

Charting New Frontiers in Knowledge Production in Incentivizing Just Renewable Energy Transitions in Kenya

Charity Mbaka,
University of Leicester

Key words: Renewable energy, Just transitions, Critical Nexus Thinking, Knowledge production Ethnography

ABSTRACT

The global push for net-zero carbon pathways to avert the impacts of climate crises has placed the transition to renewable energy at the forefront of decarbonization efforts. Kenya, endowed with abundant renewable energy resources, including geothermal sources, has made remarkable strides, earning global recognition in geothermal energy development. What is particularly noteworthy, however, is that the 'ideal' sites for large-scale renewable energy developments, including geothermal, are often located in rural and remote areas that have long grappled with marginalization and continue to face heightened vulnerability to climate crises, as evidenced by challenges such as prolonged droughts and diminishing livelihoods. The dilemma lies in the proposition that while the development of renewable energy projects yields positive outcomes, it could potentially trigger a simultaneous wave of disruptive changes in host communities and beyond, often obscured, leading to the creation and reinforcement of (in)equalities and (in)justices. In a seemingly oblivious manner, the negative externalities of renewable energy developments have been projected as collateral damage highlighting the compartmentalized approach of pertinent policies and frameworks in tackling the intricacies linked with the implementation of renewables. To harness these fragmented aspects, Critical Nexus Thinking (CNT) is conceptualized as a novel framework that is attentive to complexities, offering an in-depth understanding of the synergies, trade-offs, and hidden or unforeseen impacts across the board in the deployment of renewables. The CNT framework illuminates how such impacts resonate across various places and populations, contributing to injustices. Therefore, the CNT framework serves as a new frontier in knowledge production on the far-reaching impacts of renewable energy deployment. CNT addresses gaps in energy transition policies that are commonly perceived as fragmented in nexus thinking and lacking spatial awareness in identifying and addressing injustices, ultimately resulting in sub-optimal outcomes. While charting novel knowledge production in addressing just transitions, CNT is rooted in the underpinnings of ethnography that prove prudent in obtaining a profound understanding surpassing superficial interpretations of just energy transitions. Charting novel pathways in knowledge production for just transitions, the integration of ethnography with the principles of the CNT framework proves indispensable in attaining a deep understanding that transcends superficial interpretations of just energy transitions

1 INTRODUCTION

The urgency for just and equitable energy futures is pressing, especially considering global efforts to achieve net-zero targets and combat climate change, with renewable energies emerging as pivotal drivers of this transition (Lee and Amanuma, 2023). Given that the energy sector contributes to approximately three-quarters of greenhouse gas emissions, this transition is imperative (IEA, 2023). Countries are actively pursuing pathways to achieve net-zero carbon emissions by developing their own distinct strategies and trajectories for low-carbon growth. Such initiatives are considered effective when integrated with context-specific and place-based understanding (International Renewable Energy Agency (IRENA), 2023). Therefore, it is imperative to recognize that as the transition gains momentum, the deployment of renewables is not superficial and straightforward. Instead, it involves complex interactions with existing and projected dynamics of evolving social, political, economic, and infrastructural networks within specific geographies (Harrison and Popke, 2018).

Kenya has reportedly been on a positive trajectory in renewable energy deployment over the past years, boasting an impressive renewable electricity generation mix of 84.93%. Geothermal stands as the largest source of electricity generation, accounting for 44.5% of the total electricity (EPRA, 2023). Furthermore, Kenya has achieved the sixth rank globally in total installed geothermal power generation capacity (ThinkGeoEnergy, 2023).

While Kenya has made commendable progress in the renewable energy sector, concerns have arisen regarding the impacts on operational and pipeline projects, especially on the host communities (Cheddadi, 2022). Mainly, renewable energy resources and projects are situated in rural and remote areas identified as ideal sites for large-scale projects, where green energy ecosystems, such as solar radiation, wind kinetic energy, and geothermal heat energy, are abundant (Poggi et al., 2018). These geographies, which have long grappled with heightened marginalization, now face increased vulnerability in the Anthropocene era. This heightened susceptibility is manifested through challenges such as droughts, water scarcity, food insecurity, and diminishing livelihoods (Nyika, 2022).

