

# The Bibliometrics Insight: Role of Spatial Planning in Just Energy Transition in South Africa

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DOI: 10.48494/REALCORP2026.1124

## 1 ABSTRACT

In the Global South, the repurposing of decommissioned power stations offers a unique opportunity to address the energy crisis while advancing spatial justice. This paper explores the socio-spatial dimensions of energy transitions, with a focus on the role of spatial planning in facilitating a just energy transition that addresses the needs of historically marginalized communities through the equitable redistribution of resources and opportunities. Using PRISMA and bibliometric methods, the study examines the key themes and geographic trends shaping the discourse on spatial justice and renewable energy integration. The study also examines best practices in balancing socio-economic and environmental goals during the transition from coal to renewable energy, drawing on case studies from the Global South. The study's findings highlight strategic insights for a Just Energy Transition in South Africa, emphasizing the need for policies that align spatial equity and social inclusivity with technical innovation.

Keywords: Spatial planning, renewable energy, coal-fired power station, bibliometric analysis, energy transition

## 2 INTRODUCTION

In the discord of the global energy transition, the Global South faces a paradoxical challenge: the shift from coal to renewables is essential for climate resilience, yet it risks perpetuating spatial injustices if not well managed through inclusive planning (Rocco, 2022). According to Moeng (2024), in South Africa, decommissioned coal-fired stations, such as those in Mpumalanga, exemplify both the legacy of extractive economies under the apartheid regime and the potential for transformative spatial equity. Here, spatial planning emerges as a critical, yet underexplored tool for just energy transitions (Teng et al., 2025). In any case, the study investigates this gap by exploring how spatial planning can recalibrate energy landscapes to redress historical marginalization; this mechanism can ensure that the just energy transition is well supported by spatiality and ensures that renewable energy is well integrated, including its technical imperatives to deliver tangible socio-spatial equity. By harmonizing bibliometrics and PRISMA analysis with case studies from the Global South, the study reveals discrepancies between on-the-ground realities and policy rhetoric. Furthermore, this research aims to challenge the prevailing narratives that examine the infrastructural efficiency of energy distribution. Moreover, at the heart of this inquiry, this study underpins a bold proposition: that spatial planning is not only a logistical tool used by practitioners, but also a radical framework for reconfiguring power from both political and technical expertise. Drawing on the leading authors in the field of energy geographies and urban justice, this study disassembles the techno-centric principle of energy transitions. This paper proposes a logical discussion that harmonizes renewable innovation with spatial restoration. The study's narrative is suspended by its dual criticism: firstly, a methodology that charts out the socio-spatial contours of energy justice and uncovers the myopia of "just energy transition" policies that intend to forsake the spatiality of resource distribution. In the context of South Africa, a nation battling with the legacy of apartheid spatial planning, this paper offers not only an analysis but also a manifesto: energy just transitions must be spatially literate to be truly proclaimed as just.

## 3 LITERATURE REVIEW

### 3.1 Legacy of spatial Injustice in South Africa's Energy Landscape

Apartheid era spatial planning entrenched deep infrastructure and economic disparities, enforcing the Black communities to underdeveloped townships and vacant land while concentrating economic opportunities and infrastructure in white urban centers (Gambill, 2019; Ramatlo, 2021; Kararach, 2024). To date, this legacy is prevailing in coal-dominated energy systems. According to Frantál & Nováková (2014) and Perez-Sindin et al. (2022), mining regions continue to bear disproportionate environmental and health burdens, while urban centres are the primary beneficiaries; this spatial injustice is also reflected in the Global South.

Notwithstanding the post-apartheid policies, such as the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP or REI4P), the policy seeks to optimize electricity capacity through private sector investment in renewable energy infrastructure. Herbst & Lalk (2015) & Wenzel (2016) advance the argument that energy poverty still dominates marginalized communities due to inconsistencies in electricity accessibility, load-shedding, and perpetuation of apartheid-era discrepancies. The transition efforts, according to Besada (2022) and Beires & Lincoln (2017), remain hindered by the lack of localized capacity and bureaucratic fragmentation, which leads to the failure to address the spatial inequities embedded in the energy infrastructure. Nevertheless, a just energy transition exceptionally demands spatially literate policies that can restructure the apartheid's geographic legacy, warrant renewable energy projects that adequately prioritize historically disadvantaged and marginalized communities, and integrate economic measures that seek to repair the fragmented spatial layout (Chandratreya, 2025).

