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Editorial: Energy, economy, and climate interactions: challenges and opportunities

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Editorial on the Research Topic

[Energy, economy, and climate interactions: challenges and opportunities](#)

Climate change has become one of the most prominent problems facing the world today and climate change prevention and adaptation are effective means of response (Shi et al., 2023). In contemporary world, energy plays an important role in all aspects of economic development. However, excessive energy use also leads to a rapid increase in greenhouse gas emissions, which eventually bring about climate change and have a negative impact on environment, economy, agriculture, and society. Global climate change mainly includes extreme climate, such as global climate warming, which has disrupted social organizations, housing, and food systems. In detail, climate change enhances species extinction risk, causes melting of glaciers, and even destroys the development of the world and human wellbeing. The Sixth Assessment Reports of IPCC assessed the impacts of climate change, looking at ecosystems, biodiversity, and human communities at global and regional levels, and emphasized the development path of climate adaptation.

In addition, global energy supply shortage and worldwide economic downturn at present might magnify this poor influence. These phenomena indicate a sense of urgency in the collaborative promotion of addressing energy security, economy growth and climate change issues. In other words, the consequences and costs caused by climate change will be significantly magnified and thus hardly affordable. Elshkaki believes that if the current vicious cycle of environmental degradation, such as climate change, caused by the consumption of traditional energy through carbon emissions is maintained, then in the near future, the natural resources of developing countries may not be sufficient to meet the sustainable economic growth of the new generation (Elshkaki, 2023). Therefore, it is advisable for our world to coordinate the promotion of energy security, economic growth, and climate mitigation, although this process consists of various challenges, opportunities and even failures. More importantly, climate change is the result of a complex process of social transformation, which we all need to understand and respond to the challenges it brings.

In order to reduce future climate change and ensure that our economy can grow in a sustainable manner, green and low-carbon transformation of energy is considered as an effective approach, which focuses on greenhouse gas emissions reduction and utilizes

technologies of the information age to promote green and low-carbon transformation in many aspects, such as urbanization, transportation, finance, and construction industry.

Extreme climate that remains a fundamental pressing global environmental challenge warns us to focus on low-carbon transformation and sustainable development (Mei et al., 2020; Ren et al., 2023). Gül et al. analyze the influence of different variables on securing energy and reducing carbon emissions and achieves this goal through economic indicators (Gül et al., 2022). They get the results eventually that the global electricity generation by solar and wind is beneficial for securing energy and climate change mitigation. Russo et al. emphasize one of the main reasons for climate change is the use of fossil fuels for energy production (Russo et al., 2022). Then they demonstrate that reducing the use of non-renewable energy and making renewable energy play an important role in achieving carbon neutrality is a key link strategy to weaken the impact of climate change on society and the environment. The above findings confirm the viewpoint of the interaction between energy, economy and climate in this study, and emphasize the necessity of mitigating climate change.

Facing these challenges, many scholars have also put forward their own opinions to mitigate and adapt to climate change. Correctly quantifying uncertainties in future climate variation is useful to design low-carbon energy systems towards sustainable cities (Liu et al., 2022). Green finance, as the factor of mitigating climate change, can support to develop green and renewable energy and reduce carbon dioxide emissions (Yu et al., 2022; Lang et al., 2023; Lorente et al., 2023). It is sensible for us to improve climate adaptability through sustainable urban development and make the cities leading force for climate change adaptation and resilience (Mehryar et al., 2022).

Although the impact of climate change has been widely recognized, there is the shortage of understanding the process of green and low-carbon transformation and exploring green transformation methods. As emphasized in the AR6 reports of IPCC, which consider emission pathways and corresponding mitigation measures for the 21st century, technological development and innovation are key to mitigating climate change. Meanwhile, the reports discussed mitigation opportunities, related risks, and common interests in energy, agriculture, land use, settlements, construction, transportation, and industry. Thus, this Research Topic closely follows the theme of the above reports and attempts to explore innovative green transformation from multiple perspectives and fields, including economic development, transportation, monitoring model, finance and trade, and urbanization.

In terms of economic development, Zhou et al. explored whether digital economic growth has a reducing effect on carbon emissions. For transportation, Ma et al. analyzed carbon emissions efficiency in the transportation industry and Semab et al. analyzed carbon offsetting costs of ocean transportation in developing countries. In terms of monitoring model, Li and Chen established a multi-dimension long-term carbon emissions analysis model. For finance and trade, Yang

et al. discussed carbon transfer in trade and economic spillover effects of employment and Xue et al. analyzed the development of green finance under the goal of carbon neutrality. In terms of urbanization, Lv and Wang deemed that green city efficiency is the key to national green growth. The common feature of these papers in the Research Topic is that they analyzed the development of green and low-carbon energy transformation in different fields or regions.

In the nutshell, the aim of this Research Topic addressing challenging problems is to highlight and show knowledge on the social, economic, and cultural implications of climate change, as well as reflect the transformation in social-cultural strategies to accelerate mitigation, adaptation and prevention. This Research Topic collection of articles discussed the challenge and opportunity of energy, economy and climate interaction by introducing the development status of green energy transformation in different fields and provides evidences indicating the urgency of reducing greenhouse gas emissions and mitigating climate change, which helps to identify key areas for further research and development. The articles included in this Research Topic address a variety of themes seeking to clarify the need to understand and act on climate change and green transformation, as well as provide insightful information that can help reduce carbon emissions related to energy utilization, mitigate and adapt to climate change, and promote sustainable development in the future.

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