Thus, presently, a dilemma arises as renewable energy, serving as a vital strategy for mitigating climate change, appears to exacerbate or introduce new socio-ecological impacts in these critical green ecosystems. Harrison and Popke (2018) purports that while the deployment and the expansion of renewable energy in Kenya facilitates a host of positive externalities, it also ushers in a simultaneous wave of disruptive changes on lives and livelihoods. Therefore, there is need to align renewable deployment projects to sustainable development, inclusivity, and equity (Dunster, 2022).

Previous studies in Kenya have shown co-generated benefits from renewable energy projects, including employment opportunities and ancillary infrastructures (Greiner et al., 2023), while also acknowledging negative externalities such as the loss of land, livelihoods, cultural identity, and environmental concerns (Klagge et al., 2020; Greiner et al., 2021). This indicates that the potential negative impacts of renewable energy projects in communities are often overlooked or deliberately ignored during the inception and implementation phases (Healy and Barry, 2017). Indeed, in a seemingly oblivious manner, the negative impacts of renewable energy projects on communities are showcased as collateral damage (Hughes, 2020).

Such assumptions underscore the fragmented and biased nature of comprehending and managing the intricate interconnections and interdependencies in renewable energy deployment. These complexities are often obscured and not fully understood, resulting in unforeseen impacts on lives, livelihoods, places, and ecosystems (Howarth and Monasterolo, 2017).

A significant global trend is the prioritization of addressing climate change through the deployment of renewable energy, which often infringes upon communities' rights to essential resources such as land, food, water, livelihoods, power, and cultural identity (Seddon et al., 2021). The disruption in access and interconnectedness to these critical resources for the population draws attention to the fact that renewable energy deployment has the potential to exacerbate both new and existing (in)equalities and (in)justices across populations and places. In light of the above-identified empirical and conceptual gaps this review paper illustrates how the CNT framework can be utilized in addressing the existing, emerging and unforeseen impacts critical in fostering just transitions.

The subsequent sections of this paper delve into the literature regarding the evolution of the concept of just transitions, CN, and how CNT advances the empirical and conceptual understanding of just transitions. The discussion then progresses to the empirical validation of CNT, including its philosophical underpinnings and suitable methodological approach. It is important to note, however, that this review paper is based on an ongoing study applying the CNT framework. Therefore, the paper will not dwell on results but will extensively explore the novelty and integration of CNT in advancing just renewable energy transitions.

2 DELVING INTO THE UNDERPINNINGS OF JUST TRANSITION AND CRITICAL NEXUS THINKING PERSPECTIVES

2.1 *Exploring the concept and framing of just transition in context of renewable energy deployment*

The concept of just transition traces its roots back to the North American labor movement of the 1970s that emerged as a response to the imperative of ensuring fairness and equity in the transition from a carbon-dependent to a low-carbon economy. The International Labour Organization (ILO) defines just transition as the process of shifting towards a greener economy while safeguarding fairness and inclusivity for all stakeholders. This entails creating opportunities for decent work and ensuring that no one is marginalized or left behind in the transition (Gerrard and Westoby, 2021).

In the Anthropocene era, justice issues have continued to arise from the ongoing proactive dimensions and approach to climate action. The definition and interpretations of just climate transitions have garnered significant attention in international dialogues, with some focusing primarily on environmental objectives while others emphasize the social dimension (Wang and Lo, 2021). Consequently, tensions emerge from the multitude of definitions and interpretations. Nonetheless, there is a consensus that the core of a just transition is to address potential unfairness and foster improved outcomes for diverse individuals, nations, and regions grappling with disruption and marginalization across political, social, and economic domains (Porter et al., 2020).

