



REVIEW ARTICLE

CARBON EMISSION REGULATION IN TRANSPORT SECTOR; A COMPARATIVE LEGAL ANALYSIS OF INDIA, EU AND UK

¹Shankha Pati, ²Dr. Farah Khan and ³Dr. Anupama Thakur

¹Ph.D Scholar, School of Law, Graphic Era Hill University, Dehradun; ²Associate Professor, Graphic Era Hill University, Bhimtal; ³Assistant Professor, Graphic Era Hill University, Dehradun

ARTICLE INFO

Article History:

Received 19th April, 2026

Received in revised form

25th May, 2026

Accepted 29th June, 2026

Published online 31st August, 2026

Keywords:

Carbon emission, Transport Sector, Environmental regulation, European Union, United Kingdom, India, Low-carbon transport, Climate Policy

*Corresponding author:

Shankha Pati

ABSTRACT

The aim of this research is to analyse carbon emission policies in transport in India, European Union (EU) and United Kingdom (UK) and to recognise its differences in carbon emission policies in these three regions in regard to regulatory framework, policies and impacts. The transport sector continues to be a key source of global CO₂ emissions, as a direct result of the population growth of urban areas, countries' economic developments and growing energy requirements. The paper draws conclusions about the legal approaches, policy tools and judicious measures which influence emission control in these areas by adopting a qualitative and comparative approach. These findings indicate that while the EU and UK have strict, legally binding rules with effective carbon pricing and compliance mechanisms, a gradual (incentive-based) strategy for introducing climate rules is being continued in India, taking one-on-one economic and policy flexibility into account. Although progress has been made, issues like reliance on fossil fuels, poor engagement and infrastructure remain. Overall, the study highlights the importance of adopting a holistic approach that incorporates both legal and technological solutions and behavioural shift to create sustainable, low-carbon transportation systems at the international level.

Copyright©2026, Shankha Pati et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Shankha Pati, Dr. Farah Khan and Dr. Anupama Thakur. 2026. "Carbon Emission regulation in Transport Sector; A comparative legal analysis of India, EU and UK", *International Journal of Recent Advances in Multidisciplinary Research*, 13,(08), 12770-12772.

INTRODUCTION

In the last a decade, carbon emissions have emerged as a pressing worldwide issue, presenting considerable obstacles to sustainable development. The transportation industry is a significant contributor to global carbon emissions, responsible for over 25% of all energy-related CO₂ emissions worldwide, according to the "International Energy Agency (IEA)". The fast progression of urbanisation has intensified this problem, with anticipated travel demand likely to significantly elevate transportation-related carbon emissions without effective mitigating measures (1). Climate change induced by "greenhouse gases (GHGs)" has emerged as a worldwide priority. Carbon emissions from fossil fuel burning are the primary component of greenhouse gases, at 58%. Transport, being a fundamental sector for social advancement and the national economy, requires significant energy resources. Consequently, it has emerged as an internationally acknowledged industry characterised by excessive energy consumption. The International Energy Agency said that in 2018, transport emerged as the second biggest sector for carbon emissions globally, with 25% of total emissions. In that year, carbon emissions from the transport sector were 9.17%

of the total, establishing transport as a significant contributor to carbon emissions. Consequently, regulating the surging carbon dioxide (CO₂) emissions from transportation has become a crucial component of CO₂ emission reduction efforts (2).

