P22 / Energy Justice and Climate Resilience: A Pathway to Equitable and Sustainable Energy Transitions

Topic : ENVIRONMENT, SDGs, ENERGY

Chair : KHALID AHMED (Institute of Policy Studies, Universiti Brunei Darussalam)

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GENERAL OBJECTIVES, RESEARCH QUESTIONS AND SCIENTIFIC RELEVANCE

Energy Justice and Climate Resilience: A Pathway to Equitable and Sustainable Energy Transitions

1. Background

Energy justice and climate resilience are emerging yet crucial concepts in the debate on sustainable development and environmental governance. The term energy justice refers to equitable access to, distribution of, and decision-making about energy resources—so that all communities, particularly those that are vulnerable and marginalized, have access to affordable, clean energy. This notion aims to rectify the historical and rising systemic inequalities amidt growing climate change adversities within traditional energy systems, which disproportionately affect low-income and marginalised communities (Jenkins et al., 2016). Climate resilience focuses improving the ability of energy infrastructures and local communities to adapt, recover, and prosper amidst climate change-driven derangements such as extreme weather conditions and energy supply disruptions (Meerow et al., 2016).

2. Significance

Integrating energy justice principles with climate resilience strategies is essential to ensure a just transition toward low-carbon energy systems. Conventional approches to energy transitions often prioritize economic growth and technological advancement without adequately addressing the socioeconomic disparities they create. Disadvantaged and low-income communities are often excluded or not even accounted for before undertaking these advancements— thus, bear the brunt of environmental degradation and energy poverty at the same time. By incorporating energy justice into climate resilience frameworks, policymakers can address these inequities, making energy systems not only more sustainable but also inclusive and equitable. This combined approach aligns closely with the SDGs, specifically SDG-7 (Affordable and Clean Energy) and SDG-13 (Climate Action), by promoting inclusive access to clean energy solutions while enhancing societal resilience to climate impacts. Addressing these issues at the public policy levels is critical to mitigation and as well as adpaptation to climate change effects, and promoting sustainable economic development.

3. Potential Research Questions

i. How can principles of energy justice be effectively integrated into national and regional energy policies to ensure equitable access to clean energy resources?
ii. What are the socio-economic and structural barriers to achieving climate resilience in energy systems, particularly in marginalized and low-income communities?
iii. In what ways do decentralized renewable energy systems contribute to the dual goals of energy justice and climate resilience in vulnerable regions?
iv. How can smart grid technologies and innovations in energy storage enhance resilience and promote fair access to energy across diverse populations?
v. What role do social and political frameworks play in shaping energy justice outcomes in the face of climate-related disruptions?

4. Scientific Relevance

Research at the crossroads of energy justice and climate resilience has profound implications for advancing both scientific inquiry and public policy imperative. By examining how socio-economic inequalities intersect with energy access and climate vulnerabilities, scholars can develop frameworks to foster more just and resilient energy systems (McCauley et al., 2019). The growing body of literature argues that without a focus on social equity, energy transitions risk exacerbating existing injustices and creating new forms of socio-economic exclusion (Sovacool et al., 2021).

This research area has broader relevance to innovations in renewable energy technologies. A focus on decentralized, community-based energy solutions can enhance the adaptation startegies and reduce the vulnerability of marginalized groups and communities (Heffron et al., 2018). Furthermore, the integration of smart grids and energy storage technologies plays a crucial role in enabling more equitable distribution of energy resources, enhancing system reliability, and reducing the carbon footprint (Caramizaru & Uihlein, 2020).

Since this research domain helps to addresses not only the technical and economic aspects of energy transitions, but also the ethical and socio-political dimensions essential for achieving a sustainable future. As the impacts of climate change intensify, adopting a framework that integrates energy justice with climate resilience will be crucial in guiding public policy, scientific research, and community-driven initiatives towards more inclusive and sustainable energy practices.

References:

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CALL FOR PAPERS

Call for Papers: Energy Justice and Climate Resilience in Sustainable Energy Transitions

We invite submissions for a panel dedicated to exploring the intersection of Energy Justice and Climate Resiliencewithin the context of sustainable energy transitions and beyond. As the global community struggles the challenges posed by climate change, achieving equitable access to clean energy and enhancing resilience against climate-induced disruptions have become preeminent priorities. This call for papers aims to bring together innovative research encompassing the socio-economic, technological, and policy dimensions of these critical themes, fostering a deeper understanding of how energy justice can drive the development of climate-resilient solutions for all.

