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Characterizing 'injustices' in clean energy transitions in Africa

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ABSTRACT

The global shift towards renewable energy sources presents promising prospects for environmental sustainability and social welfare. However, without proper management, this transition risks exacerbating disparities, creating winners and losers in the process. Achieving a just energy transition demands equitable distribution of benefits and costs alongside inclusive decision-making processes. Nonetheless, transition dynamics vary widely across contexts, necessitating a nuanced understanding of local specificities. This study identifies and characterizes injustices within renewable energy projects in Africa through a systematic review of 26 studies from 11 countries. Using content and thematic analysis supported by Atlas.ti software, various forms of injustice — distributive, procedural, recognition, and restorative — were delineated. Distributive injustices accounted for 58 % of all injustices, while procedural, restorative and recognition injustices accounted for 18 %, 15 %, and 9 %, respectively. Distributive injustices primarily arose from project siting, resource conflicts, the objectives of the renewable energy projects (grid stability vs local connectivity), and disparities in job creation. Procedural injustices manifested as regime dominance and limited community participation. Restorative injustices often manifested as inadequate mitigative measures and compensation, while marginalization and inadequate representation of vulnerable and minority groups underscored recognition injustices. The effects of these injustices included inequalities (49 %), resource dispossession (18 %), institutional lock-in (12 %), resource strains (6 %), and migration of labor force (6 %), among others. Additionally, the study highlights potentially misconstrued injustices arising from local communities' misunderstanding of the objectives and benefits of renewable energy projects in their localities. Overall, the findings underscore the subjective and context-specific nature of justice in energy transitions, emphasizing the need to consider contextual factors when delineating what injustices are in clean energy initiatives across diverse African contexts.

Introduction

By the year 2050, the total energy supply from renewable sources is projected to constitute at least two-thirds of the global energy mix in order to keep global warming below 1.5 °C (IRENA, 2023). Steady progress is being made towards this goal as clean and renewable energy growth has maintained a constant upward trend in the last decade. According to the International Renewable Energy Agency (IRENA, 2023) renewable energy sources accounted for 83 % of new capacity additions, as global installed capacity for renewable power hit 40 % in 2022 with an unprecedented increase of 295 gigawatts of renewable capacity. The increasing competitiveness of renewable energy, maturing technologies, and mounting global pressures for decarbonization are rapidly driving investments in clean energy, reducing emissions from fossil-fueled economies, and enhancing energy access worldwide. While this transition to cleaner energy sources is exciting and is good for both people and the planet, it is hardly without any downsides. Manufacturing clean energy technologies such as wind turbines, solar panels, and storage batteries require critical and rare earth minerals such as lithium, cobalt, and silicon, whose extraction, processing, and disposal pose several environmental threats.

Solar and wind farms may require large swathes of land; solar panels require significant amounts of water for cleaning; feedstocks for biofuels require large tracts of arable land, while the decommissioning of fossil-fuel power plants could result in massive job losses. The conversion of land and use of water resources, for example, could affect agricultural activities, potentially exposing, especially, rural folks to food insecurity (Favretto et al., 2014). Thus, while the transition to renewable energy is at the forefront of achieving climate change mitigation objectives and brings along several opportunities, it could also potentially create

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winners and losers if not managed carefully. Ensuring that both benefits and costs accruing from this transition are fairly distributed in a manner that leaves no one behind underlies the concept of just energy transitions (JET) (Carley & Konisky, 2020; Löhr et al., 2022; Soriano-Hernández et al., 2022). It is worthy of note that while JET is often used to refer to a transition to clean and renewable energy, the term does not inherently imply so as the energy transition itself refers to a shift from one dominant energy resource to another, whether renewable or non-renewable (Carley & Konisky, 2020). However, this study focuses on renewable and clean energy development.

JET is rooted in the concept of energy justice, which emphasizes the need for equity in access to adequate energy services, the distribution of costs and benefits from energy systems, and adequate representation and participation of all stakeholders in energy decision-making processes (Sovacool & Dworkin, 2015). The three most common tenets of energy justice are distributive justice, procedural justice, and recognition justice. Distributive justice in clean energy transitions addresses how the benefits and costs from clean energy projects can be fairly distributed to ensure that there are no winners and losers. These include both the physical distribution of projects as well as the socio-economic benefits, such as access to energy services, skills development, and employment opportunities, that they bring along (Hägele et al., 2022; Jenkins et al., 2016). Also, distributive justice is concerned with how the ills associated with clean energy projects, such as job losses from fossil fuel phase-out and resource dispossessions for clean energy projects, among others, are borne equitably.

Procedural justice, on the other hand, is concerned with equitably engaging and incorporating all stakeholders, including marginalized and vulnerable groups/communities, in decision-making processes for clean energy development (Jenkins et al., 2016; Sovacool & Dworkin, 2015). It emphasizes maximum consultation and participation of all affected stakeholders in the design, planning, and implementation of clean energy projects, ensuring that all affected persons/groups/communities have a say in decisions that affect them. Recognition justice addresses the need to recognize the vulnerabilities and necessities of various stakeholders, as well ensuring freedom from threats, fair representation, and respect for all groups of people (Jenkins et al., 2016). A fourth but not very common tenet of energy justice is restorative justice, which is concerned with repairing both past and ongoing harm caused by energy systems and decisions (Wallsgrove et al., 2021; Welton & Eisen, 2019). It includes mitigative measures as well as compensations for the ills caused by clean energy projects or decisions.

These forms of injustice play out differently in different contexts, thus necessitating a synthesis of their manifestations across different regions to better understand and theorize the nature, causes, and forms of injustices in the clean energy transition (Späth et al., 2022). Carley and Konisky (2020), for example, employ the energy justice lens and draw from the just transitions literature to provide a comprehensive review of the adverse consequences of energy transition for communities and socio-economic groups in the Global North. Such reviews are, however, hard to come by in the Global South, particularly in Africa. Even though the literature on JET is fast evolving in Africa, a more nuanced view of how place-based specificities of injustices manifest in clean energy transitions across different African contexts is yet to be unveiled. Späth et al. (2022) emphasize the context-sensitive nature of transitions and the need for theorizing transition processes on place-based specificities. They, however, note that *"…such pluralities of material constraints and transition pathways are not consistently recognized in the dominant literature"*(p.2). As an attempt to address this gap, this study utilizes a systematic review approach to explore the application of the energy justice framework in clean transition in Africa and draw from the various tenets of this framework (distributive, procedural, restorative, and recognition) to identify and characterizes forms of injustices that emanate from clean energy projects in different African countries.

Our review differs from that of Lacey-Barnacle et al. (2020) in three ways. First, their study focused on theoretical frameworks, methods, and research themes regarding energy justice scholarship in the Global South. This review, on the other hand, focuses on specifically identifying various forms of injustice from clean energy projects implemented in African countries. Secondly, we explore the contextual nature of injustices by doing an in-depth comparative analysis of two case studies of solar PV power plants in Ghana and Rwanda. The choice of these case studies is informed by the similarity of contextual information of the clean energy projects studied and the depth of the empirical findings reported in the studies published on the projects (Brunet et al., 2021; Stock et al., 2023). Studies on both projects (Kaleo and Lawra solar plants in Ghana and Rwamagana solar plant in Rwanda) provided comparable level of detail regarding procedural, recognition, and distributive injustices regarding resource dispossessions, displacements, and gendered impacts in settings where many livelihoods are resource-dependent (Brunet et al., 2021; Stock et al., 2023). Both studies presented elaborate quotations from their interviewees, allowing us to make further deductions from the primary data and not just the results reported. Thirdly, we identify and outline contextual factors that need to be considered in delineating injustices in clean energy projects. Though the geographic focus of this study is on Africa, we also infer from the broader literature on energy justice and JET to bolster the discussion of the results. The rest of the paper is organized as follows. Section 2 presents the systematic review approach and method used for the study. The results and discussion are presented in Sections 3 and 4, while the conclusions and future research recommendations are outlined in Section 5.