Carbon Emission Regulation in India, Europe, and the UK: India, Europe and the United Kingdom provide examples of varying and overlapping paths of carbon emissions regulation, both in the transport and energy sectors. As India is the top 3 emitter of CO₂ globally, transport emission has increased 2.3 times from 155.9 Mt in 2008 to 368.2 Mt in 2020 of which 88% is from road transport. Decomposition analysis reveals that economic growth, population growth and growth in energy demand are behind emissions, whereas an increase in energy efficiency and the adoption of electric mobility are behind emissions reduction. But emissions are still slightly connected to economic growth (3). The European Union, on the other hand, has a more policed driven approach, combining fiscal, ecological and sanitary dimensions in the term energy footprint. The EU is the first to have set itself the target of becoming climate neutral by 2050 and to focus on renewables transitions and structured policy instruments to limit emissions (4). The United Kingdom is a

country that has experienced a mixed result; transport as a sector accounts for the 34% of national emissions and is high in fossil fuels use. While there have been tremendous strides in the efficiency of vehicles on the road, this has been largely lost due to increased traffic and selection of larger vehicles, which has only limited the effectiveness of the emission reduction benefit (5).

The *M.C. Mehta v. Union of India (Taj Trapezium Case)*: This case historically was about the emission of sulphur dioxide by industrial processes, but was precedent-setting in terms of regulation of industrial emissions for the benefit of the environmental assets. (6).

***Verein Klima Seniorinnen Switzerland v. Switzerland*:** The European Court of Human Rights deemed that Switzerland infringed the rights of human beings by not fulfilling emission reduction goals partly because of a lack of action to protect elderly women from climate impacts (7). The study investigates and compares the carbon emission norms of transport sector in India, EU and UK. It reviews current legislation and policies, determines transport emission regulatory challenges as well as assessing their effectiveness. The study also investigates possible legal changes and policy options to encourage low carbon transport solutions, with the ultimate goal of gaining a full and integrated picture of the regulatory tools for the reduction of transport-related carbon dioxide emissions.

REVIEW OF LITERATURE

The transport sector contributes significantly to greenhouse gas emissions and the regulation of carbon emissions has turned into a key issue in policies. With rapid urbanization, industrialization and dependency on vehicles increasing, transportation-related CO₂ emissions have emerged as a significant environmental issue, according to (8). They identified that for transport sector emissions to be reduced and contributing to sustainable development, systematic emission measurement techniques is a necessity as well as the integration of emissions into policies. Likewise, recent research on transportation carbon emissions has now tended to concentrate on low carbon mobility, green supply chain management and the policy measures for emissions reductions (9). Additionally, (10) asserted that demand-side measures, including behavioral change and modal shift, are essential complements to regulations to fully reduce transport emissions, and (11) noted the importance of establishing tight fuel economy standards and policy incentives for quicker decarbonisation. Additionally, a number of studies signal that government policies that promote the use of electric vehicles (EVs), public transit and multimodal mobility plays a substantial role in carbon mitigation. Electromobility, micromobility and intermodal transportation were found as emerging themes in sustainable transport governance by (12). The study conclude in their review that policies for cleaner technologies and urban planning integration can significantly reduce carbon emissions, with a more efficient transport system. Furthermore, (13) highlighted the need for life cycle assessment (LCA) methodology for assessing carbon emissions from the transport sector. Their findings showed that EVs have a positive impact on direct emissions but that it is important to have comprehensive regulatory measures that take into account emissions related to EV production, energy generation and infrastructure.

Research Gap: Existing literature has a wide coverage which addresses carbon emission reduction approaches in the transport sector, but insufficient consideration in combining legal, policy and technological approaches within one analysis. Most works revolve around either the developed regions or around general trends across the globe, leaving a space in the understanding about the effectiveness of regulation by region, especially in the emerging economies like India. Moreover, although the possibilities of electric mobility, renewable integration are widely mentioned, there is a lack of attention to lifecycle emissions and infrastructure related effects. There is also no empirical assessment of the results obtained from the implementation of the policies relative to the theories applied. In addition, judicial interventions in the process of carbon regulation have been under studied.