Through extensive scholarly analysis and policy reviews, it becomes apparent that there are substantial gaps in the conceptual and theoretical foundations of just transitions in deployment of renewables. For example, while previous studies draw upon valuable insights from diverse disciplines, they frequently suffer from methodological and conceptual limitations (Wang and Lo, 2021). This underscores the increasing call for empirical research grounded in real-world practice and expanded conceptual frameworks to enhance our comprehension of just transitions. Moreover, there is an urgent need to expand the geographical scope of research to incorporate the viewpoints of developing countries and to consider local power dynamics and governance structures. Power dynamics and governance frequently intertwine with complex notions of justice, particularly regarding epistemic justice, such as when individuals are marginalized from decision-making

processes rooted in public participation. Empirical research on justice concerns and democratic aspirations, along with amplifying the voices of marginalized groups, enables researchers to articulate alternatives and promote constructive conflict resolution (Späth et al., 2022). Furthermore, multiscale governance dimensions of institutions and policies governing renewable energy deployment shed light on the connections, tensions in promoting just transitions in the sector.

Jenkins et al. (2018) advocate for a just energy transition discourse that extends beyond socio-technical configurations, acknowledging the intricate ties with political formations across the energy sector and beyond. Neglecting these dimensions of power and politics risks perpetuating tensions and hindering progress toward just transitions (Finley-Brook and Holloman, 2016) as sociotechnical transition frameworks tend to foreground supply-side factors, emphasizing only on the way technology and innovations become embedded in society.

To address these shortcomings, Sareen and Haarstad (2018) employ a holistic approach, integrating justice dimensions and sociotechnical dynamics within sustainable energy transitions. Additionally, they draw on insights from science and technology studies and energy geographies literature to develop a comprehensive understanding of key factors in sustainable energy transitions. In this review paper, we propose Critical Nexus Thinking as an ideal framework to comprehensively advance the discourse on just transitions and to bridge existing empirical and policy gaps in the promotion of just renewable energy transitions.

2.2 Critical Nexus Thinking: A Novel Framework for Just Transitions Research and Policy

Critical Nexus Thinking (CNT) is a novel framework conceptualized to unravel and untangle interwoven root causes of (in)justices and (in)equalities in the transition to renewable energy deployment. As demonstrated in this review, CNT navigates complexities unlike traditional just transition approaches, which often fail to capture the full spectrum of dynamics at play, leading to incomplete understandings and limited pathways for transitions. As a result, inadequacies in assessing renewable energy just transitions have referred to renewable energy deployment as a 'resource curse' in action, as suggested by Ahmad et al. (2023).

The CNT conceptual framework serves as a valuable tool, enabling a comprehensive examination from three intersecting areas drawn from nexus policy logics, critical human geography, and theoretical scholarship within the social sciences. These three key intersecting areas that underpin CNT framing include socio-material-ecological interactions; politics of scale; and flows, blockages, dis/connectivity (Walker and Coles, 2022). Building on these foundations, CNT complements and advances existing conceptual framings by extending its scope to trace synergies, trade-offs, and unforeseen consequences in the deployment of renewables. Moreover, CNT explores how such impacts resonate across different places and populations, contributing to inequalities and injustices.

Furthermore, CNT offers a nuanced understanding of the far-reaching impacts, challenging the notion that energy transitions and nexus policies are fragmented and spatially blind, which often results in sub-optimal outcomes (Organization for Economic Cooperation and Development (OECD), 2023).

CNT offers a holistic perspective that embraces the existing local context nexus complexity which are typically overlooked or fragmented in energy transition studies. For instance, many studies examining the rights of access to key resources in project-affected communities tend to disregard the complex nexus interactions—synergies and trade-offs—of such resources (Sareen and Shokrgozar, 2022; Baka and Vaishnava, 2020). While these studies focus solely on sector-specific

challenges and opportunities—SMART or PASTEL ¹models— they fail to untangle and trace socio-material-ecological trade-offs, synergies, and flows, which are crucial in understanding injustices where they originate from and flow to and who they impacts on (Poque González et al., 2023; Sovacool et al., 2017).