Methods

This study follows the systematic literature review approach proposed by Page et al. (2021). In the first step, a search criterion was designed to identify suitable publications to be included in the study. This criterion involves setting the geographic scope of the study to Africa; hence, only studies conducted in any African country were included. Secondly, the study focuses on renewable energy projects and energy justice or just energy transition—specifically, only the original research/case studies of such projects were targeted. Thirdly, given the special emphasis on energy justice and just transition studies, the search focused on studies in which these keywords were mentioned. The search terms "energy justice", "just transition", "renewable energy" and "Africa" were combined in different search strings to retrieve publications from the SCOPUS database. Four combinations were performed, and the search string that yielded the most publications was selected. In SCOPUS, articles are tagged by country and region based on normalized institutional information of authors, allowing for the precise tracking of publication output by region and country (White, 2021). Thus, by using "Africa" as a keyword, the search result returns all articles tagged with an African country. Nonetheless, search strings containing the names of all African countries were also executed but yielded fewer results (see Appendix A for each search string). The initial search returned 89 publications. The search terms were then limited to original articles and book chapters authored in English, and 15 publications that did not match this criterion were excluded, thus reducing the number to 74. This search was performed in January 2024. A second search in March 2024 yielded 77 articles after specifying article types and language. However, the three new publications did not meet the inclusion criteria outlined at the screening stage in Fig. 1, which outlines the four steps followed in conducting the review and an overview of the final documents selected for analysis.

In the second step, the titles and abstracts of the 74 papers were screened, and 31 papers that did not match the inclusion criterion were excluded. Next, the full texts of the remaining papers were skimmed through to verify their eligibility for inclusion. After this process, 25 articles were excluded. The final selection included 18 publications that were eligible for the study. The reference lists of these studies were then examined to identify other eligible studies that could have been missed during the searching and screening process. This analysis led to the

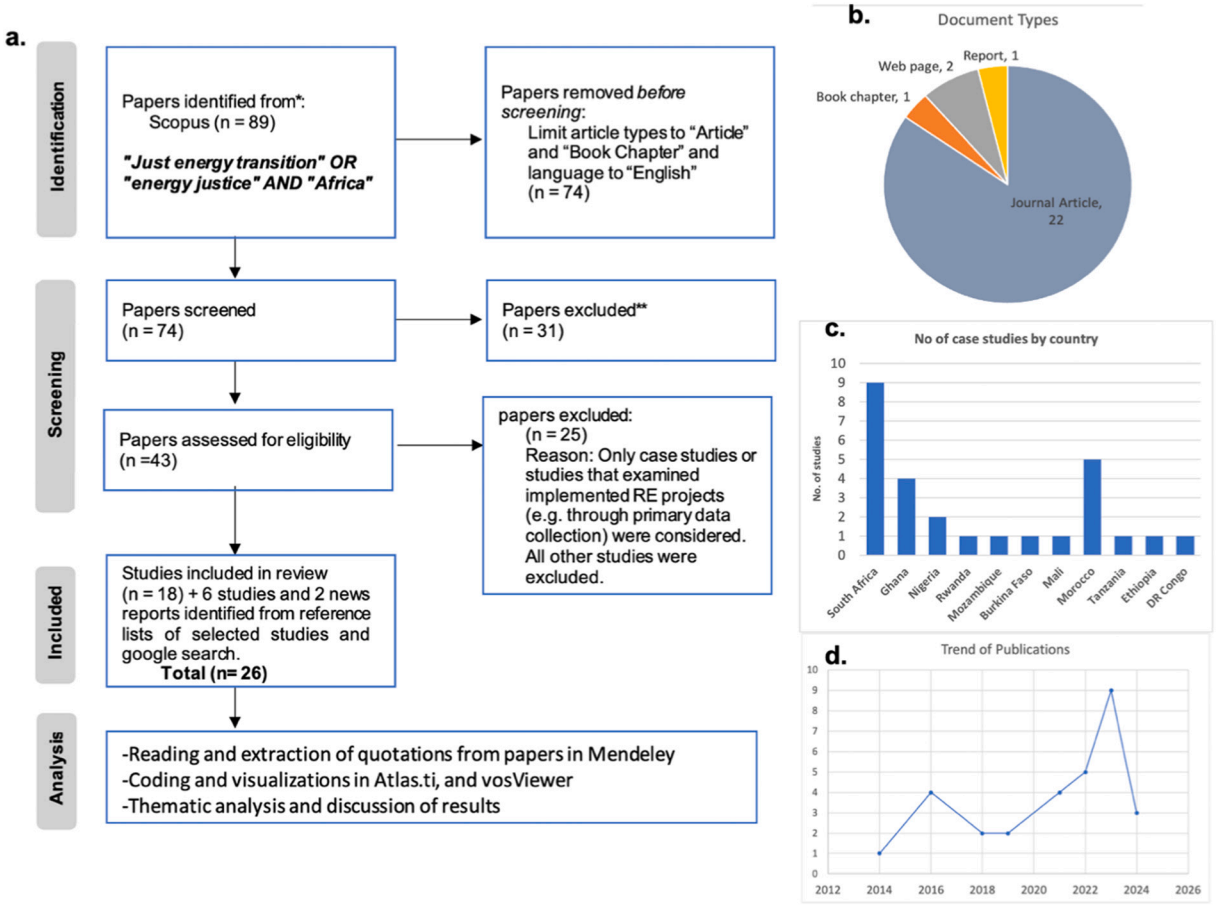

Fig. 1. Approach to literature search and analysis (a) and overview of selected studies (b, c and d). Panel a is adapted from Page et al. (2021). *Note: The total in* ***c*** *is more than 24 because some publications presented case studies from multiple countries,* e.g., Cantoni et al. (2022).

identification of an additional 6 publications and 2 news reports that were essential for the study, thus bringing the total to 26 studies from 11 countries. These publications were imported into *Mendeley* Library, where each was read in detail to extract texts about the energy justice tenets. The text was mainly extracted from the results sections of the studies and stored in a Microsoft Word file, which was then uploaded into *Atlas.ti* software for analysis. The text was then coded in line with the four energy justice tenets. These codes are presented in Table 1. Samples of codes and their corresponding quotations from various studies can be found in Appendix B. The coding was done in three steps. First, quotations were marked and coded as distributive, procedural, recognition, or restorative (in)justices based on which of these tenets is reported in the extracted text from the articles. In the second step the quotations were read through to identify specific forms of injustices and coded accordingly, and in the last step, the effects of these injustices were identified from the text and coded (see Table 1). Thus, each body of extracted text has three levels of coding first by the tenet of energy (in) justice, second by the form of injustice, and third by the effects. With these levels of coding, the code co-occurrence analysis tool in *Atlas.ti* was used to visualize the relationship between the types of injustices and their corresponding effects, allowing for the identification of dominant effects that occur with each form of energy justice tenet. These visualizations are presented in the form of Sankey diagrams in the Results and discussion section.