Research Methodology: The study utilises qualitative research methodology and analyses and compares the implementation of carbon emission regulations in the transport sector in India, EU and the United Kingdom. These three jurisdictions are the only ones available for the study area as this is needed to do a focused comparative analysis. The type of research design used is descriptive and analytical research, the research in which existing regulations are first described and analyzed descriptively and then followed up analytically to identify similarities, differences and effectiveness. The study also evaluates some of the challenges of regulating transport emissions in these areas and recommends legal change to encourage the use of low carbon transport. The main method of data collection has been secondary research, which involves the use of government documents (e.g. reports), policies, international agreements/charters, legal statutes and academic literature, alongside reports from trade and industry bodies such as the environmental and transport planning agencies in order to be able to make a full and comparative assessment of the regulatory situation.

Descriptive Results

Objective 1: To compare carbon emission regulations in the transport sector across India, EU, and UK.

Carbon emission rules in the transport industry in India, European Union and United Kingdom (UK) vary in terms of the maturity and enforcement of the rules. The EU implements high standards for fleet-wide CO₂ emission targets and emissions trading systems, whereas India is prioritizing after treatment technologies, such as Bharat Stage VI norms and policies to incentivize electric mobility. Post-Brexit, the UK has introduced individual yet parallel measures, like the 2035 ban on buying new petrol and diesel cars. The regimes have also been influenced by judicial intervention; the Supreme Court of India in *M.C. Mehta* case ordered using cleaner fuels in Delhi. The European applications of *ClientEarth v. UK Government* forced governments to toughen up their air quality plans, and the cases of *R (Friends of the Earth) v. Secretary of State for Transport* argued that inadequate climate plans are being challenged by the Courts, which is another indicator of the importance of the more accountable accountability to transport emissions in Europe.

Objective 2: To assess key challenges in regulating transport emissions and suggest legal reforms foe advancing low-carbon transport: The regulation of transport emissions is confronted with a number of problems in India, the European Union, and the United Kingdom such as the lack of oversight, the lack of infrastructure, the lack of public awareness, and the

dependence on fossil fuels. There are also limitations as there are at the economic level and some opposition to governmental changes. Addressing these challenges, legal measures would need to increase the harmonisation of emission standards, enhance compliance and monitoring mechanisms, lead the market and industry transition to zero emission vehicles, and introduce cost-effective technology transfer incentives like subsidies and exemptions. Furthermore, the introduction of sustainable urban transport policy, plus the promotion of PPs can greatly help to develop low carbon transport systems.

DISCUSSION

Recent studies emphasize that fiscal incentives and administrative actions have a higher impact on India's decarbonisation path than enforcing carbon caps (14). The EU has adopted a very robust supranational framework, with Regulation (EU) 2019/631 and the European Green Deal, imposing mandatory reduction targets and carbon pricing mechanisms for CO₂ (15). Following Brexit, the UK has put in place the UK Emissions Trading Scheme and enacted binding cut commitments on net zero (16). Generally speaking, EU and UK are leaning towards a hard-law governance model, and India towards gradual steps to regulatory compliance (17). India has adopted a flexible and developmental mode of regulation through policy instruments Bharat Stage-VI emission norms, "Corporate Average Fuel Efficiency (CAFE)" norms, and incentives for electric mobility, under the National Electric Mobility Mission Plan that mainly leverage policy intervention (18).

CONCLUSION

The study finds that regulation of carbon emissions in the transport sector differs considerably by geographical region based on policy strength, its enforcement, and policy development priorities between India, the EU and the UK. The EU and UK have expended great effort in establishing very tough, legally binding frameworks to anchor climate action and accountability measures, while India has taken a gradual approach and offered incentives. Although there is progress, areas in need of improvement have also endured, including continued reliance on fossil fuels, weak enforcement, and the lack of infrastructure. The implementation of air emission reduction strategies is a composite approach that addresses changes in behaviour, technological improvement and legislative action. Building up institutional capacity and encouraging clean mobility and international cooperation will be key to sustainable, low carbon transport.

