Search strategy:**

The search strategy is mainly based on authoritative journal literature. Includes Nature Climate Change, Global Environmental Change, Environmental Science & Technology, Transportation Research Part D: Journals such as Transport and Environment, whose publications in the fields of carbon neutrality and environmental science are widely recognized and cited; Key words: "Carbon neutrality", "carbon neutral transportation", "public transportation" etc.

### **1.2. Source selection criteria:**

First of all, the date of the first edition is limited to after 2010. The importance of recent literature is higher than that of long-term literature, because short-term references can better reflect the current actual situation. In addition, the topics of the literature should include topics related to carbon neutrality and transportation to prevent excessive divergence and ineffective reading. For the consideration of credibility, this paper tries to select more journals and official institutions accepted by peers to obtain various kinds of information.

### **1.3. Literature analysis process:**

Literature analysis includes the comparison and synthesis of literature, summarizing the keywords and research methods of each literature in the form of a list, so as to summarize the commonalities and differences. Of course, some appropriate methods can also be used to analyze the literature: subject analysis, content analysis or meta-analysis.

### **1.4. Discuss specific recommendations:**

Based on the analysis of public government data from 2004 to 2014 in Singapore, it is found that the number of registered green public transport has a high negative correlation with carbon monoxide emission, PM<sub>2.5</sub> and other environmental pollution indicators, indicating that public transport has an important impact on the realization of urban

carbon neutrality.

However, based on the urban status quo of Singapore, there are still many challenges, such as: the efficiency of public transport operation still needs to be improved, and the penetration rate of electric public transport is not high, which is lower than that of comparable developed countries. Based on this, this paper puts forward the following suggestions: promote electric public transport vehicles, accelerate the promotion of electric buses, electric taxis, and other electric public transport vehicles. Improve the operational efficiency of the public transport system, optimize bus routes, improve vehicle scheduling and passenger management measures. Enhancing the integration of public transport with other modes of transport, for example by promoting seamless connection with shared transport, to improve the overall efficiency of the transport system. The above recommendations are intended to help Singapore's public transport sector achieve its goal of carbon neutrality. A comprehensive approach combining technological innovation, policy support and public engagement can move public transport systems towards greener and more sustainable development and reduce their impact on climate change.

## 2. Results

Based on the study of Singapore, this paper finds that the operation quantity, quality and running status of public transport have a strong correlation with environmental pollution indicators such as carbon dioxide, carbon monoxide and PM2.5, indicating that public transport has an important impact on the realization of urban carbon neutrality. Singapore's public transport is moving towards a more environmentally friendly, efficient and sustainable development direction: the Singapore government vigorously promotes electrification, intelligence, digitization, shared transport, light rail network expansion, and implements the sustainable development strategy into the transport industry. Therefore, the contribution of Singapore's environmental status to carbon neutrality increases year by year. The gaps and challenges are as follows: Although Singapore has taken many measures and promulgated relevant policies in the field of public transport, there are still problems such as low operating efficiency of public transport and lower penetration rate of electric public transport than that of the same developed countries. Singapore has room to promote the development of public transport by improving operational efficiency, enhancing the integration of multi-modal transport (especially with shared transport), and introducing innovative technologies to achieve carbon neutrality.

In conclusion, the implications of public transport in the process of carbon neutrality are as follows:

### 2.1. Reduce energy consumption and improve overall efficiency

Public transport, which mainly uses a centralized mode of transport, can carry more passengers than private cars. According to the Singapore Land Transport Authority (LTA), each public transport can replace about 12 private cars. Therefore, by promoting the use of public transport, a significant amount of exhaust emissions can be reduced. Reducing air pollution and greenhouse gas emissions will help mitigate climate change. At the same time, the planning and management of public transportation help to optimize the utilization of transportation resources. Reasonable design of bus routes, vehicle scheduling and passenger flow management can reduce vehicle congestion and traffic jams and improve the overall traffic efficiency. This not only saves energy and time, but also reduces energy waste and carbon emissions.

### 2.2. Forming a closed loop of sustainable development

The development of public transport is closely related to urban planning and sustainable development. By building an efficient public transport system, urban traffic congestion and waste of land resources can be reduced. Public transport also helps to improve the travel experience of residents and increase the accessibility and social inclusion of cities. Shaping green travel and promoting the use of public transport can cultivate people's awareness and habit of green travel. The formation of this green travel culture will further promote the process of carbon

neutrality and reduce the negative impact of individual carbon footprint.

Therefore, the development of public transport is of great importance in achieving the goals of urban sustainability and carbon neutrality. By continuing to improve the reliability, accessibility and environmental quality of public transport, we can encourage more people to take public transport, reduce reliance on private cars, and reduce carbon emissions and environmental burdens on cities. This requires governments, transport authorities and society to work together to develop and implement policies to invest in and improve public transport infrastructure to achieve sustainable and green urban transport systems.