Topics of Interest Include, but are not limited to:

1. Integration of energy justice principles in national and regional energy policies.
2. Socio-economic barriers and solutions for enhancing climate resilience in marginalized communities.
3. Decentralized renewable energy systems and their role in achieving energy equity.
The impact of smart grid technologies and innovations in energy storage on system resilience.
4. Policy frameworks and social innovations that promote fair access to clean energy.
5. Case studies on community-driven energy solutions that build climate resilience.

6. Intersection of socio-political factors with energy justice in climate adaptation strategies.

Submission Guidelines

We welcome contributions from researchers, practitioners, policymakers, and interdisciplinary scholars engaged in energy studies, environmental science, social policy, and related fields. Manuscripts should present original research, case studies, or comprehensive reviews that offer new insights into the challenges and opportunities of integrating energy justice with climate resilience.

Important Dates:

A call for papers: November 15, 2024 - January 31, 202

Submission Process

All manuscripts must be submitted electronically through our submission portal [Link to submission portal]. Submissions will undergo a rigorous peer-review process, and accepted papers will be notified.

Contact Information

For any inquiries regarding this call for papers, please contact the editorial team at [email address].
We look forward to receiving your submissions and to advancing the discourse on how energy justice and climate resilience can shape the future of sustainable development.

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Session 1

Thursday, July 3rd 16:00 to 18:00 (SME-G4)

Debt, Solar Power, and Energy Inequality in Pakistan: The Role of International

KHALID AHMED (Institute of Policy Studies, Universiti Brunei Darussalam)

1. **Background & Significance:** Pakistan's renewable energy transition, driven by solar power adoption, is increasingly framed as a solution to chronic energy crises and climate vulnerabilities. However, this transition unfolds against a backdrop of crippling external debt (exceeding $130 billion) and structural adjustment mandates from the IMF. This study interrogates the debt-energy justice nexus—the interplay between sovereign debt obligations, IMF conditionalities, and the equity of solar energy policies—to reveal how macroeconomic constraints perpetuate energy injustices in Pakistan. Using a mixed-methods approach, the research assesses how IMF-mandated austerity measures, fossil fuel subsidy cuts, and tariff hikes intersect with solar energy adoption, exacerbating disparities between wealthy and marginalized communities.

2. **Theoretical Framework:** The analysis is grounded in the energy justice triad (distributional, procedural, and recognition justice), expanded to incorporate macroeconomic power dynamics and neocolonial critiques. While existing literature highlights technical and governance barriers to solar equity, this study pioneers a focus on how global debt architectures—mediated through IMF loan conditions—distort national energy priorities, privileging fiscal stability over distributive fairness.

3. **Methodology**:

i. Macro-Fiscal Analysis: Econometric modeling traces the impact of IMF loan agreements (e.g., 2023 Stand-By Arrangement) on Pakistan's renewable energy budgets, juxtaposing solar subsidies against fossil fuel subsidy cuts and debt servicing costs.

ii. Micro-Level Equity Assessment: Household surveys (n=1,200) across income quintiles quantify solar adoption rates, energy expenditure burdens, and access to subsidies. Case studies of IMF-funded projects (e.g., Sindh Solar Energy Project) evaluate procedural justice through interviews with rural communities and policymakers.

iii. Discourse Analysis: Critical examination of IMF reports and Pakistani policy documents identifies narratives that frame solar energy as a fiscal liability versus a social good.

4. **Contribution to Scholarship and Potential outcomes**

This research advances energy justice theory by integrating global financial governance as a structural determinant of inequity. It challenges the neoliberal framing of solar transitions as apolitical techno-fixes, instead exposing how debt perpetuates green colonialism—where Global North financial systems dictate Global South energy futures.

Pakistan's solar transition risks replicating historical inequities unless divorced from extractive debt cycles. By centering the debt-energy justice nexus, this study provides a blueprint for aligning renewable energy policies with distributive fairness, offering lessons for other indebted nations navigating the tension between climate imperatives and fiscal austerity.