REFERENCES

1. X. Wang, X. Dong, Z. Zhang, and Y. Wang, "Transportation carbon reduction technologies: A review of fundamentals, application, and performance," *Journal of Traffic and Transportation Engineering*, 2024.
2. Y. Yu, S. Li, H. Sun, and F. Taghizadeh-Hesary, "Energy carbon emission reduction of China's transportation sector: An input-output approach," *Economic Analysis and Policy*, vol. 69, pp. 378–393, 2021.
3. S. Jain and S. Rankavat, "Analysing driving factors of India's transportation sector CO₂ emissions: Based on LMDI decomposition method," *Heliyon*, vol. 9, no. 9, 2023.
4. D. Sala, O. Liashenko, M. Pyzalski, K. Pavlov, O. Pavlova, K. Durczak, and R. Chorny, "The energy footprint in the EU: How CO₂ emission reductions drive sustainable development," *Energies*, vol. 18, no. 12, p. 3110, 2025.
5. H. Thomas and A. C. Serrenho, "Using different transport modes: An opportunity to reduce UK passenger transport emissions?," *Transportation Research Part D: Transport and Environment*, vol. 126, p. 103989, 2024.
6. M.C. Mehta v. Union of India & Ors. (1997) 2 SCC 353
7. Verein KlimaSeniorinnen Schweiz v. Switzerland (2024) ECHR 304, 53600/20
8. M. Zubair, S. Chen, Y. Ma, and X. Hu, "A systematic review on carbon dioxide (CO₂) emission measurement methods under PRISMA guidelines: Transportation sustainability and development programs," *Sustainability*, vol. 15, no. 6, p. 4817, 2023.
9. J. Fan, X. Meng, J. Tian, C. Xing, C. Wang, and J. Wood, "A review of transportation carbon emissions research using bibliometric analyses," *Journal of Traffic and Transportation Engineering (English Edition)*, vol. 10, no. 5, pp. 878–899, 2023.
10. F. Creutzig, L. Niamir, X. Bai, M. Callaghan, J. Cullen, J. Díaz-José, et al., "Demand-side solutions to climate change mitigation consistent with high levels of well-being," *Nature Climate Change*, vol. 12, no. 1, pp. 36–46, 2022.
11. Liu, Q. and Y. Yin, "RETRACTED ARTICLE: Strategies for emission reduction in construction: The role of China's carbon trading market," *Journal of the Knowledge Economy*, vol. 16, no. 1, pp. 3000–3029, 2025.
12. Reis, J., Costa, J., Marques, P., Pinto, F. S., and Mateus, R. J. G., "Sustainable transport: A systematic literature review," in *Proceedings of the International Conference on Flexible Automation and Intelligent Manufacturing*, Cham, Switzerland: Springer, 2024, pp. 898–908.
13. W. Zhang, Y. Li, H. Li, S. Liu, J. Zhang, and Y. Kong, "Systematic review of life cycle assessments on carbon emissions in the transportation system," *Environmental Impact Assessment Review*, vol. 109, p. 107618, 2024.
14. S. Amin, "Decarbonisation of road transportation in India—A round-robin review on low-carbon strategies and financial policies," *Future Transportation*, vol. 5, no. 2, p. 36, 2025.
15. E. Zeyen, S. Kalweit, M. Victoria, and T. Brown, "Shifting burdens: How delayed decarbonisation of road transport affects other sectoral emission reductions," *Environmental Research Letters*, vol. 20, no. 4, p. 044044, 2025.
16. M. Leroutier, "Carbon pricing and power sector decarbonization: Evidence from the UK," *Journal of Environmental Economics and Management*, vol. 111, p. 102580, 2022.
17. S. Oberthür and C. Dupont, "The European Union's international climate leadership: Towards a grand climate strategy?," *Journal of European Public Policy*, vol. 28, no. 7, pp. 1095–1114, 2021.
18. R. F. Doelp, "Temporal evolution of circular economy research in the Indian automotive industry: A bibliometric analysis,"