### **3.2 The Limitations of Current Just Energy Transition Frameworks**

The current Just Energy Transition frameworks often redirect the concepts to labour-centric and technical challenges, which has led to the continuous neglect of its spatial and socio-economic dimensions (Muinzer et al., 2024; Del Guayo & Cuesta, 2022). The findings by Garvey et al. (2022) and Topaloglou & Ioannidis (2022) underscore that policies, such as those in Greece and Western Macedonia, have utilized a top-down approach as a governance model, which frequently limits public participation by local communities. This has led to the exacerbation of spatial injustices, as the communities' needs are not being addressed. The experience of Global South case studies reveals that they also face the same pitfalls as South Africa's REIPPPP, as identified by Müller & Claar (2021) and Mirzania et al. (2023). Notwithstanding the growth of renewable capacity, REIPPPP is criticized for failing to address energy poverty and warrant local ownership. However, countries such as Bhutan, India, and Nepal bespeak the decentralization of community-driven projects, including microgrids, which demonstrates that decarbonization is aligned with democratization (Misra & Bhardwaj, 2024; Kirchhoff et al., 2016). In any case, the cases indicated underpin the call for redefining Just Energy beyond technocratic solutions to include spatial equity, multi-scalar justice, and participatory governance (Abram et al., 2022; Kanger & Sovacool, 2022). Without such integration, the energy transition stands at risk of the same inequalities it aims to resolve.

### **3.3 Spatial Planning as a Catalyst for Energy Justice**

Spatial planning plays a vital role in the redistribution of both literal and political power, rooting energy justice into the fabric of sustainable development (Rocco, 2022; Wang & Gu, 2023). Furthermore, operationalizing spatial justice entails equitable access to resources and inclusive decision-making; this approach prompts questioning of historical energy marginalization patterns (Bouzarovski & Simcock, 2017). According to Rocco (2022), this method views planning as a socio-political institution, where public justification and reasoning serve as mechanisms for institutionalizing justice. Essentially, spatial planning serves as a tool for decentralizing energy systems, redirecting power from centralized entities to local communities through initiatives such as Renewable Energy Communities (RECs) (Teng et al., 2025). Wang et al. (2022) and Ardi et al. (2023) delineate that RECs symbolize redistribution; this is where the optimization of regional renewable resources is achieved to achieve energy self-sufficiency while democratizing governance through participatory frameworks. Wang et al. (2022) underscore that such models dismantle technocratic energy hierarchies and further address the conflict between greens by prioritizing the spatially mediated competing land uses. Ultimately, spatial planning must extend beyond infrastructure siting to actively restructure power dynamics in communities, necessitating energy transitions that enhance both social equity and sustainability.

## **4 METHODOLOGY**

This study adopts a systematic literature review approach, led by the PRISMA framework, to investigate the integration between spatial planning and the just energy transition in South Africa. This method was utilized for this purpose in improving the reproducibility and transparency in the screening and selection process of academic literature. At first, the dataset of 204 peer-reviewed documents was extracted from the SCOPUS database using a combination of keywords such as "spatial planning," "spatial justice," "just energy transition," "coal transition," and "renewable energy". Using this method, duplicates were removed, and the screening process was based on document type, looking at the keywords and abstracts; this was to enhance

the relevance of the documents. At the end of the process, 161 studies were selected as eligible for review. VOSviewer was a tool used for the analysis of the dataset. Thus, the study infuses the bibliometric analysis. Moreover, this approach was utilized to map the scientific landscape, determine geographic trends, identify the key thematic clusters, and underpin the most influential authors and countries that excessively contribute to the discourse of spatial planning and just energy transition. The study visualized metrics such as citation analysis, co-occurrence of keywords, and publication trends to expose the social and intellectual structure of the field. By combining the two methodologies, the study provides both depth and breadth of critical gaps, best practices, and emerging themes related to spatial equity and renewable energy transition, focusing on the context of South Africa and the Global South.