Key Words: Energy Justice; Solar Power; IMF; Debts; Environmnet; Pakistan

Harnessing Solar-Powered Cold Storage for Climate-Resilient Agriculture in Rural Bangladesh

Md Adil Ibne Sifat (Independent Researcher)

In Bangladesh, rural agricultural communities face significant challenges in preserving perishable goods, leading to food wastage and economic losses. The impacts of erratic weather patterns, frequent power outages, and limited access to cold storage facilities exacerbate these issues. This study will investigate the potential of solar-powered cold storage solutions as a climate-resilient and sustainable technology to address these challenges. By exploring existing projects in Bangladesh, such as the Solar Energy-based Portable Micro-Cold Storage, this research will examine how solar power can be integrated with cold storage systems to provide off-grid solutions, thereby reducing reliance on costly and environmentally harmful fossil fuels, food spoilage and improving the livelihoods of farmers.

One notable project, the Sustainable Renewable Energy Power Generation (SREPGen) initiative by UNDP Bangladesh, has installed solar-powered ice plants in off-grid areas such as Char Montaz Island in Rangabali Upazila. This project aims to support the local fishing community by providing reliable storage solutions for preserving fish, thereby improving their livelihoods and reducing waste (Rahman, 2019). Additionally, the development of pico hydro power plants and solar home systems under the same project has enabled rural communities to overcome energy poverty, enhancing access to essential infrastructure and promoting community energy resilience (Rahman, 2019). This project has also demonstrated the potential to preserve seafood and other perishables, reducing food loss during storage and transportation, particularly in remote, off-grid locations (Hossain & Talukdar, 2020).

The research will focuse on the integration of renewable solar energy with cold storage technologies, enabling rural farmers to store perishable goods for longer durations. Solar-powered cold storage systems, including portable micro-cold storage units, have shown promising outcomes in reducing the spoilage of agricultural products like fish, fruits, and vegetables, particularly in off-grid areas where electricity is often unavailable. These systems support climate resilience by mitigating the effects of temperature fluctuations and also help stabilize income for farmers by extending the shelf life of their produce.

Through a detailed analysis of these projects, this study will assess the technological, economic, and social impacts of solar-powered cold storage systems. The results will highlight the role of solar energy in transforming rural agricultural practices, contributing to food security, and supporting the livelihoods of vulnerable populations. The findings will also suggest that how solar-powered cold storage can be a viable solution to combat the adverse effects of climate change on agriculture and rural economies, particularly in regions heavily reliant on agriculture but facing challenges related to electricity access. The paper will conclude with policy recommendations for scaling up solar-powered cold storage solutions in Bangladesh and other developing nations to promote sustainable agricultural practices, reduce food waste, and enhance climate resilience.

Who benefits from distributed energy generation in Mexico? A socio-spatial analysis of the latest advances in distributed energy generation

Natalie Ortiz-Guerrero (Secretary of Science, Humanities, Technology and Innovation (SECIHTI))

Michele Gonzalez Galindo (Secretary of Science, Humanities, Technology and Innovation (SECIHTI))

Distributed energy generation in Mexico presents a crucial opportunity to address socioeconomic and energy inequalities in the country. In an international context where sustainability and the transition to clean energy are global priorities, the analysis of who benefits from this energy model becomes imperative. Through a geospatial approach, this study examines the advances in distributed generation and its relationship with the most marginalized communities, seeking to outline public policies that promote equitable access to affordable and clean energy.

To address the energy requirements of the most marginalized populations, mitigate congestion in the national electricity grid, and simultaneously contribute to the reduction of the carbon footprint, it is advisable to utilize distributed energy while progressing towards the Sustainable Development Goals (SDG), particularly SDG-7 (Affordable and Clean Energy) and SDG-13 (Climate Action).

The Energy Regulatory Commission of Mexico has reported a 15. 6% increase in the capacity of distributed plants between the years 2023 and 2024, but ¿does this advancement benefit the most marginalized populations? In addressing this inquiry, this study delineates geospatial areas concerning the severity of the structural deficiencies experienced by their residents, considering the marginalization index, household electricity consumption, rural or urban status, and the climate, to provide a robust criterion that assists in shaping public policies such as incentives for the purchase of more efficient household appliances, financing for the acquisition of distributed energy equipment, and simultaneously enhancing the autonomy of the most disadvantaged communities while reducing greenhouse gas emissions, thus contributing to a broader debate on energy justice in Mexico. The analyses conducted indicate that as residential electricity consumption per capita diminishes, elevated marginalization rates emerge, which correspond to the rural demographic. Furthermore, it is noted that the highest amount of distributed generation capacity is being established in municipalities characterized by elevated electricity consumption and low marginalization

rates. Consequently, this assessment can assist in directing public policies aimed at enhancing the installation of distributed generation plants, with the goal of mitigating socio-economic inequalities by facilitating access to energy while also promoting access to clean and affordable energy.

