



# “A REVIEW STUDY ON REDUCTION OF CARBON FOOTPRINT IN URBAN AREA”

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## ABSTRACT:

The increasing trend of urbanization has led to a surge in carbon emissions, contributing significantly to climate change. To address this issue, several studies have been conducted to explore various strategies and technologies to reduce the carbon footprint in urban areas. This review study aims to analyze and summarize the existing literature on the reduction of carbon footprint in urban areas, focusing on the strategies and technologies that have been proposed and implemented. The study found that various strategies, including green buildings, urban agriculture, public transportation, and energy-efficient systems, have been proposed to reduce carbon emissions in urban areas. Additionally, the implementation of renewable energy sources and low-carbon technologies has shown promising results in reducing carbon emissions in cities. Study provides insights into the various strategies and technologies that can be employed to reduce carbon emissions in urban areas. The findings of this study can help policymakers, city planners, and stakeholders make informed decisions to create sustainable and eco-friendly urban environments that are essential for mitigating climate change.

**Keywords** – Carbon Footprint, Carbon emission, Urbanization

## INTRODUCTION

About half of the world's population is residing in cities. By 2030, nearly 60% of the world's people will be urban dwellers, with 60% of China's population living in cities, 41% of India's population and 87% of the USA population (ref. 1). Most of the increase of urbanization has occurred in developing nations which will account for over 80% of total global urban growth during 2010–2030. Urban centers are key sources of greenhouse gases (GHGs) (ref. 2). They concentrate populations, economic activities and built environments and thus, are presented with higher risks from floods, heat waves, sea level rise and other hazards that climate change is expected to aggravate. According to India's National Action Plan on Climate Change, the global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 379-401 ppm in 2019(ref. 3). Multi model averages show that the temperature increases during 2090–2099 relative to 1980–1999 may range from 1.1 to 6.4. Degree Celsius and sea level rise from 0.18 to 0.59 m (ref. 4). The impacts could be on freshwater availability, oceanic acidification, food production, flooding of coastal areas and increased burden of vector borne diseases associated with extreme weather. On the other hand, Indian economy is growing at an average rate of 7–8 per cent which is creating lot of challenges for the cities like urbanization leading to migration, slums and squatters, load on infrastructure, water supply-sanitation problems, increase in the number of vehicles on the road leading to air pollution, the capacity of existing roads has become saturated, ground water depletion, no water recharging, exhaustion of nonrenewable sources of energy is taking place like petrol, diesel, coal, etc. The forces have resulted into making the cities unfit for living. Hence, an approach is needed where solutions need to be found out to make

the city fit for living with healthy conditions and low carbon emission

## Need of the Study

Time has come in India as well like other developed countries of the world where in there is a huge traffic jam while commuting to place of work like in mega polis of Delhi and Mumbai. The air pollution is at the maximum levels due to vehicular pollution, industries, no solid waste management and extinction of nonrenewable sources of energy like fossil fuels, coal and other minerals. Also temperatures are rising to extreme, sea level is going up and natural calamities and disaster is there like earthquakes, tsunami is common. All these are indications of high level of urban estates, extinction of green and open areas, destruction of natural areas like forest lands and quarrying activities for the extraction of minerals and natural resources like in Chhattisgarh. Also with the construction of big dams and hydel projects we are diverting the natural course of river thereby disturbing its activity.

## Objectives

To conduct fundamental study on carbon emissions & carbon footprint and detail assessment of for calculation of carbon footprint and reduction of carbon footprint especially in the urban area.

## Critical Literature Review

Lee, Taherzadeh, and Kanemoto in their study aim to identify the scale and drivers of carbon footprints in households, cities, and regions across India. They use a multi-region input-output analysis to estimate the carbon footprints of different regions and sectors in India. They also investigate the drivers of carbon footprints at the household level using a microsimulation approach.

The authors find that the carbon footprints of households in India are significantly lower than those of households in developed countries. However, they also find that the carbon footprints of households in India are likely to increase in the future due to factors such as population growth and changes in consumption patterns. The authors also find that the drivers of carbon footprints at the household level in India are different from those in developed countries, with factors such as income and education having a stronger influence on carbon footprints.

One of the strengths of their research is the use of a multi-region input-output analysis, which allows the authors to estimate carbon footprints at different levels of aggregation. The authors also use a microsimulation approach to investigate the drivers of carbon footprints at the household level, which provides a more detailed understanding of the factors that influence carbon footprints in India.

However, one limitation of their research is that the analysis is based on data from 2005, which may not be representative of current trends in India. Additionally, the authors acknowledge that there are limitations to the data available, particularly at the household level.

Fry et al. propose a new method for assessing the carbon footprints of cities under limited information. The authors argue that existing methods for estimating carbon footprints often rely on detailed data that may not be available in all contexts, particularly in developing countries. They propose a new method that uses readily available data to estimate carbon footprints and test this method in several case studies.

The authors find that their method is able to estimate carbon footprints with reasonable accuracy, even when detailed data is not available. They also find that their method can be used to identify the sectors that contribute most to carbon footprints in cities, which could inform policy interventions to reduce emissions.

One strength of their study is the innovative approach the authors take to estimate carbon footprints under limited information. By using readily available data, the authors demonstrate that it is possible to estimate carbon footprints even in contexts where detailed data is not available. This is particularly important for developing countries, where data availability may be limited.