## 5 FINDINGS

The bibliometric analysis, conducted using VOSviewer on the 161 PRISMA-selected studies, reveals an interconnected thematic landscape encompassing spatial planning, sustainability, and energy systems. As shown in Figure 1 below (Keyword co-occurrences and a link strength of 210, highlighting its essential role in integrating related fields. As visualised in Figure 1 (keywords co-occurrence network), “spatial planning” emerges as the central node with 85 occurrences and a link strength of 210, underscoring its pivotal role in integrating related fields. Closely integrated keywords include “sustainable development” (62 occurrences), “climate change” (48), “renewable energy” (45), and “energy planning” (38), reflecting the growing convergence of environmental and spatial concerns in energy transition research. The network identifies four key clusters: (1) urban transformation (e.g. “urbanization” “urban planning”); (2) marine spatial planning (e.g., “offshore wind farms,” “marine environment,” “fisheries”); (3) energy justice (e.g., “energy transition,” “spatial justice”); and (4) policy framework (e.g., “land use,” “governance”). Geographically, the analysis shows dominance by Global North countries like the Netherlands (32 publications), the United Kingdom (28), and Germany (25), with minimal representation from the Global South (e.g., South Africa: 8; India: 6). This bias underpins a critical knowledge gap in context-specific application of spatial planning to just energy transition in rejoin like South Africa, justifying this study’s focus.

The below Figure1 illustrates the Keyword Co-occurrence Network, generated through VOSviewer; minimum keyword occurrence: 5; clusters colored for distinction.

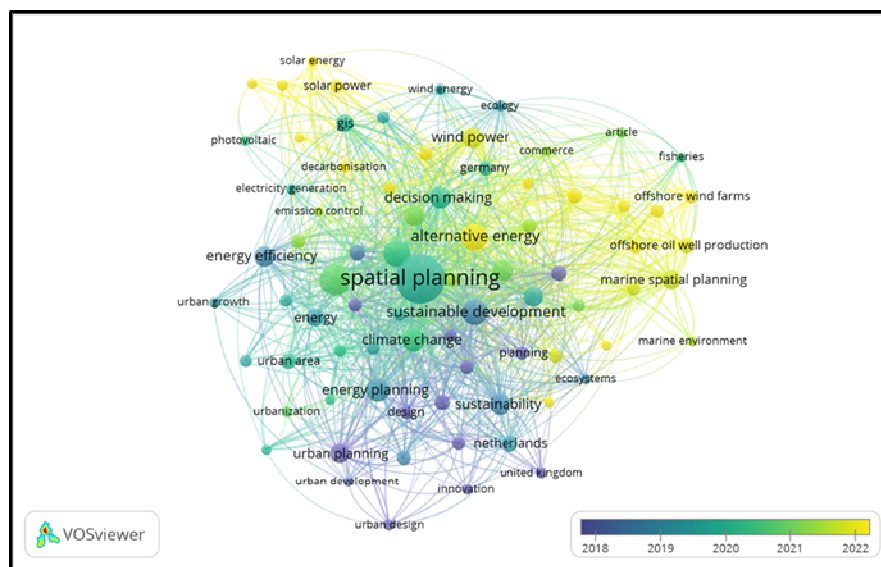


Fig. 1: Keyword Co-occurrence Network (generated via VOSviewer; minimum keyword occurrence: 5; clusters colored for distinction). This visual map reveals the interconnection, highlighting how renewables, such as solar and wind, are underrepresented in discussions of spatial justice.

To complement Figure 1, Figure 2 above represents publication trends over time. Of the 161 studies, only 28 (17%) have a clear integration of spatial planning with just energy transitions; this is often linked to policy frameworks, land-use optimization, and urban development for renewables. There are stresses that spatial planning is a tool for siting infrastructure and resolving land conflicts, while promoting equitable energy access to communities. Additionally, a key gap emerges in the siloed treatment of domains: 112 studies

(70%) focus on the technical aspects of renewable energy or policies without considering spatial aspects, such as community participation in wind project zoning or addressing geographic disparities in solar access.

