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Editorial: Low-carbon economy and sustainable development: driving force, synergistic mechanism, and implementation path

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Editorial on the Research Topic
Low-carbon economy and sustainable development: driving force, synergistic mechanism, and implementation path

Introduction

In the face of escalating global environmental challenges, transitioning toward a low-carbon economy has become a pressing priority for nations worldwide. The overarching aim is to achieve sustainable economic growth while mitigating the adverse impacts of climate change, resource depletion, and environmental degradation. This Research Topic, Low-Carbon Economy and Sustainable Development: Driving Force, Synergistic Mechanism, and Implementation Path, featured in Frontiers in Environmental Science, brings together 20 insightful articles that explore the driving forces and synergistic mechanisms underpinning low-carbon transitions. The research highlights how innovative solutions and interdisciplinary strategies can support sustainable development across diverse sectors.

The role of agriculture in reducing carbon emissions

Agriculture plays a central role in global carbon emissions, and this sector must be part of the solution to achieving a low-carbon economy. Several articles within this Research Topic focus on agriculture's potential for carbon reduction.

In *The Influence of Agricultural Insurance on Agricultural Carbon Emissions: Evidence from China's crop and livestock sectors*, Jin et al. analyze the impact of agricultural insurance on reducing carbon emissions across China's crop and livestock sectors. The study reveals that agricultural insurance encourages farmers to adopt more sustainable practices, such as restructuring crop types and expanding scale, which, over time, leads to significant carbon emission reductions.

Similarly, Zhang et al., in *How the Rural Digital Economy Influences Agricultural Carbon Emissions*, investigate the role of digital technologies in enhancing green agriculture and reducing emissions. The study highlights how rural digital infrastructures, especially in highly developed regions, contribute to the adoption of low-carbon agricultural technologies, thereby reducing overall emissions in the agricultural sector.

Liang et al., in *The Impact of Green and Low-Carbon Agricultural Production on Farmers' Income in Minority Areas*, explore the relationship between low-carbon agricultural practices and farmer income in China's rural areas. Their findings suggest that adopting green and low-carbon technologies not only contributes to reducing emissions but also improves the socioeconomic wellbeing of farmers, highlighting the dual benefits of low-carbon agricultural transformation.

Corporate governance and financial mechanisms in promoting sustainability

Corporate governance and financial mechanisms are instrumental in steering businesses toward sustainable practices. Several papers in this Research Topic examine how corporate and financial sectors can contribute to carbon reduction and sustainability goals.

Li and Wang, in *Does State Capital Equity Affect ESG Performance of Private Firms*?, examine how state-owned capital influences the environmental, social, and governance (ESG) performance of private firms in China. The study finds that state capital can significantly enhance corporate governance, thus improving ESG outcomes and driving sustainable corporate practices.

In *The heterogeneous impacts of environmental technologies and research and development spending on green growth in emerging economies: The moderating role of financial globalization*, Borojo investigate how financial globalization and environmental technologies contribute to green growth. Their research underscores the importance of financial mechanisms in fostering innovation and promoting green technologies, particularly in emerging economies where such developments are essential for reducing environmental impacts while sustaining economic growth.

Khoza and Biyase, in *Symmetric and Asymmetric Effects of Financial Development on Ecological Footprint in South Africa*, delve into the complex relationships between financial development and ecological footprints. Their findings reveal that while financial markets tend to promote environmental improvements, financial institutions can have mixed effects, underscoring the need for nuanced policy interventions to ensure sustainable financial development.

Technological innovation and urbanization as catalysts for a low-carbon future

Technological innovation and urbanization are powerful drivers of low-carbon transitions. Several articles in this Research Topic focus on the role of technology and urbanization in promoting sustainable development.

Khan and Khan, in *The Effect of Technological Innovations, Urbanization, and Economic Growth on Environmental Quality*, analyze how technological advancements in Belt and Road Initiative (BRI) countries can mitigate the negative environmental impacts of rapid urbanization. Their findings suggest that fostering technological innovation, particularly in urban areas, is key to achieving carbon reduction goals without compromising economic growth.

Similarly, Han, in *Can Intellectual Property Rights Pilots Reduce Carbon Emissions?, investigate the impact of intellectual property rights (IPR) on carbon emissions in Chinese cities*. The study shows that IPR pilots, by encouraging cleaner technologies and industrial restructuring, contribute significantly to carbon emissions reductions.

Chai et al., in *The Impact of Household Population Aging on Carbon Emissions: Micro-scale Evidence from China*, examine how demographic shifts impact carbon emissions at the household level. The study finds that as populations age, carbon emissions tend to decrease due to changes in consumption patterns and lifestyle, offering a unique perspective on the relationship between population aging and carbon reduction.

Regional synergies and policy interventions for green development

Several contributions emphasize the importance of regional cooperation and policy interventions in promoting green development.

Yu and Zheng, in *Efficiency of Green and Low-Carbon Coordinated Development for Mega Urban Agglomerations, focus on the Guangdong-Hong Kong-Macao Greater Bay Area,* analyzing how coordinated regional policies can promote sustainable development. The study highlights that regional cooperation and policy integration are essential for achieving balanced and effective low-carbon development.

In *Collaborative Integration or Policy Diversification: The Influence of Policy Synergy on Regional Green Development*, Chang and Wang explore how synergistic policy approaches—such as combining carbon trading and free trade zone policies—can enhance green development in urban areas. Their findings demonstrate that integrated policies amplify positive outcomes, fostering regional sustainability efforts.

Tang et al. (2024), in *Resources on carbon emissions reduction in China*, analyze the role of natural resource accountability audits in enhancing green technological innovation and reducing emissions across China. Their findings underscore the importance of governance in driving sustainable resource management and achieving carbon reduction targets.

Public perception and stakeholder engagement in the low-carbon transition

The role of public perception in influencing environmental policy and corporate behavior is explored in Sentiment Analysis of Global News on Environmental Issues by Bucur et al.. Using sentiment analysis of global news articles, the authors find that public perception of environmental issues significantly influences both policy and corporate actions. Positive sentiment toward

sustainability enhances stakeholder engagement and accelerates the low-carbon transition.

Conclusion and future directions

The 20 articles in this Research Topic provide a comprehensive overview of the driving forces and synergistic mechanisms that promote a low-carbon economy and sustainable development. From agriculture and corporate governance to technological innovation and regional policy, this Research Topic offers valuable insights for policymakers, business leaders, and researchers committed to achieving sustainability goals. As the global community continues to grapple with the challenges of climate change, these contributions emphasize the importance of interdisciplinary approaches and cross-sector collaboration. By integrating technological advancements, financial mechanisms, and public engagement, stakeholders can drive meaningful progress toward a low-carbon, sustainable future.

We hope that this Research Topic serves as a valuable resource for future research, policy formulation, and practical implementation in the pursuit of a more sustainable and resilient global economy.

Author contributions

ZL: Conceptualization, Writing–original draft, Writing–review and editing. JL: Investigation, Writing–original draft, Writing–review and editing. WP: Investigation, Writing–review and editing. JZ: Investigation, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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