Furthermore, CNT adds a geographical lens to understand the impacts that extend beyond the areas designated as directly affected by projects, often referred to as 'project-affected communities,' which are frequently overlooked (Greiner et al., 2023). One unique component of CNT framing is that it tends to understand the less quantifiable impacts such as distress, suffering, apprehension, anxiety, and fear related to proximate socio-economic and environmental disruptions, which also portray injustice when energy projects reinforce existing inequalities on individuals or groups. As such, CNT is keen on understanding the holistic impact of renewable energy and how this leads to injustices, thereby informing better policy and decision-making.

Furthermore, CNT adds a geographical lens to understand the impacts that extend beyond the areas designated as directly affected by projects, often referred to as 'project-affected communities,' which are frequently overlooked (Greiner et al., 2023). One unique component of CNT framing is that it tends to understand the less quantifiable impacts such as distress, suffering, apprehension, anxiety, and fear related to proximate socio-economic and environmental disruptions, which also portray injustice when energy projects reinforce existing inequalities on individuals or groups. As such, CNT is keen on understanding the holistic impact of renewable energy and how this leads to injustices, thereby informing better policy and decision-making.

CNT emerges as a pivotal guide in steering towards a more inclusive and efficacious energy transition. It challenges the prevailing notion of a universally applicable model by spotlighting the nuanced complexities of context-sensitive and place-based approaches. Rather than adhering to broad categorizations like the "Global South" and "Global North," CNT advocates for a deeper exploration of the diverse geographies and dynamics shaping transitions. CNT underscores the significance of scrutinizing transitions through a localized lens, recognizing the indispensable role played by factors such as resource endowment, infrastructure, and socio-economic-cultural diversity. It emphasizes the imperative of discarding the one-size-fits-all approach, instead championing tailored strategies that align with the specific needs of each community.

Moreover, CNT prompts a reassessment of conventional knowledge trends, encouraging exploration of novel avenues for achieving just energy transitions. It sheds light on numerous instances where energy initiatives faltered due to overlooking local contexts and community needs. The resistance encountered by renewable energy projects from local communities serves as a poignant reminder of the necessity to prioritize inclusivity and engagement. As communities articulate their concerns regarding potential adverse impacts on their livelihoods and cultural heritage, CNT underscores the importance of listening, learning, and adapting our approaches accordingly. In doing so, it underscores the vital role of inclusivity and engagement in ensuring a fair and successful energy transition.

¹SMART- Specific, Measurable, Achievable, Relevant, and Time-bound; PASTEL-Political, Economic, Social, Technological, Environmental and Legal.

3.0 EMPIRICAL VALIDATION OF CRITICAL NEXUS THINKING FRAMEWORK

3.1 *Philosophical underpinnings*

In the context of proposed research focus on understanding aspects of just transitions in renewable energy transitions, I propose an empirical validation approach to identify the most suitable research methods for collecting and analyzing data to effectively apply the Critical Nexus Thinking (CNT) framework in real-world contexts. CNT is rooted in ²interpretivism philosophical epistemological underpinnings, aligning with the ³constructivist philosophical ontology favoring naturalistic inquiry, and acknowledging the role of human agency and social context in knowledge production and meaning (Adom et al., 2016). This interpretive-oriented methodology prioritizes subjectivity as the primary domain of research inquiry in social sciences, emphasizing understanding over explanation (Holdo, 2020) and underscores the significance of individuals' subjective perceptions, interpretations, and experiences in shaping their understanding of the world. The knowledge gaps in understanding the impact of renewable energy deployment on resource nexuses are evident across different stages of project implementation. Therefore, CNT comprehensively addresses these deficiencies by incorporating a bottom-up approach that attends to local context, empowering grassroots involvement.