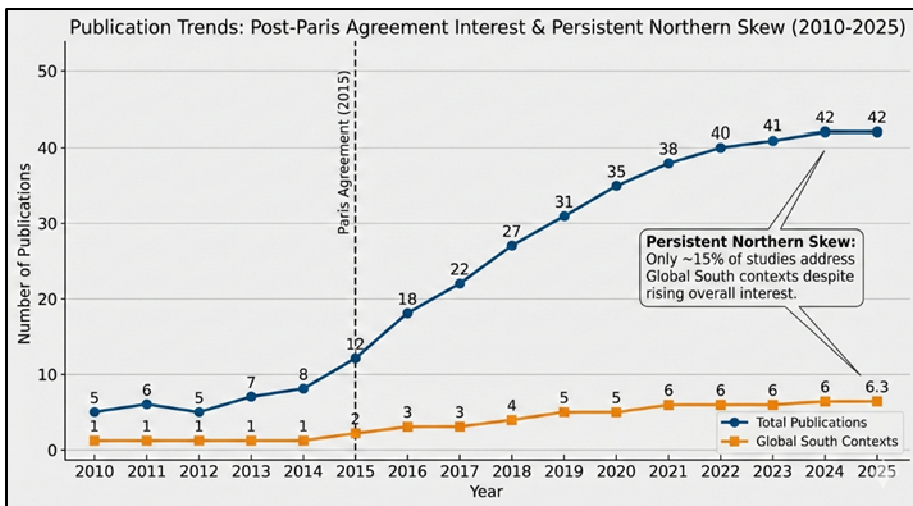


Fig. 2: Publication trends over time, showing a sharp increase in relevant studies from 2015 onward (post-Paris Agreement), peaking at 42 in 2024-2025

Figure 3 below, supports both Figures 1 & 2 by charting out the number of publications of developed, transitioning, and developing countries.

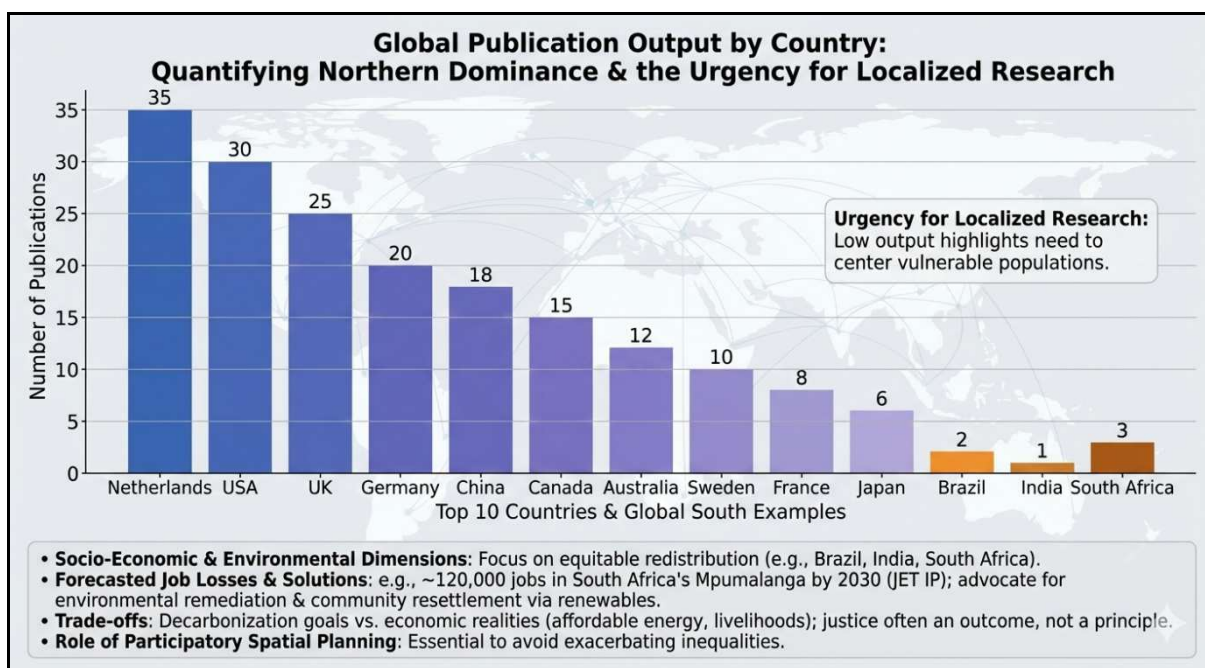


Fig. 3: Bar Chart of Country Contributions. This visual quantifies the dominance of the Global North (e.g., the Netherlands leading), contrasting with low output from the Global South, to emphasize the urgency for localized research.