A *RIS* (Research Information Systems) file of the selected studies was also exported from the *Mendeley* library and used for keyword co-occurrence analysis with the aid of *VosViewer* Software. The keyword co-occurrence analysis aims to ascertain an overview and connections between key concepts/terms related to JET in the literature. The minimum number of keyword occurrences was set to one for this analysis to ensure that all keywords were included. The two news reports were not included in the co-occurrence analysis since they do not have keywords. The results of the study are thematically presented and discussed in line with the codes generated within the frame of the objectives of the study in the next section.

Table 1
Categories of codes and sub-codes.

Main code	Sub-codes
Distributive	– Costly requirements
	– Grid stability vs local connectivity
	– Imbalanced competition
	– Job losses
	– Lack of tech. enablers
	– Projects' siting
	– Resource conflicts
	– Temporary jobs
Procedural	– Inadequate involvement/participation
	– Regime dominance
Recognition	– Deprivation/marginalization
	– Inadequate representation
Restorative	– Inadequate compensation
	– Inadequate mitigative measures
Effects	– Conflicts
	– Resource dispossession
	– Inequality
	– Lock-in/path dependency
	– Migration of labor force
	– Resource strain
	– Transnationalization

Results and discussion

Trend and co-occurrence of key terms related to JET

The trend of publications manifests recent increased attention on JET in both international and local policy discussions, with an observable upward trend in the number of publications related to the subject since 2019. The trend of keywords shows that energy transition, renewable energy, just transitions, and climate change form the foci of most recent studies. The keywords *just transition*, *energy justice*, *climate change*, and *renewable energy* had the highest number of occurrences in the publications, highlighting the increasing integration of energy justice concerns into current climate and energy transition discussions. Africa has significant renewable energy potential, particularly in solar and wind energy across its regions (IEA, 2022), which can drive both environmental and economic benefits. The prominence of keywords like "energy justice" and "poverty" alongside "gender" reflects the recognition that energy transitions must address social inequalities. Energy justice frameworks advocate for the fair distribution of both the benefits and burdens of energy production and consumption (Sovacool et al., 2017). This means ensuring that marginalized communities and groups have access to affordable and reliable energy, which is critical for improving living standards and economic development. Previous studies have affirmed this argument, highlighting that access to energy creates positive social impacts on women and communities (Brunet et al., 2021; Nuru et al., 2022; Tladi et al., 2024). In terms of co-occurrence with other keywords, '*just energy transition*' was the highest, forming the largest cluster of keywords (in red color, Fig. 2b). This cluster contained 12 keywords, which often co-occurred with the term 'just energy transition'. Observably, energy justice is closely linked with energy poverty and energy access, while JET is closely linked with renewable energy investments, transition theory, and sustainability. These keywords are depicted in Fig. 2.

The keywords also indicate a significant focus on specific countries such as South Africa, Ghana, Morocco, and Burkina Faso. The country names in the keywords highlight a geographically diverse interest in JET and the connections between these countries and various thematic areas suggest the need for a comprehensive approach to understanding and addressing the challenges and opportunities of energy transitions in different socio-economic and political contexts. Also, the linkage of country names with broader themes like "climate change" and "renewable energy" shows that while the research is geographically focused, it is also connected to global environmental and energy discussions. It is apparent from the keyword clusters that South Africa features prominently in studies on JET in Africa. Three reasons could explain this. First, the country relies heavily on coal, and it is Africa's largest emitter of greenhouse gases (GHG), putting coal phase-out on top of the energy transition agenda of the government (Chetty et al., 2023; Mirzania et al., 2023). The terms 'coal phase-out' and 'just transition' are prominently featured in studies conducted in South Africa. Not only does the country rely primarily on coal for its energy needs, but its coal production sector also employs a substantial part of the labor force. For instance, Müller and Claar (2021) noted that decommissioning coal power plants could result in some 35,000 job losses in the country. Secondly, owing to the high levels of income inequalities in the country, there are concerns that the transition to clean energy sources could deepen these inequalities if not appropriately managed. A third factor is the country's efforts to transition to clean energy and bolster its energy security through international partnerships for JET. For example, at COP26, South Africa launched its long-term Just Energy Transitions Investment Plans in partnership with Global North countries such as France, Germany, the United States, and the United Kingdom (European Commission, 2022).

These three factors underscore the need to ensure equitable distribution of clean energy investment benefits such as job creation, access to energy services, and skills development, concerns that are often linked with energy justice and just transitions. It is, thus, not surprising that there are many studies on the subject in South Africa. Morocco, though not as visible as South Africa in the keyword clusters, has also received significant research attention regarding JET. This attention stems from its Noor Ouarzazate solar power station, the largest concentrated solar powerplant in the world. Built on some 3000 ha of land, the project has received considerable attention regarding its benefits and socio-environmental impacts within the context of energy justice and JET (Cantoni et al., 2022; Okpanachi et al., 2022). Ghana and Burkina Faso also host several solar power projects, including some of the most notable ones in Africa. These include the recently commissioned Bui floating solar power system in Ghana, the largest of such systems in West Africa (Suuk, 2024) and the 26.6 MW Zina solar power station in Burkina Faso (Beyer, 2024). Another possible reason for the dominance of these countries in the literature is the fact that South Africa, Ghana, and Morocco, for example, are among the top ten African countries in terms of scientific research publications and collaboration (Ali & Elbadawy, 2021; Toivanen & Ponomariov, 2011).

The "Just Energy Transitions" cluster underscores the importance of integrating social equity into energy transition strategies. Keywords like "international partnerships," "socioeconomic development," and "investment patterns" suggest that achieving a just energy transition requires collaboration, investment, and a focus on equitable development. Quitzow et al. (2019), for instance, note that investments in renewable energy infrastructure and international cooperation are essential for scaling up clean energy solutions and ensuring they are accessible to all. Most of the case studies (Brunet et al., 2021; Cantoni & Rignall, 2019; Müller & Claar, 2021; Stock et al., 2023) highlight significant international and donor support, particularly, in terms of funding for clean energy projects in Africa, which could be a further reason for the occurrence of these keywords.

Overseas Development Assistance (ODA), for example, has been found to positively drive renewable energy development in Sub-Saharan Africa (Guo et al., 2024; Wang et al., 2021). The presence of terms like "leave no one behind" and "sustainability" also points to the broader goals of inclusivity and long-term environmental sustainability (Bohlmann et al., 2023; Carley & Konisky, 2020). Fig. 2 illustrates the interconnectedness of various factors in achieving a just energy transition in Africa. Such interconnectedness underscores the need for an integrated approach that considers social equity, climate change mitigation, renewable energy adoption, and international cooperation. Addressing these issues holistically is key to ensuring that energy transitions are both just and sustainable. In the ensuing sections, various forms of injustices emanating from clean energy projects are delineated and discussed alongside some policy actions that can be taken to address them.

Forms of injustices in clean energy transitions in Africa

Injustices in clean energy transitions in Africa arise from policy design and project implementation, with the latter being the dominant source. An example of injustices emanating from policy design manifests in South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP). The REIPPPP seeks to facilitate renewable energy deployment in South Africa by establishing a competitive bidding process and creating a conducive investment environment for foreign and domestic investors to invest in renewable energy projects and socio-economic development (McDaid, 2016). This program has had significant success in renewable energy projects, with over 100 projects created since its inception in 2011 (Müller & Claar, 2021). A key upside of this program is that it requires large-scale renewable energy investors to allocate 1 % to 1.5 % of the proceeds from their projects to invest in socio-economic development ventures of areas within a 50-kilometer radius of their projects (Mirzania et al., 2023).