3.1 *Research Design*

For the practical application of CNT, I suggest employing an ethnographic methodology grounded in the foundational philosophical principles of just transition within the realm of renewable energy deployment. Ethnography facilitates a deep exploration of renewable energy just transitions within natural contexts, providing insights that go beyond surface-level interpretations and enabling the development of compelling research narratives (Gobbo, 2022). In this approach, the researcher assumes the role of an interpreter, striving to understand events from the participants' perspectives. Ethnography aligns well with interpretivist and constructivist paradigms, enabling researchers to delve into the complexities of just renewable energy transitions of human experience within cultural and social contexts, emphasizing the significance of subjective interpretations and the socially constructed nature of reality.

Expanding upon the cross-cutting scalar and sectoral dynamics articulated in this study, I propose a multi-sited ethnography lens to consider broader societal structures and systems that influence practices, interactions, and experiences. Multi-sited ethnography seeks to pioneer innovative interventions by prioritizing outcomes collaboratively shaped through dialogues and engagements spanning various scales and involving diverse stakeholders, thereby fostering the emergence of inclusive solutions (Bartoszko, 2021).

Application of ethnography in validating CNT advocates for decentering expertise by recognizing and harnessing local knowledge held by communities directly affected by renewable energy projects. In ethnography accessing local knowledge entails actively seeking and integrating insights, experiences, and understanding from individuals within specific contexts or communities, acknowledging their valuable perspectives often overlooked by traditional academic or technical knowledge. Therefore, ethnography has potential as an interpretative tool to highlight ways in which the crisis and proposed energy transitions are encountered based on-the-ground contexts where transitions are experienced and where policy is

² Favors naturalistic inquiry and recognizes the role of human agency and social context production of knowledge and meaning.

³ Individuals and collective agency construct knowledge and meaning through socio interactions

being developed or applied (Goodman, 2018). The proposed approach for understanding just transitions involves overt participant observation and semi-structured interviews with community members and stakeholders across the renewable energy sector. This approach aims to capture experiences, interactions, alterations observed in day-to-day activities, and both opportunities and obstructions encountered, providing insights into deeply ingrained emotions, attitudes, and social practices in the context of renewable energy transitions.

3.2 Data analysis

The data collected through the proposed empirical validation approach can be analyzed using various qualitative research methods. Firstly, thematic analysis can be employed to identify and analyze patterns within the qualitative data collected from participant observations and semi-structured interviews (Squires,2023). Thematic analysis involves systematically coding the data to identify recurring themes or patterns, which can then be interpreted to understand participants' perspectives, experiences, and attitudes related to renewable energy transitions and the nexus framework. Additionally, discourse analysis can be utilized to examine the language and communication patterns within the qualitative data. This method focuses on how language constructs meaning and shapes social reality, allowing researchers to uncover underlying discourses and power dynamics surrounding renewable energy transitions and the implementation of the Critical Nexus Thinking framework (Jones, 2024). Furthermore, content analysis can be applied to analyze any textual or visual data collected during the ethnographic research process. Content analysis involves systematically categorizing and coding the data to identify key themes, concepts, or representations related to renewable energy transitions and the interconnectedness of water, energy, food, and land (Kuckartz and Rädiker, 2023).The data analysis process will involve a rigorous and systematic examination of the qualitative data collected, aiming to uncover insights, patterns, and relationships that contribute to a deeper understanding of just transitions and the applicability of the Critical Nexus Thinking framework in real-world contexts.

4 CONCLUSIONS

The urgency of climate change mitigation and the imperative to phase out fossil fuels are undeniable. However, the current set of solutions presents its own challenges, necessitating novel approaches for the way forward. There is a critical need not only to critique existing trajectories but also to create space for envisioning alternative futures from diverse perspectives. Critical Nexus Thinking (CNT) embodies a synergistic and integrated approach, serving as a holistic framework for advancing knowledge and policy interventions related to just transitions. While the narrative of just renewable transition commonly focuses on energy, employment, and climate change, it is essential to broaden the scope to encompass aspects of governance, resource synergies, trade-offs, and ripple effects to ensure the effective and sustainable implementation of renewable energy projects. Therefore, CNT advocates for a holistic approach to just transition that prioritizes ecological and human well-being.