In the context of the socioeconomic and environmental dimensions of energy transitions, countries such as Brazil, India, and South Africa clearly engage with the theme of equitable redistribution, underscoring the need to prioritize historically marginalized communities during the shift from fossil fuels to renewable energy sources. The study forecasts job losses in coal-dependent regions, but also advocates for the remediation of degraded environments and community resettlement. A remarkable pattern may emerge as a result of trade-offs between environmental goals, including decarbonization and emissions reductions, and the economic realities of affordable energy, accessibility, and local livelihoods (Müller & Claar, 2021). Withal, various studies treat justice as an outcome rather than a guiding approach principle of transition. This finding reinforces the significance of rooting participatory planning and spatial justice at the core of transition strategies, ensuring that vulnerable populations are not further disadvantaged in the process.

Figure 4 below. It is a radar chart of trade-offs in Energy Transition. The image effectively illustrates the role of spatial planning in countries of the Global South, highlighting both balanced and imbalanced approaches.

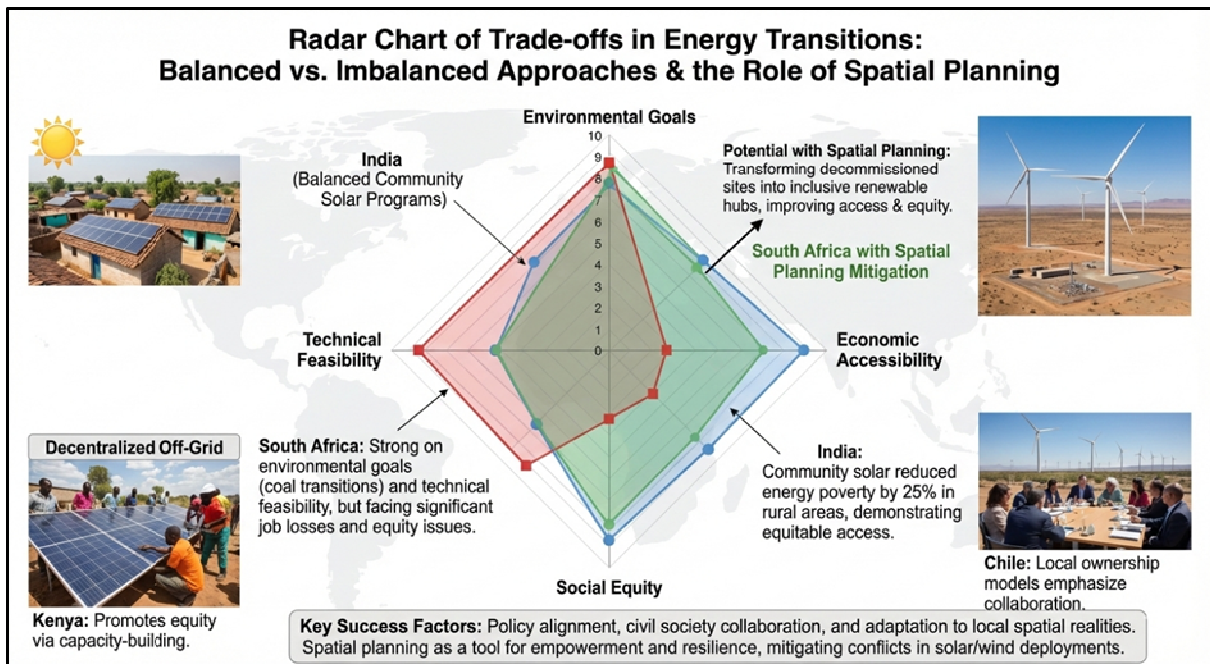


Fig. 4: Radar Chart of Trade-offs in Energy Transitions. This visual illustrates balanced vs. imbalanced approaches, showing how spatial planning can mitigate conflicts in solar/wind deployments.