Nonetheless, studies on the energy justice and just transition dimensions of this program have uncovered several issues. According to

McDaid (2016), the program has failed to ameliorate but rather perpetuate inequities in power relations between investors and impacted communities. While the program is anticipated to augment employment opportunities, long-term manufacturing jobs were concentrated in urban areas, whereas only short-term construction jobs were initiated in affected rural communities (McDaid, 2016). McEwan (2017) found that the REIPPPP has created spatial disparities in that it has resulted in the formation of renewable energy clusters in certain geographical regions while other regions did not benefit. Müller and Claar (2021) noted that the program gives foreign investors a strong foothold in the renewable energy market as local investors cannot compete with large foreign corporations in the bidding process. They likened this situation to 'auctioning' and 'transnationalizing' the clean energy transition process, a move that is counter to the goals of local ownership and knowledge transfer (Müller & Claar, 2021).

The second and largest sources of injustice emanate from implementing clean energy projects. These implementation stage injustices stem from the location/siting of projects, nature of jobs created, distribution of benefits and costs, use of natural resources, and local participation/involvement in decision-making, among others. Overall, distributive injustices were dominant, often originating from projects' siting, resource conflicts, the objectives of the renewable energy projects (grid stability vs local connectivity), and disparities in job creation. The dominance of distributive injustices is not surprising given that similar findings are widely reported in the existing literature in part due to the fact that distributive injustices are easier to identify and quantify (Baker et al., 2023; Jenkins et al., 2016). On the other hand, earlier notions of justice have revolved around distributive justice, primarily concerned with the distribution of outcomes and opportunities (Konow, 2001; Rawls, 1971) making it a much older strand of the energy justice principles. Procedural injustices were in the form of regime dominance and limited community participation.

Restorative injustices manifested as inadequate mitigation measures and compensation schemes, while marginalization and inadequate representation of vulnerable and minority groups underscored recognition injustice. Restorative injustices had a higher proportion than recognition and procedural injustices, highlighting particular interest in this tenet on the African continent. Also, this is not very surprising, given that clean energy projects are often located in peri-urban or rural settings where their installations compete with land and other natural resources that provide livelihoods for local communities. In this regard, the enclosure of forest commons, resource dispossessions, and adverse-livelihood impacts of clean energy projects have received considerable attention in the energy justice literature in Africa (Akintoye et al., 2016; Brunet et al., 2021; Ryser, 2019; Stock et al., 2023). More discussions on these restorative injustices are provided in Section 3.2.3. Fig. 4 provides a summary of the various forms of injustice by the four tenets of energy justice. These forms of injustice are thematically discussed according to the tenets of energy justice in the ensuing sub-sections.

Distributive injustices

Disparities in the siting/location of clean energy projects accounted for the largest share of distributive injustices. These disparities are characterized by the unequal distribution of projects across geographical regions, thus denying access to energy services, jobs, and other opportunities that come with clean energy projects in some areas. In South Africa, for example, few clean energy projects are located in the regions where the country's coal power plants are concentrated, setting the conditions for massive job losses and unemployment once the plants are decommissioned (Müller & Claar, 2021; Tladi et al., 2024). Castán Broto et al. (2018) also found that in Mozambique, clean energy innovations are mostly located in rural areas, with little attention to peri-urban settings. Such disparities are not limited to the location of projects but also the allocation of clean energy aid. In their study of the distribution of energy aid in Tanzania, Nigeria, Ethiopia, and the Democratic Republic of Congo (DRC), Heerae and Huijoo (2024) discovered that rural areas received less aid while cities/urban received most of the aid in the renewable energy sector.

The second major form of distributive injustice is the

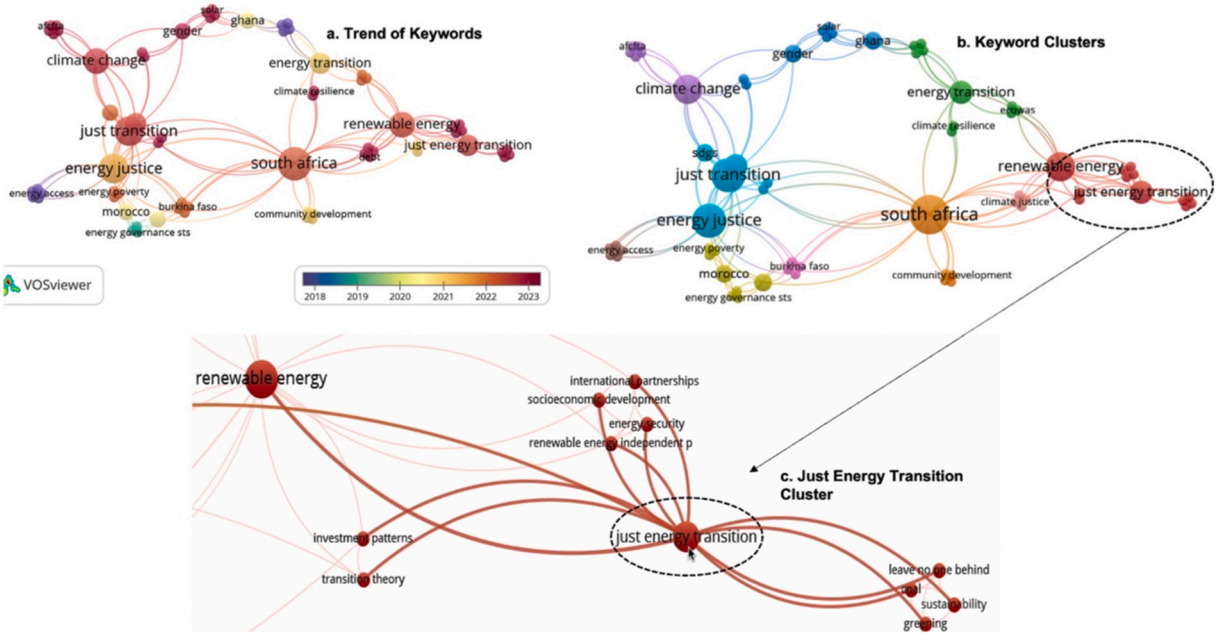

Fig. 2. Network visualization of keyword trends and clusters in studies on just energy transitions in Africa[1].

[1] Parts of **c** are cut off because it's a snapshot from the zoomed-in portion of b to reveal non-visible keywords in that cluster. The entire image does not fit on the screen when zoomed in.

Fig. 4. Types and sources of injustices in clean energy projects in Africa.

disproportionate burden of the adverse effects of using resources such as land, forest areas, and water bodies for clean energy projects. The use of land and water resources for biofuel projects, for example, led to severe water stress for human consumption and agricultural activities in Mali, with rural communities suffering the most from these impacts (Favretto et al., 2014). In Morocco, Hamouchene (2016) recounted that drawing water from the El Mansour Eddahbi dam for cooling and cleaning solar panels at the Ouarzazate solar power station has significantly affected the community's water source. It is estimated that some 2.5 to 3 million cubic meters of water are used for wet-cooling (Noor I) and dry-cooling (Noor II and III) at the plant annually (AfDB, 2014). Ryser (2019) recounts that the project has severed access to land, water, and herbage on what used to be communal land and common-pool resources. This severance affected the livelihoods of some locals who made a living from handicrafts such as pots, chairs, and sunshades made from local resources around the dam (Ryser, 2019). Similarly, Stock et al. (2023) found that the enclosure of forest areas for solar PV plants in the Upper West Region of Ghana has severed access to forest resources such as firewood, farmlands, and grazing lands, disproportionately affecting women who relied on these resources for their households' consumption as well as livelihoods.