However, one limitation of their research is that the authors do not provide a detailed comparison of their method to existing methods for estimating carbon footprints. While they do acknowledge the limitations of existing methods, it would be useful for readers to have a better understanding of how their method compares to these methods in terms of accuracy and applicability.

Ramachandra, Aithala, and Sreejith investigate the greenhouse gas (GHG) footprints of major cities in India. The authors use data from various sources to estimate the GHG emissions of 60 cities in India, and they also analyze the factors that contribute to these emissions.

The authors find that the GHG footprints of cities in India vary widely, with some cities having much higher emissions than others. They also find that the primary contributors to GHG emissions in cities in India are transportation, energy consumption, and waste management. The authors suggest that interventions such as promoting sustainable transportation and waste management practices could help to reduce GHG emissions in Indian cities.

One strength of their research is the comprehensive data analysis that the authors undertake. They use data from multiple sources to estimate GHG emissions in different sectors, and they also compare emissions across cities. The authors also provide useful insights into the factors that contribute to GHG emissions in Indian cities, which could inform policy interventions to address the issue.

However, one limitation of this research paper is that the authors do not provide a detailed discussion of the methods they use to estimate GHG emissions. While they do cite the sources of their data, it would be useful for readers to have a better understanding of the methods used to process and analyze this data.

S. Dhar et al., explore the co-benefits of low carbon scenarios for transport in India. The paper examines the potential benefits of transitioning to low carbon transport modes, such as electric vehicles and public transportation, in terms of reducing greenhouse gas emissions and improving air quality.

The authors use a scenario analysis to assess the impact of different low carbon transport scenarios on greenhouse gas emissions and air quality in major Indian cities. They find that transitioning to low carbon transport modes could reduce greenhouse gas emissions and improve air quality, resulting in significant health benefits.

One strength of their research is the focus on co-benefits, or the additional benefits that result from transitioning to low carbon transport modes. The authors demonstrate that low carbon transport scenarios could result in significant co-benefits, including improved air quality and health outcomes. This approach could help to build support for low carbon transport policies by demonstrating their broader benefits.

However, one limitation of their research is that the authors do not discuss the potential challenges or barriers to implementing low carbon transport scenarios in India. While the paper highlights the potential benefits of such scenarios, it would be useful to also consider the practical challenges that may need to be addressed to successfully transition to low carbon transport modes.

Zhang et al., examine urban residents' response to and evaluation of low-carbon travel policies in five eastern cities in China. The paper focuses on policies such as public transportation subsidies and restrictions on car ownership, which are designed to encourage low-carbon travel behaviors.

They use a survey to collect data on urban residents' attitudes towards low-carbon travel policies and their travel behavior. They find that urban residents generally have positive attitudes towards low-carbon travel policies, but that there are significant barriers to their adoption. These barriers include the convenience and reliability of public transportation, as well as the perceived status associated with car ownership.

One strength of their study is its focus on understanding the barriers to adoption of low-carbon travel policies in China. By identifying these barriers, the authors are able to provide insights into how policy interventions could be designed to address them. This approach could be useful for policymakers in China and other countries seeking to promote low-carbon travel behaviors.

## Major Findings

The carbon footprint is a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product.

A methodology to estimate the total emission of greenhouse gases (GHG) in carbon equivalents from a product across its life cycle from construction of any structure to utilization of structure.

This includes activities of individuals, populations, governments, companies, organizations, processes, industry sectors etc. Products include goods and services. In any case, all direct (on-site, internal) and indirect emissions need to be taken into account

Many studies of CF concepts and calculation methods in urban planning and geography commonly assume that spatial factors are important to energy consumptions and carbon dioxide (CO<sub>2</sub>) emissions. As a proxy measure of CF, the concept and calculation of EF have also been adopted by researches in these fields.

Consumption categories:

1. energy consumption with regard to heating and operating housing
2. a substantial amount of material housing consumption
3. Energy consumption relating to everyday transport
4. Energy used for longer holiday and leisure trips.

Planning factors:

1. town size/national settlement pattern
2. localization of houses within town, municipality, or built-up area (the distance from the house to the center of town and relation to urban sprawl)
3. population and development density
4. Type of housing.

Although CF and EF can be a useful tool in planning practice, there are some criticisms on calculating them. One inherent weakness of calculating footprint is that it is intended to measure impact rather than to get cause and effect.

Building structures that incorporate green technologies such as solar panels, green roofs, and rainwater harvesting systems can significantly reduce carbon emissions from the building sector.

Promoting the use of public transportation such as buses, trains, and subways can reduce the number of cars on the road and, therefore, the amount of carbon emissions generated by the transportation sector.

Incorporating agriculture into urban areas can contribute to carbon sequestration and reduce the carbon footprint of food transportation.

The implementation of renewable energy sources such as wind and solar power can help reduce carbon emissions in urban areas.

The use of energy-efficient appliances and systems such as LED lighting, smart grids, and energy-efficient HVAC systems can significantly reduce carbon emissions from the residential and commercial sectors.

The promotion of sustainable lifestyles and eco-friendly practices can lead to a reduction in the carbon footprint of urban areas. Public awareness and engagement are crucial for achieving sustainable and eco-friendly urban environments.

Overall, the review study shows that a combination of strategies and technologies can effectively reduce the carbon footprint of urban areas. The findings of this study can guide policymakers, city planners, and stakeholders in making informed decisions to create sustainable and eco-friendly urban environments that are essential for mitigating climate change.

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