### **3. Discussion**

Public transport is important in the context of carbon neutrality. With the growing threat of global climate change, reducing greenhouse gas emissions is a top priority. As a centralized transportation mode, public transport vigorously promotes the construction of a low-carbon transportation system that can reduce exhaust emissions, optimize the allocation of transportation resources, promote sustainable urban development, and realize low-carbon transportation.

First of all, the promotion and use of public transport can reduce a lot of exhaust emissions, air pollution and greenhouse gas release. Singapore's public transport system saves millions of tonnes of carbon dioxide emissions every year, according to official figures. This has significant implications for improving air quality, protecting people's health and mitigating climate change.

Secondly, the planning and management of public transportation helps to optimize the utilization of transportation resources. Through rational design of bus routes, dispatching vehicles and managing passenger flow, vehicle congestion and traffic jams can be reduced and the overall traffic efficiency can be improved. This not only saves energy and time, but also reduces energy waste and carbon emissions.

In addition, public transport can contribute to sustainable urban development. By building an efficient and convenient public transport network, private car use can be reduced, traffic congestion and parking needs can be reduced, and land resources waste can be reduced. This provides the city with more space for public space, greening and community facilities, improving the quality of life of residents.

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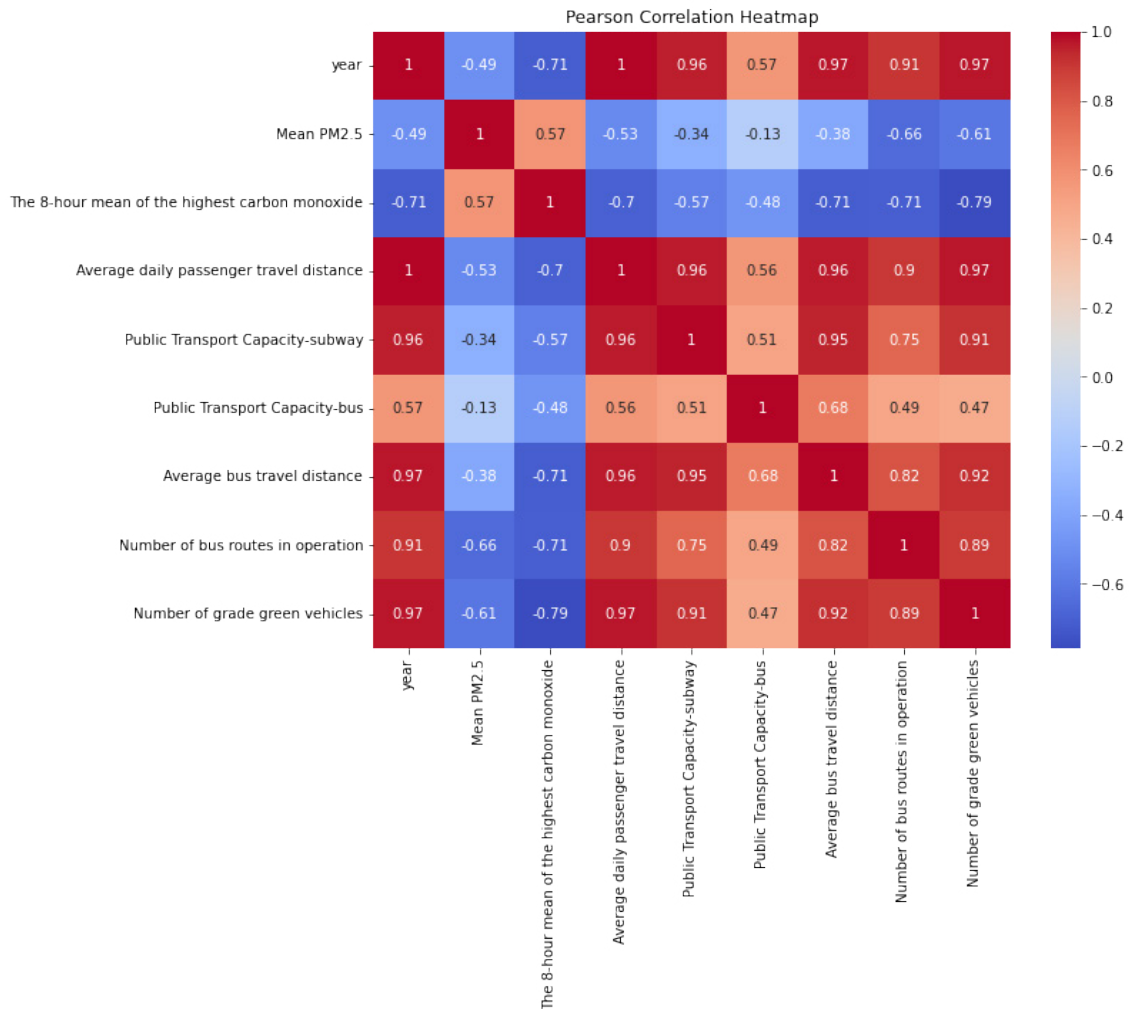


Figure 1. shows the correlation between data on Singapore from 2004 to 2014