Sustainable Transportation to Mitigate Climate Change

Subjects: Environmental Studies | Environmental Sciences

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The build-up of greenhouse gases (GHGs) is causing warmness in the Earth's atmosphere, resulting in climate change. The transport sector is one of the active causes of GHG emissions and it is imperative to use sustainable transport sources to control climate change. There is a measure that aims to encourage citizens to stop using their own vehicles as their choice of transport and instead opt for joint sustainable mobility during traveling.

sustainability transportation climate change reduced carbon emissions

1. Introduction

The transportation industry is crucial as it is an integral part of the economy and the environment. Investment, growth, and carbon dioxide (CO_2) emissions are all areas in which it has a significant impact on the economy and environment. More specifically, the transport sector creates acceptable and undesired outputs at a specific level of transportation inputs, such as traffic flow, traffic automobiles, and energy consumption. Moreover, greenhouse gases (GHGs), especially CO_2 emissions, have negative effects on countries, making climate change and ecological degradation urgent problems. Two fourths of all greenhouse gas emissions come from the transportation industry [1].

The topic transportation and its effect on climate change constitutes a new domain with unstudied potential in sustainable transportation to reduce carbon emissions and address climate change globally. Both personal mobility and the transportation of heavy objects have dramatically increased over the last century. This progress has been significantly influenced by the advancement of the internal combustion engine. Engine efficiency has increased, and emissions have decreased significantly. Additional upgrades are needed to comply with local zero-emission regulations and global climate goals. Rapid renewable energy sources are essential for producing clean power and the wide-scale use of sustainable fuels. As every nation has a responsibility, developing countries must learn to reduce their reliance on fossil fuels as their economies expand. They should indeed pursue a sustainable path and swiftly convey crucial insights to gain expertise. Technology evaluations should consider the influence of each life cycle stage rather than just the tailpipe emissions. It would be smart to adopt a fact-driven approach, keep various options open, and build on prior accomplishments. A variety of low-carbon technologies should be pursued rather than placing all the stakes on one [2].

Research that considers sustainable transportation to reduce carbon emissions have a rich background to address the issue of climate change. For example, Ref. [1] observed that to create low-carbon transportation and land-use policies to address climate change, it is essential to understand the factors affecting climate change with the help of CO_2 emissions. They aimed to determine how the built environment (BE) involves CO_2 emissions connected to commuting and how it affects climate change. Most studies were conducted in developed countries and evaluated the link between BE and CO_2 emissions using conventional modeling, considering the direct effects associated with BE. Predicting the overall impact of BE on commuter CO_2 emissions while accounting for the mediating role of GHG technologies is a research gap.

2. Sustainable Transportation to Mitigate Climate Change

Over the past century, human mobility and the movement of large goods have expanded with the help of transportation. The development of the internal combustion engine has tremendously increased emissions, leading to pollution [1]. For instance, Ref. [3] briefed that local zero-emission standards and global climate objectives need further renovations to meet these requirements and reduce carbon emissions. Ref. [4] described that producing clean energy and the wide-scale usage of sustainable fuels is impossible without the rapid development of renewable energy sources. Their findings revealed that a wide variety of diversified transportation purposes and the relationship between low-carbon technology and climate change mitigation are significant.

Ref. [2] examined how CO_2 emissions affect climate change and how to implement low-carbon transportation for a sustainable environment. Climate change mitigation and sustainable transport have a connection that further improves the polluted environment for human beings. Climate change mitigation and a reduction in GHG emissions is often difficult due to automobile pollution [1][5][6][7]. Ref. [8] focused on CO_2 and other GHG emissions from regional transportation and local resources. The findings showed that automobile CO_2 sources accounted for 23% of global energy related GHG emissions. Regarding human caused GHGs, automobile sources accounted for 28% of all US emissions in 2004 and a staggering 39% of all CH_4, N_2O, and HFC emissions. They have controlled climate change by examining CO_2 emissions from several megacities, and carbon footprints in CO_2 and the amount of CO_2 per person were used as a sustainability measure.

Furthermore, lowering GHG emissions in the transportation industry could disturb the environment and cause climate change. Transport inefficiency is aggravated by the combined effect of climate change mitigation technologies. Climate change mitigation technologies have a more significant influence on air transportation efficiency as compared with rail and road transportation [9][10][11]. Studies on climate change and transportation have received more attention and expertise recently, but again GHGs such as CO_2 and HFCs are the factors that affect the Earth's atmosphere [12][13][14][15]. On the other hand, Ref. [9] suggested that the transportation business significantly influences both the economy and the environment. As a result of its rapid expansion, it has sustained the economy but has harmed the sustainable environment, which is a detrimental factor. A suggestion was put forward to the policymakers to evaluate hazardous transportation factors in the context of GHG.

The effectiveness of the transportation industry has been studied and several viable technological solutions have been found to sustain it. For example, Refs. [16][17] pointed out that the estimation of cities' GHG emissions has improved. Cities need more data on GHG emissions to assess where the present issues come from. The common practice of projecting 2020 emissions to the beginning of 2022 is no longer adequate. For instance, cities' climate change objectives might include an aim to cut emissions from 2007 by 80% until 2030. Many other factors, such as transport traffic gas emissions in the form of CO_2, CH_4, and N_2O, are other hazards to a sustainable environment. However, climate change and transportation have a relationship and more expertise is needed in mitigating global warming. The study found that GHGs such as CO_2, CH_4, N_2O, and HFCs have an inverse association with climate change [13]. For example, Ref. [14] measured the reflection of the transportation industry and climate change and the intervening effect of GHGs. Likewise, zero GHG emissions are impossible due to transportation needing fuel and petrol, which causes environmental disturbance and climate change. The study found that climate change mitigation technologies and road transport automation are not associated. Air and railway transportation could be associated with climate change mitigation technologies [10].

Ref. [18] analyzed the influence of the strict controlling measures of COVID-19 on the air quality of Anhui. Both regression and path analyses were taken into account to identify these relationships. During the time of peak activity of COVID-19, they discovered a reduction in air pollution: 21% for PM10 and 19% for PM2.5. An AQI drop of 3% after COVID-19 indicates that air quality may deteriorate in the future, but an even more dramatic drop of 16% was reported while COVID-19 was at its peak. Similarly, Ref. [19] predicted air pollution in China using data collected from 72 air quality monitoring stations and found a significant affiliation between transportation and air quality. In a similar vein, Refs. [20][21] used the algorithm method and found vehicle infrastructure as a significant predictor of climate change. In the context of the above studies, it is proved that sustainable transportation and reduced carbon emissions could address climate change in China's most developed cities, which has not been analyzed before; thus, a gap exists.

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