CNT also addresses the interconnectedness of renewable energy transitions across different locations and scales, recognizing that actions taken in one place may have unintended consequences elsewhere. It complements and extends existing frameworks by specifically examining the spillover effects of renewable energy projects on the territorial rights, sovereignty, and ways of life of indigenous peoples and local communities. Furthermore, the novelty of CNT extends to its

practical methodological approach, which captures on-the-ground encounters of energy transition. By actively engaging with and integrating the experiences and insights of individuals within specific contexts often overlooked by traditional academic or natural sciences research, CNT ensures a more comprehensive understanding of the complexities involved in just transitions.

References

1. Ahmad, M., Peng, T., Awan, A., & Ahmed, Z. (2023). Policy framework considering resource curse, renewable energy transition, and institutional issues: Fostering sustainable development and sustainable natural resource consumption practices. *Resources Policy*, 86, 104173.
2. Bartoszko, A. (2021). Social worlds of person-centered, multi-sited ethnography. *Doing Human Service Ethnography*, 119.
3. Energy & Petroleum Statistics Report. Kenya: Energy & Petroleum Regulatory Authority; 2022
4. Finley-Brook, M., & Holloman, E. L. (2016). Empowering energy justice. *International journal of environmental research and public health*, 13(9), 926.
5. Gerrard, E., & Westoby, P. (2021). What Is a Just Transition? *Coal and Energy in South Africa*, 22.
6. Gerrard, E., & Westoby, P. (2021). What Is a Just Transition? *Coal and Energy in South Africa*, 22.
7. Gobbo, A. D. (2022). Energy and the ethnography of everyday life: A methodology for a world that matters. *Ethnography*, 14661381211065598.
8. Goodman, J. (2018). Researching climate crisis and energy transitions: Some issues for ethnography. *Energy Research & Social Science*, 45, 340-347.
9. Greiner, C., Greven, D. and Klagge, B., 2021. Roads to change: livelihoods, land disputes, and anticipation of future developments in rural Kenya. *The European Journal of Development Research*, 33, pp.1044-1068.
10. Greiner, C., Klagge, B. and Owino, E.A., 2023. The political ecology of geothermal development: Green sacrifice zones or energy landscapes of value? *Energy Research & Social Science*, 99, p.103063.
11. Harrison, C. and Popke, J., 2018. Geographies of renewable energy transition in the Caribbean: Reshaping the island energy metabolism. *Energy research & social science*, 36, pp.165-174.
12. Harrison, C. and Popke, J., 2018. Geographies of renewable energy transition in the Caribbean: Reshaping the island energy metabolism. *Energy research & social science*, 36, pp.165-174.
13. Healy, N. and Barry, J., 2017. Politicizing energy justice and energy system transitions: Fossil fuel divestment and a “just transition”. *Energy policy*, 108, pp.451-459.
14. Holdo, M., 2020. A relational perspective on deliberative systems: Combining interpretive and structural analysis. *Critical policy studies*, 14(1), pp.21-37.
15. Howarth, C. and Monasterolo, I., 2017. Opportunities for knowledge co-production across the energy-food-water nexus: Making interdisciplinary approaches work for better climate decision making. *Environmental Science & Policy*, 75, pp.103-110.
16. Hughes, Lotte and Daniel Rogei (2020). “Feeling the heat: responses to geothermal development in Kenya’s Rift Valley.” *Journal of Eastern African Studies* 14.2: 165-184.
17. IEA, P. (2022). *World energy outlook 2022*. Paris, France: International Energy Agency (IEA).
18. Jenkins, K., Sovacool, B. K., & McCauley, D. (2018). Humanizing sociotechnical transitions through energy justice: An ethical framework for global transformative change. *Energy policy*, 117, 66-74.
19. Jones, R. H. (2024). *Discourse analysis: A resource book for students*. Taylor & Francis.
20. Klagge, B., Greiner, C., Greven, D. and Nweke-Eze, C., 2020. Cross-scale linkages of centralized electricity generation: Geothermal development and investor–community relations in Kenya. *Politics and Governance*, 8(3), pp.211-222.
21. Kuckartz, U., & Rädiker, S. (2023). *Qualitative content analysis: methods, practice and software*. Sage.