Thirdly, one key expectation from situating clean energy projects in marginalized communities is that this approach will bring access to energy services to such communities and ameliorate inequities in access to electricity (Hoicka et al., 2021; Löhr et al., 2022). However, the experience from many African countries shows that this is not the case, as many households remain unconnected to energy services, particularly electricity, even after clean energy projects are developed in their communities. Two main reasons account for this problem—high connection costs and objectives of the projects. Case studies from Burkina Faso and South Africa (Cantoni et al., 2022), Rwanda (Brunet et al., 2021), and Mozambique (Castán Broto et al., 2018), for example, all found that the costs of installations and connecting to electricity are too high for many households even when the projects are located in their community.

In the case of South Africa, households seeking to connect to electricity from a solar PV mini-grid in Qandu Quandu, a peri-urban settlement near Cape Town, had to incur an additional cost of switching their household appliances to direct current (DC) ones because the mini-grid does not provide alternating current (AC) which many household appliances use (Cantoni et al., 2022). Regarding the objectives of the clean energy projects, regional objectives often overshadow local energy needs, thus creating inequities in access to electricity. In the case of Burkina Faso, for example, Cantoni et al. (2022) recount how residents of Zagtouli, a peri-urban settlement near Ouagadougou, did not benefit from a solar PV plant installed in the community because the objective of the project was to produce electricity to stabilize the national grid and not to provide electricity for the community. Similarly, Castán Broto et al. (2018) noted that some clean energy projects in Mozambique aimed to electrify district/administrative posts of the government and, in the process, overlooked local energy needs. In Ghana, Stock et al. (2023) reached an identical conclusion that solar PV plants installed in the Kaleo and Lawra districts "address regional energy poverty through the provisioning of solar electricity while exacerbating localized energy poverty by denying access to essential firewood resources" (p.6).

Lastly, while the development of clean energy projects comes with some employment opportunities, these opportunities are often limited for people in affected communities. Host communities mainly benefit from only short-term construction works, which end when the construction of the project is over. Hägele et al. (2022) noted that long-term

manufacturing jobs related to clean energy projects are often located in urban areas, whereas rural areas where the implementation occurs only benefit from short-term jobs during construction. Chetty et al. (2023) also cite how jobs created by the Cookhouse and Longyuan-Mulilo wind farms in South Africa were only during the construction phase of the projects for people in the affected communities.

Procedural injustices

Regime dominance and inadequate involvement/participation of all stakeholders in the planning and implementation of clean energy projects emerged as critical forms of procedural injustices in clean energy transitions in African countries. The case studies reviewed have shown that not all affected persons/groups are involved or consulted in the planning and implementation of clean energy projects. A common thread from different African countries is that often, only landowners (title holders) are involved, particularly during land acquisition and compensations resulting from displacements and dispossession. Brunet et al. (2021) recount from their case study in Rwanda that only people living in the construction zone of the solar PV plant were consulted. Consequently, there was some confusion among the wider community regarding the ownership of the project, its construction and operation, and the government's role in it, given that it was constructed by a foreign (Dutch) company (Brunet et al., 2021). Similarly, Okpanachi et al. (2022) noted that the lack of ownership has raised doubts about whose interests are being prioritized in Morocco's energy transition program, while in South Africa, there is an average of only 9 % local community ownership in the country's energy transition program (Müller & Claar, 2021).

Transitions to cleaner energy are also dominated by centralized regimes (state utilities/government agencies), some of which are reluctant to pave the way for private sector participation in clean energy transition investments. McDaid (2016), for instance, cites the reluctance of South Africa's state utility, Eskom, to phase out coal and invest in clean energy. Hägele et al. (2022) describe the political nature of coal phase-out in South Africa, citing the government's support for Eskom, which makes it "a central and powerful actor, thereby slowing down a just energy transition process" (p. 104). In Mozambique, planning and decisions regarding clean energy investment are top-down, often carried out by the state utility (FUNAE) at its headquarters without adequate local consultations and participation (Castán Broto et al., 2018).

Restorative injustices

Two main forms of restorative injustices were uncovered—insufficient compensation and inadequate mitigative measures. Insufficient compensation arises when reparations for the use of land, forest, water, and other resources fail to meet the actual value that owners place on such resources. Clean energy projects typically require large tracts of land, sometimes leading to the enclosure of forest commons, displacements, and dispossessions from farmlands or even settlements. Such displacements do not only affect livelihoods but also the cultural identity and sense of belonging, especially among indigenous communities. Akintoye et al. (2016) point out how the provision of new housing did not even make up for the sense of loss felt by an indigenous community that was relocated due to a liquefied natural gas[2] plant in Nigeria. In Morocco, Hamouchene (2016) likened the Ouarzazate CSP project to 'green capitalism,' while Bouhmouch (2016) likened the acquisition of land for the project to 'green grabbing,' noting that residents felt the compensation received was less than the value of the land taken. The experience from Ghana and Rwanda shows that only land owners (title holders) receive compensation when their lands are used for clean energy projects. Thus, in instances where clean energy projects are constructed on public lands or even private lands that are used as common pool resources, all affected persons (e.g., farmers, herders, etc.) who use such lands but do not hold any titles to the land receive no compensation. For example, Stock et al. (2023) noted in their Ghanaian case study that farmers, herders, and women who collected firewood from the lands on which the solar PV power plants were built could no longer access these areas. Nonetheless, only four landowners from whom additional land was acquired for the projects were compensated (Stock et al., 2023). Brunet et al. (2021) provide a similar example in their Rwandan case study, where only families whose lands were acquired for the solar PV project were compensated.

The second form of restorative injustice identified is the lack/inadequate mitigative measures to ameliorate the negative consequences arising from clean energy project development. Clean energy projects can cause water stress, limit access to forest resources, and create dispossessions from arable lands, all of which affect livelihoods and food security in affected communities. Yet, most projects often fail to provide alternative livelihoods and opportunities for such communities, leading some authors to argue that some clean energy projects lead to the creation of "*solar surplus populations*" (Stock et al., 2023, p. 4). The term surplus population or relative surplus population was used by Karl Marx to describe an instance where the agrarian labor force is not absorbed into other sectors after being displaced from the agricultural sector due to the expropriation of land for different investments (Marx, 1867). Such an unabsorbed labor force may not only arise from land displacements but also from the decommissioning of fossil fuel power plants. Müller and Claar (2021), for example, warn that the capacity of renewable energy projects to absorb labor force from the fossil fuel industry remains low in regions where dated coal power plants are to be decommissioned in South Africa.