Transformative Potential of Climate Finance on Social Equity in Developing Countries

Ji Qi (Fudan University)

Climate finance has great potential to mitigate the socioeconomic impacts of climate change, particularly in vulnerable regions, by promoting social equity and sustainable development. This study examines the distributional effects of climate finance on social indicators in low- and middle-income countries from 2000 to 2020. Using data from Demographic and Health Surveys (DHS) covering 37 countries, the research focuses on the impact of climate finance on access to electricity, clean cooking fuels, child health, and gender-related outcomes. Generalized Estimating Equations (GEE) with interaction terms across 20 wealth quantiles are employed to analyze variations within and between countries.

The findings show that climate finance helps reduce inequalities in health and gender dimensions, though its impact on energy access is more varied. Middle-level wealth quantiles benefit most from improvements in electricity access, while upper-middle quantiles face reduced access to clean cooking fuels, likely due to investments in clean energy systems and rising fuel prices. Child health and gender-related indicators show positive effects across all wealth groups, with significant gains in reproductive health and women's rights, especially among the poorest.

Between countries, lower-middle-income countries (LMICs) show strong responsiveness to climate finance, particularly in electricity access, whereas low-income countries (LICs) and upper-middle-income countries (UMICs) display more modest trends due to infrastructure challenges and mature electricity access, respectively. The analysis of cooking fuel indicators reveals negative marginal effects on clean cooking fuel access, though targeted finance improves outcomes in LMICs and UMICs.

With the COP29 outcome on the floor, a bold and equitable commitment to international climate finance is essential to address the challenges of climate change in the Global South. Given the developing countries' need for at least $1.3 trillion annually by 2035, the focus must be on scaling up funding and improving the quality of its delivery. Our simulations of projected climate finance by 2035 show the significant impact on demographic and health outcomes in increasing the overall volume of climate finance and redistributing more funds to the least developed and vulnerable countries. These findings are closely related to the NCQG and COP discussions on climate finance commitment, underscoring the need for an inclusive framework to maximize social benefits.

Unlocking Electricity Market Liberalization in ASEAN: The Role of Third-Party Access (TPA) Policy

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Areeporn Asawinpongphan (Thailand Development Research Institute (TDRI))

This paper explores how Third-Party Access (TPA) can serve as a foundational step in ASEAN's electricity market liberalization, paving the way for a long-term equitable and sustainable energy transition. As Southeast Asia grapples with increasing energy demand and the urgent need for decarbonization, ensuring transparent regulatory frameworks that facilitate private sector participation is crucial for enhancing energy access, affordability, and sustainability.

ASEAN's electricity market liberalization has initiated policies to encourage competition and investment in renewable energy. However, the full potential of Independent Power Producers (IPPs) remains constrained due to limited grid access and regulatory uncertainties. This research investigates how TPA policies can serve as a strategic entry point for market liberalization and, in the long run, support a just transition that ensures energy equity and inclusivity.

The study employs a policy-oriented approach through a comprehensive policy analysis. It examines successful TPA implementations in countries such as Germany, the UK, and Australia, which have demonstrated how clear market regulations, independent regulatory oversight, and non-discriminatory grid access contribute to increased IPP participation and renewable energy adoption. Additionally, Thailand serves as a key case study within ASEAN, illustrating both the progress and challenges of implementing TPA policies in a market transitioning towards liberalization. Thailand's efforts to enhance competition, introduce regulatory reforms, and integrate renewable energy into its grid provide valuable insights into how ASEAN countries can adapt and implement similar policy frameworks.

By focusing on ASEAN as a region, with Thailand as an illustrative example, this research provides

actionable insights into how the implementation of TPA can serve as an initial step toward a competitive and inclusive electricity market. Also, how the utlilies companies (EGAT, PEA and MEA) should be adjusted themselves for moving toward liberlized market. A well-designed regulatory framework prioritizing TPA mechanisms will not only advance the clean energy transition but also ensure a just and equitable energy future for all stakeholders. The findings contribute to the broader policy discourse on how liberalization efforts in Southeast Asia can be structured to balance efficiency, sustainability, and social equity.