22. Lee, S. Y., Hengesbaugh, M., & Amanuma, N. (2023). Just and sustainable transitions for a Net-Zero Asia: emerging issues and solutions. IGES Working Paper. Hayama.
23. Lee, S. Y., Hengesbaugh, M., & Amanuma, N. (2023). Just and sustainable transitions for a Net-Zero Asia: emerging issues and solutions. IGES Working Paper. Hayama.
24. Nyika, J.M., 2022. Climate change situation in Kenya and measures towards adaptive management in the water sector. In Research anthology on environmental and societal impacts of climate change (pp. 1857-1872). IGI Global.
25. OECD (2023), Rural Agenda for Climate Action, OECD Publishing, Paris, <https://www.oecd.org/regional/rural-development/Rural-Agenda-for-Climate-Action.pdf>
26. Poque González, A.B., Masip Macia, Y., Ferreira, L.D.C. and Valdes, J., 2023. Socio-Ecological Controversies from Chilean and Brazilian Sustainable Energy Transitions. *Sustainability*, 15(3), p.1861.
27. Porter, L., Rickards, L., Verlie, B., Bosomworth, K., Moloney, S., Lay, B., ... & Pellow, D. (2020). Climate justice in a climate changed world. *Planning Theory & Practice*, 21(2), 293-321.
28. Sareen, S., & Haarstad, H. (2018). Bridging socio-technical and justice aspects of sustainable energy transitions. *Applied energy*, 228, 624-632.
29. Seddon, N., Smith, A., Smith, P., Key, I., Chausson, A., Girardin, C., ... & Turner, B. (2021). Getting the message right on nature-based solutions to climate change. *Global change biology*, 27(8), 1518-1546.
30. Sovacool, B.K., Burke, M., Baker, L., Kotikalapudi, C.K. and Wlokas, H., 2017. New frontiers and conceptual frameworks for energy justice. *Energy Policy*, 105, pp.677-691.
31. Späth, P., Castán Broto, V., Bawakyillenuo, S., & Pregernig, M. (2022). The governance of energy transitions in Africa: a sketch of plural perspectives. *Energy, Sustainability and Society*, 12(1), 51.
32. Squires, V. (2023). Thematic analysis. In *Varieties of qualitative research methods: Selected contextual perspectives* (pp. 463-468). Cham: Springer International Publishing.
33. Walker, C. and Coles, B. (2022) 'Points of convergence: Deploying the geographies of critical nexus-thinking', *Environment and Planning E: Nature and Space*, 5(3), pp. 1618-1638.
34. Wang, X., & Lo, K. (2021). Just transition: A conceptual review. *Energy Research & Social Science*, 82, 102291
35. Waters-Bayer, A., & Wario, H. T. (2022). Pastoralism and large-scale Renewable energy and green hydrogen projects.
36. Wolde, Z., Wei, W., Kunpeng, W. and Ketema, H., 2020. Local community perceptions toward livelihood and water–energy–food nexus: A perspective on food security. *Food and Energy Security*, 9(3), p.e207.
37. ThinkGeoEnergy (2023) <https://www.thinkgeoenergy.com/thinkgeoenergys-top-10-geothermal-countries-2023-power-generationcapacity>. Retrieved on 15th February, 2024.