Recognition injustices

Recognition injustice manifested in the form of marginalization and inadequate representation of different groups of stakeholders in clean energy transition processes. Marginalization occurs when the needs and plights of vulnerable groups are not recognized and or considered unimportant during the development of clean energy projects. The key principle of recognition justice is that vulnerability and the needs of different groups of people need to be recognized, alongside ensuring respect and diversity in the transition process (Jenkins et al., 2016). Failure to recognize the needs of smallholder farmers, herders, and other groups whose livelihoods are resource-dependent tends to worsen the plight of these groups first by denying them participation in the decision-making, and secondly, by exposing them to the risks of food insecurity, unemployment, and poverty. For example, according to Akintoye et al. (2016), the resettlement of indigenous people in Old Finima in Nigeria for an LNG project not only fostered a sense of forced deprivation of the historical and cultural sense of being among the indigenes but also the new settlement and the project attracted migrants into the community, eventually raising the cost of living and influencing the culture of the indigenes. In terms of representation, Müller and Claar (2021) recount that, in South Africa's REIPPPP, there is 33 % black ownership in the sale and purchase of equity shares while the renewable energy market is being dominated by foreign corporations because local bidders are unable to compete with such corporations. This inadequate representation of local investors coupled with only 9 % of local community ownership of projects led them to caution against 'auctioning a just energy transition' in South Africa, noting that this could lead to a transnationalization of the transition process (Müller & Claar, 2021).

Effects of injustices in the clean energy transition

The effects created by various forms of injustice are outlined in

[2] LNG emits 40 % and 20 % less CO_2 than coal and oil, respectively; thus, it is considered a relatively cleaner source of energy, and a transition fuel. For reference, see https://justenergy.com/blog/liquefied-natural-gas-lng-what-and-why/#:~:text=Is%20Liquefied%20Natural%20Gas%20Clean,energy%20than%20coal%20and%20oil and https://www.naturalgasintel.com/is-lng-clean-energy/.

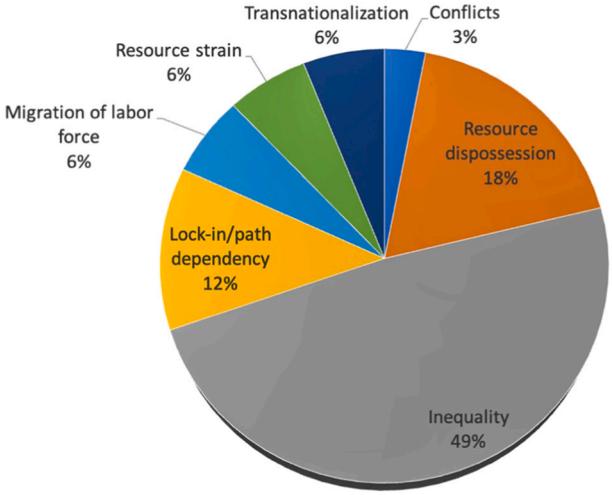

Fig. 5. Effects of injustices in clean energy transition.

Fig. 5. Injustices in the clean energy transition mostly create or perpetuate inequalities, resource dispossessions, and lock-in/path dependency. A just energy transition epitomizes balancing clean energy transition with progress in human development. Apparently, the effects uncovered by this study are all human development issues, underscoring the importance of ensuring *just transitions* in Africa's clean energy transition. Addressing inequalities and energy poverty, for example, are central to the energy justice debates (Sovacool & Dworkin, 2015). The effects identified and the forms of injustices they emanate from are discussed in the ensuing sub-sections.

Inequalities

Inequalities are largely created by distributive injustices, often stemming from the unequal distribution of the benefits and costs arising from clean energy projects. Unequal distribution of the location of projects, for example, means that benefits that accompany clean energy projects, such as access to energy services, jobs, and knowledge transfers, are limited to only certain locations, especially in urban areas (Heerae & Huijoo, 2024). Also, where projects are located in rural or, in some cases, peri-urban areas, high costs of connecting to energy services such as electricity make such services inaccessible to low-income households, thus deepening inequalities between the poor and the rich as more affluent households can connect to such services. Boamah et al. (2021) provide an example from Ghana, where beneficiaries must first purchase the balance of system (BOS) components to benefit from a capital subsidy program for residential rooftop solar PV. This cost makes the subsidy inaccessible to low-income households who cannot afford the BOS. Inequalities in access to energy services also result from the objectives of the clean energy projects, as seen in the examples from Burkina Faso and Mozambique, where the clean energy projects aimed to stabilize the national grid and to power up government administrative units, respectively, thus, overlooking local energy needs (Cantoni et al., 2022; Castán Broto et al., 2018). Such objectives ensure that grid-connected urban dwellers enjoy a reliable supply of electricity while rural folks remain unconnected, thus perpetuating inequalities in access to electricity between urban and rural areas. Inequalities result not only from the distribution of benefits but also from costs. The burden of using land, forest, and water resources for clean energy projects is primarily borne by local communities. Stock et al. (2023) provide an example where the enclosure of forest commons has severed access to farmlands and fuelwood, creating gendered exclusions and dispossessions that deepen inequalities between men and women.

Lock-in and path dependency

Institutional lock-in and path dependency are the significant effects of procedural injustices. These two are intertwined in that procedural injustices can lead to lock-in and path dependency while lock-in and path dependency in turn can create procedural injustices. Institutional lock-in and path dependency occur when influential actors use their authority to generate changes in rules (e.g., regulatory frameworks) to enhance their power (Foxon, 2002). Thus, such lock-in and path dependency results from regime dominance, which is evident in the energy sector of many African countries. An example can be seen in the case of South Africa, where the state utility (ESKOM) is reluctant to phase out coal and let other players enter the competition to provide clean energy. For example, in their study, Mirzania et al. (2023) quoted one of their interviewees saying, "*…I have read about how many, for example, private farmers who have built solar grids…are not able to connect to feed back into the grid…so there is a lost opportunity there. Is it because of infrastructure capacities, or is it because they [Eskom] do not want to have competition or someone to pay?* (p.11).

Similarly, Boamah et al. (2021) recount how state electric utilities in Ghana failed to compensate both domestic and industrial net-metered solar energy users for supplying their excess electricity to the national grid, citing the absence of an agreeable tariff scheme for not crediting such users. Not creating the enabling conditions for private actors to invest in clean energy creates a fundamental dependence on dominant regime actors who largely manage a fossil-laden energy sector, thus creating not only an institutional lock-in but also a carbon lock-in (Foxon, 2002). Such dominance also constrains effective participation in energy decisions by affected stakeholders, as seen in the example of Mozambique, where Castán Broto et al. (2018) noted that the state utility made decisions regarding off-grid renewable energy projects without adequate local consultations and participation. Fig. 6 shows the occurrence and co-occurrence of effects of distributive and procedural injustices extracted from the reviewed studies, of which inequalities and lock-in/path dependency are the major ones.

Resource strain, dispossessions, and migration of labor force

The acquisition and use of land and water resources for clean energy projects creates strains on such resources and, in some instances, leads to dispossessions when adequate restorative measures are not put in place. An example is the Ouarzazate plant's use of dam water for cooling and cleaning which has stressed local water supplies, impacting nearby community livelihoods (Cantoni & Rignall, 2019; Hamouchene, 2016). In some other cases, communities had to be relocated to new locations in order to construct clean energy projects, thus dispossessing them of their lands (Akintoye et al., 2016). Such displacements and dispossessions affect livelihoods, cultural heritage, and food security, especially in already vulnerable rural communities. The use of land and water resources for cultivating jatropha for biofuel, for example, was found to negatively impact food security and livelihoods in Mali (Favretto et al., 2014). Case studies from Rwanda (Brunet et al., 2021), Nigeria (Akintoye et al., 2016), Morocco (Ryser, 2019), and Ghana (Nuru et al., 2022; Stock et al., 2023) all provide examples of how clean energy projects have severed access to farmlands, forage, fuelwood, and water resources, sometimes through enclosures, and consequently dispossessing nearby inhabitants of these resources. Such dispossessions and the failure of clean energy projects to absorb the latent labor force either as a result of dispossessions or decommissioning of fossil power plants provide an impetus for the migration of the labor force from affected regions (Bohlmann et al., 2023).

