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Editorial: Fostering the energy transition amidst geopolitical and climate risks in a post-COVID world

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Editorial on the Research Topic
Fostering the energy transition amidst geopolitical and climate risks in a post-COVID world

Introduction

This Editorial explores the integration of renewable energy into key sectors, emphasizing its potential to transform global sustainability. It focuses on how technological innovations and smart modeling can revolutionize agriculture, urban mobility, and energy production, advancing Sustainable Development Goals (SDGs). The studies presented in this Editorial provide insights into sustainability challenges and opportunities, offering evidence-based solutions to inform policy and practice for a sustainable future. They highlight innovative technologies and modeling tools to promote sustainable practices, addressing critical gaps in current energy strategies, such as fossil asset stranding. They emphasize the importance of equitable socio-economic transitions for developing countries, illustrating the complex interplay between technology, policy, and societal behavior in advancing sustainability, phasing out fossil energy, and reaching climate goals. Overall, the presented research addresses urgent global needs for enhanced energy efficiency and reduced environmental impact amid climate change, investigating effective renewable technology integration and the socio-economic impacts of moving away from traditional energy sources alongside evolving policies and societal influences.

The urgency of this Research Topic stems from the need to address global sustainability challenges amid rising environmental degradation and climate change. Integrating renewable energy across sectors is crucial for harmonizing economic growth with environmental sustainability. This research aligns with global efforts to reduce carbon emissions and improve energy efficiency in agriculture, urban mobility, and the broader energy mix.

Overview of contributions

The research presented in the paper "*Integration of Renewable Energy Resources into the Water-Energy-Food Nexus–Modeling a Demand Side Management Approach and Application to a Microgrid Farm in Morocco*" (Agadi et al.) examines the role of renewable energy in enhancing the water-energy-food nexus. This study, conducted within Morocco's "Green Morocco Plan," investigates a microgrid farm using AnyMOD and CropWat modeling tools to optimize agricultural irrigation and energy use, particularly through solar PV systems. Key findings include a linear optimization model for evaluating irrigation strategies, their energy implications, and the effectiveness of integrating smart microgrids and renewable energy storage to reduce costs and increase efficiency. This research underscores the challenges and opportunities in synchronizing agricultural practices with renewable energy availability, advocating for continuous innovation in sustainable agriculture practices, especially in arid regions like Morocco. Overall, this study highlights the transformative potential of renewable energy in agriculture and the synergies within the water-energy-food nexus.

The study "*Preferences for the Shared Use of Electric-Powered Vehicles in Mobility Packages: An Empirical Analysis of MaaS in a University Context*" (Decker et al.) investigates university students' preferences for various electric-powered vehicles within Mobility-as-a-Service (MaaS) offerings. Excluding public transport options, this study uses a sample of 995 students to assess preferences and willingness to pay through rank-ordered conjoint analysis. The research finds a significant preference for e-cars and e-scooters over other options, highlighting the potential of MaaS in promoting sustainable urban mobility. The study emphasizes the importance of sustainability attributes, with emission reduction features significantly influencing user preferences for mobility packages. These findings contribute to understanding how to design and market MaaS to younger demographics, particularly in university settings, by focusing on electric mobility solutions and sustainability.

The paper "*Evaluating Nuclear Power's Suitability for Climate Change Mitigation: Technical Risks, Economic Implications, and Incompatibility with Renewable Energy Systems*" (Präger et al.) critiques nuclear power as a climate change solution. It argues against nuclear power due to unresolved technical risks like accidents and proliferation, significant cost disparities with renewable energies, and incompatibility with flexible, renewable-based systems. The authors discuss the high costs and long timelines associated with nuclear energy, misaligned with the urgent need for rapid decarbonization. They highlight the risks of nuclear plant operations amid climate-induced environmental changes and increased military threats, exacerbating nuclear power's safety and economic concerns. The paper concludes that nuclear energy is neither a sustainable nor economically viable option for addressing global warming, suggesting that the persistence of interest in nuclear power may be motivated by factors other than energy supply.

The study "*Energy asset stranding in resource-rich developing countries and the just transition - a framework to push research frontiers*" (Hoffart and Holz) examines the economic and wider societal impacts of fossil asset stranding in resource-rich developing countries (RRDCs), particularly due to stringent climate policies leading to stranded fossil energy assets. It highlights the severe effects on countries heavily dependent on fossil fuel revenues, where asset stranding could cause significant social and economic disruptions. The authors propose a comprehensive framework for a just transition aligned with SDGs, stressing alternative policy approaches like economic diversification, equitable benefit sharing, and international partnerships focused on renewable energy, such as hydrogen. The paper uses Nigeria as a case study to examine asset stranding's broader implications and necessary policy interventions. The study advocates for policies that mitigate the economic fallout from asset stranding and foster sustainable development in RRDCs by promoting global cooperation and ensuring fair transitions.

Challenges and future directions

The synthesis of research findings reveals the crucial interplay of technology, environment, and society in shaping sustainable practices. In Morocco, integrating renewable energy in agriculture using AnyMOD and CropWat enhances efficiency and sustainability. Research on Mobility-as-a-Service (MaaS) highlights the influence of youth preferences on sustainable urban mobility, focusing on emission reductions. Nuclear power analyses underscore its limitations and risks, advocating for comprehensive evaluations. The economic impacts of policies causing asset stranding in resource-rich developing countries are also addressed, emphasizing the need for socio-economic strategies to support equitable transitions aligned with SDGs.

Future research is encouraged to continue exploring the integration of renewable technologies in diverse sectors. This includes conducting longitudinal studies to assess long-term impacts and exploring the socio-economic effects of energy transitions, particularly in vulnerable regions.

Policy recommendations call for fostering innovation in renewable energy and preparing for the economic effects of energy transitions. A deep understanding of user preferences and behaviors is crucial for designing incentives and programs that encourage the adoption of sustainable technologies.

Implementing smart grid and microgrid systems can enhance sustainability in agriculture and urban mobility. Developing comprehensive frameworks for just transitions, including stakeholder engagement and benefit sharing, is crucial for equitably managing the economic shifts from fossil fuels. These approaches pave the way for advancing technology while ensuring sustainable and inclusive transitions.

Conclusion

The insights from the research covered in the Research Topic "*Fostering the energy transition amidst geopolitical and climate risks in a post-COVID world*" advocate for a balanced approach that leverages technological advancements for sustainability, ensuring that economic, environmental, and social dimensions

are adequately considered. This integrated and holistic perspective is essential for creating well-rounded strategies that advance technology, ensure fairness, and support sustainable change.

Author contributions

PD'O: Conceptualization, Project administration, Supervision, Writing – original draft, Writing – review & editing. CK: Writing – review & editing. FH: Writing – review & editing.

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Conflict of interest

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