Country	Key Initiative	Spatial Planning Role	Outcomes
India	Community Solar Programmes	Integrated with rural development strategies through strategic site selection and land suitability planning	Improved affordable energy access and enhanced energy equity for rural communities
Chile	Multi-stakeholder Wind Energy Models	Spatial zoning to manage land-use conflicts, coupled with participatory planning and local ownership frameworks	Increased community acceptance, reduced land-use disputes, and strengthened local capacity
Kenya	Decentralised Off-Grid Solar Systems	Spatial planning enabled equitable distribution through zoning for service coverage and community-based infrastructure siting	Expanded energy access, reduced spatial inequality, and improved local collaboration
South Africa (JEP Renewable Energy Hubs – Potential)	Renewable Energy Hubs and Skills Transition Initiatives	Spatially targeted planning to repurpose coal regions, integrate energy infrastructure, and support regional economic diversification	Mitigated job losses, strengthened local resilience, and advanced an inclusive just energy transition

Table 1: Comparative Best Practices from Global South Case Studies. This tabular visual synthesizes transferability, enhancing actionable insights.

It is noteworthy to emphasize that several high-impact studies have provided practical examples of how regions in the Global South are navigating the dual directives of spatial justice and energy transition.

Countries including India, Chile, and Kenya have a proven record of community-based solar programs, multi-stakeholder governance models, and decentralized energy systems that position equity at the centre of energy planning (Wang et al., 2022; Ardi et al., 2023). The successful solutions are frequently underscored by local capacity-building, strong policy alignment across sectors, and collaborative frameworks between government and civil society initiatives that encourage sustainability and ownership (Rocco, 2022; Wang & Gu, 2023). Subsequently, these case studies emphasize the importance of context-specific planning, rather than a one-size-fits-all approach; needs are tailored to local conditions and spatial realities. The study considers these cases as the best practices, and potentially, they offer invaluable lessons to South Africa. The study emphasizes that the just energy transition is most feasible and will materialize when spatial planning is leveraged not only as a regulatory tool but also as an approach for inclusive development, community empowerment, and long-term resilience.

The table below, Table 1. Offers comparative best practices from case studies in the Global South. It demonstrates how context-specific spatial planning has successfully pioneered equitable renewable energy transitions in Kenya, India, and Chile, while offering transferable lessons to South Africa's Just Energy Transition Partnership (JETP) and energy hub initiatives.

## 6 DISCUSSION

By casting light on the critical yet underexplored themes, the study bridges the conceptual and practical gaps between spatial planning and just energy transition in the Global South, particularly in South Africa. Academically, the study advances the interdisciplinary discourse by mapping the convergence of spatial justice, socio-economic, and renewable energy equity using PRISMA and bibliometric methods. The study further highlights the limited opportunities for growth in integrating spatial dimensions into energy planning, thereby identifying key areas for future scholarly inquiry. For policy practitioners and industry, the study provides actionable insights into how the significance of spatial planning can be effectively utilized and leveraged to operationalize the just energy transition principle, including participatory planning, equitable redistribution, and localized energy systems. Therefore, by learning from the best practitioners in the world, the study affords a platform for designing context-sensitive frameworks and inclusive policies that adequately inform the repurposing of decommissioned power stations and other infrastructure projects.

## 7 CONCLUSION

This paper investigated the critical integration of spatial planning and a just energy transition in South Africa, deploying PRISMA and bibliometric methods to unearth key themes, identify best practices from the global South, and examine geographic biases. The analysis identified spatial planning as an essential node in the energy domain, yet the study indicates the uneven application, specifically in addressing societal equality in marginalised regions amid coal-to-renewable shifts. The study's findings highlight the critical gap: the energy transition risk reinforces apartheid era spatial injustice, unless planning actively redistributes the resources equally as per the Spatial Planning and Land Use Management Act (SPLUMA) policies. Countries such as India and Kenya are seen as key practitioners, with spatial planning as a node in the distribution of renewable energy resources. It is noteworthy to indicate that the study highlights that moving forward, spatial planning must evolve from regulatory to a catalyst for socio-spatial transformation; it should inform policies such as JETP to aid in successfully repurposing decommissioned power stations into equitable renewable hubs. By prioritising multi-scalar justice and community participation, the global south nations can pave the way for a transition that is truly just, equitable, and sustainable.

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