Transnationalization and local opposition/conflicts

The inability of local/domestic investors to compete with larger foreign corporations in bidding for clean energy projects in Africa is giving such large corporations a larger foothold in the clean energy market. According to Müller and Claar (2021), this situation is forcing local bidders out of the clean energy market, downplaying local ownership and, thus, "the tendency to transnationalize and financialize the transition process" (p.343). Mirzania et al. (2023) add that such

Fig. 6. Effects of distributive (a) and procedural (b) injustices extracted from the reviewed papers.
Notes: The thickness of the lines connecting each type of injustice to the corresponding effects, indicates the frequency of co-occurrence between the two. Red dashed rectangles indicate major effects—higher co-occurrence. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

large foreign corporations can take advantage of economies of scale and feed-in tariffs to expand their market share. Without substantial local ownership and involvement of local communities, the presence of such large corporations tends to create confusion among locals and, in some cases, lead to local opposition and conflicts regarding the construction of clean energy projects. Okpanachi et al. (2022) cite examples of opposition resulting from inadequate involvement and fears of alienation from local communities in Morocco regarding the construction of the Ouarzazate CSP station. In Ghana, Nuru et al. (2022) found that unequal access to energy services also generates conflicts within local communities when some community members are connected while others are not. Such oppositions could be attributed to recognition and procedural injustices, while resource strain, and dispossessions discussed in the preceding sub-section could be attributed to restorative injustices. As seen in Fig. 7, the dominant effects of recognition and restorative injustices are inequalities and resource dispossessions, respectively.

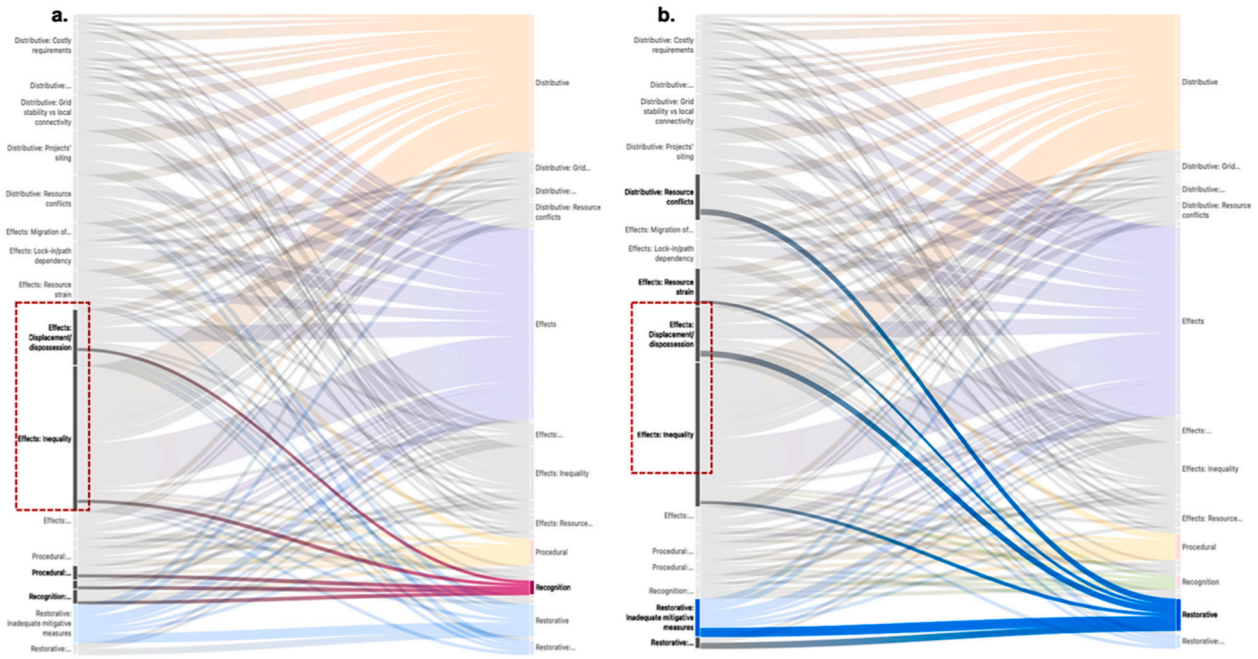

Fig. 7. Effects of recognition (a) and restorative (b) injustices.
Notes: The thickness of the lines connecting each type of injustice to the corresponding effects, indicates the frequency of co-occurrence between the two. Red dashed rectangles indicate major effects—higher co-occurrence. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Discussion

While several studies have identified various forms of injustices in different countries by applying the energy justice framework, we argue that delineating and addressing such injustices can be better understood by first considering two key contextual factors against which injustices may propagate. The foremost of these factors is local legal/regulatory provisions for energy justice. While the energy justice framework provides a global theoretical approach to examining injustices and has been applied in most of the studies reviewed in this paper, what remains unclear from all these studies is whether there are any legal/regulatory provisions specific to energy justice or just energy transitions in the countries studied. Except for South Africa, where its REIPPPP requires large clean energy producers to dedicate 1–1.5 % of their revenues to invest in the socio-economic development of areas within 50 km of their power plants (Mirzania et al., 2023), there is no mention of similar regulations in other countries. Such regulations are not only potentially beneficial for distributive justice but also for recognition and restorative justice. Figs. 8 and 9 show the before and after scenes of the construction of solar PV plants whose energy justice implications were studied by Stock et al. (2023) in Ghana.

The projects were developed by the Volta River Authority (VRA), the main electric utility in charge of generating and supplying electricity in Ghana. Stock et al. (2023) concluded that the above solar projects were implemented "*to mitigate the climate crisis and combat energy poverty but actually exacerbates social vulnerabilities through energy and resource dispossessions*" (p.9). Most of the lands on which these solar plants were constructed are public lands that served as common pool resources for farming, grazing, and fuelwood. Nonetheless, additional lands were obtained from four landowners through a leasehold. According to the VRA, these landowners were compensated for the land and its economic trees and also paid an annual ground rent (Volta River Authority, 2020). While the environmental impact assessment (EIA) report mentions that other inhabitants of the area used the land for farming, grazing, and collection of fuelwood, none of these affected persons were compensated. This non-compensation stems from the fact that under current Ghanaian laws, non-title landholders, such as squatters, are not eligible for any form of compensation (Volta River Authority, 2020). At the same time, no specific provisions are made for vulnerable groups (low-income, non-land owners, women, children, etc.) in case they are affected by the development of a project (Volta River Authority, 2020).

Thus, only the landowners and their households received compensation and assistance with resettlement in the case of this project. Nonetheless, trees cut down on the construction site were offered as fuelwood to women living in the area (Stock et al., 2023). This, however, is only a short-term respite for the women who relied on the site for fuelwood and other livelihood activities, as they have to find longer-term alternatives for which they received no assistance. It is worthy of note that international guidelines such as the World Bank's Environmental and Social Standard on Land Acquisition, Restrictions on Land Use and Involuntary Resettlement (ESS5) require that vulnerable groups such as squatters and non-title holders should be offered supplementary assistance in cases of displacements for developmental projects. Nonetheless, this guide appears to be at the discretion of project developers when national/local regulations do not mandate their enforcement.

In a similar project in Rwanda, the project's outcomes were quite the opposite of the conclusions reached by Stock et al. (2023). The Rwamagana solar power plant was also built on lands used for farming, grazing, and other livelihood activities. However, unlike the Ghanaian case, the land was first acquired by an NGO that intended to use it to foster the professional development and integration of orphans and vulnerable youths after the 1994 genocide. Thus, the resettlement and compensations were done by the NGO before it leased out the land to the project developers to construct the solar power plant. In their study, Brunet et al. (2021) found that not only were the landowners satisfied with the compensation received, but the project also brought alternative livelihoods and employment opportunities for the affected people. They quoted one of their respondents saying "*Something happened with this solar farm (…) when it started, it was supposed to be a solar farm, but they also started growing mangoes and pineapples, and the women benefit from it. They learn more about agriculture*" (Brunet et al., 2021, p. 12). Fig. 9 shows the site of the Rwamagana solar plant.

As pointed out earlier, except in South Africa, no explicit regulations for energy justice were found in the studies reviewed. However, it is worth mentioning that African countries have legal and regulatory frameworks for managing the social and environmental impacts of developmental projects (Bekhechi & Merder, 2002). These include provisions for displacements, resource dispossessions, and resettlements

Fig. 8. Before (1) and after (2) scenes of Kaleo (a) and Lawra (b) solar power plants in the upper west region of Ghana.
(Images captured from Google Earth Pro by the authors.)

Fig. 9. Before (1) and after (2) of the construction of the Rwamagana solar plant, Rwanda.
(Images captured from Google Earth Pro by the authors.)

regarding the expropriation of land and other resources for projects. All large-scale clean energy projects are, thus, subject to these regulations, as seen in the example of Ghana. Nonetheless, these EIA regulations aim to ameliorate the negative consequences of these projects. While they may address some tenets of energy justice, explicit regulations specific to energy justice and JET are hard to come by.

Drawing from the case studies in Ghana and Rwanda and the current literature in Africa, it is thus unclear if energy justice or just energy transition should be viewed as a legal obligation or social responsibility. How this is viewed has implications for designing and implementing clean energy projects. In the Ghanaian case studies, for example, it is apparent that the project developer (state electric utility) strictly implemented the project within the current legal provisions, which do not ensure that squatters, non-landowners, and other vulnerable groups do not receive any compensation or assistance. In the Rwandese case, the developers took extra responsibility to ensure that the project created alternative livelihood activities, especially for women who were affected. Thus, the project was not conceived just as a single item with the sole aim of generating electricity but as a socio-economic package that brought additional opportunities for the local community.

A second factor worthy of consideration when delineating injustices is the degree of consultation and information about the clean energy project among the host community. Similar to the Ghanaian case studies, only people living in or close to the construction sites seem to have been consulted in developing the Rwamagana solar plant (Brunet et al., 2021). Such limited consultations have implications for delineating injustices, especially in research studies conducted in affected communities. Without wider consultations and involvement of the host communities, people tend to have different expectations from clean energy projects, consequently citing injustices if their expectations are unmet. This inadequate consultation potentially gives rise to what may be referred to as *misconstrued injustices*. For example, in the Rwanda case study, despite members of the community affirming that the solar PV plant has not affected their access to potable water, some residents would not understand why sometimes they did not have access to water in their homes while the solar power plant has constant access from a pumped water system.

Also, the people living near the plant had expected to receive free access to electricity once the project was complete; however, their expectations were unmet. Consequently, based on their interviews in the community, Brunet et al. (2021) concluded that the most significant weakness of the project was "the lack of electrification and drinking water pumping system for local residents" (p.19). Solar power plants require substantial upfront and operation and maintenance costs, with many investors seeking to profit from these projects. Thus, the idea of free electricity is whimsical and unrealistic, yet local communities may not understand this if they are not adequately informed about such projects. Therefore, in delineating injustices, it becomes crucial to consider the level of consultation and involvement of affected communities and the level of information shared with them regarding what to expect and what not to expect from clean energy projects in their localities. Without this contextual information, sentiments of injustice are likely to arise from the unmet expectations of community members, even though such expectations may not be justified within the scope and aims of the clean energy project being implemented.

Conclusion and recommendations

This study attempts to provide a nuanced view of the discourse on energy justice and JET in Africa. Having reviewed 26 case studies from eleven countries, it emerged that distributive injustices are more pronounced in clean energy transition projects on the continent. The findings suggest that notions of locating clean energy infrastructure in or closer to marginalized communities could bridge the energy divide between rural and urban communities, for example, may not bridge such divides depending on contextual conditions. This study finds that in several African countries, clean energy projects have not brought energy access to rural communities due to the high costs of connections as well as the objectives of some projects that tend to overlook local energy needs. Disparities in access to other benefits such as jobs, skills development, and knowledge transfer are also evident. Adequate involvement of local communities is necessary to instill a sense of local ownership and foster skills and knowledge transfer to enable local communities to participate in the energy transition equitably. Explicit regulations, as in the case of South Africa, are also needed to ensure that clean energy transitions foster socio-economic development in areas where they are implemented.

The spatial distribution/location of projects becomes essential to avoid creating or perpetuating inequalities. This study has shown that inequalities are the major effects of injustices in clean energy transitions in Africa. Such inequalities often emanate from distributional injustices and manifest as unequal access to energy services and employment opportunities. Recognition justice becomes essential for addressing these inequalities given that a key reason for the disparity in access to energy services is the low-income levels of rural dwellers as well as the failure of some projects to recognize local energy needs by focusing only on regional objectives such as implementing clean energy projects in rural settings to stabilize the national grid. The study also highlights the importance of considering contextual factors such as local regulations and the degree of consultations in host communities when delineating injustices.

Thus, for future studies, it will be essential to contextualize and establish the scale of injustices identified when applying the energy justice framework. As outlined in the Discussion section, procedural injustice, where there are inadequate consultations and involvement of local communities, could lead to misconstrued distributive injustices. When locals do not understand what the project is and is not, who will benefit from what, and who will not, they tend to form their

expectations. Once these expectations are unmet, a blunt application of the energy justice framework would easily identify such unmet expectations as injustices. It is, thus, necessary to go beyond identifying injustices to unpacking the underlying factors such as legal/regulatory provisions, land tenure arrangements, access to information, and resource dependency, among others, and how these factors relate to reported injustices. For policymakers, it is essential to be proactive instead of reactive to energy injustices where addressing injustice becomes important only after the damage has occurred. Applying JET principles throughout the planning and implementation process would foster a forward-looking approach that is preventive and strategic, ensuring that benefits and costs are fairly distributed.

Finally, we would like to highlight some possible limitations of our study. First, the literature search focused extensively on the SCOPUS database. While this search was complemented with reference analysis to identify additional suitable publications for inclusion, it is possible that some publications may not have been found during the search process. Web of Science is another useful source, but we could not access this database due to subscription restrictions. Nonetheless, SCOPUS is a leading database for peer-reviewed journals and contains publications from all major publishers across several disciplines, thus making it the ideal search site for most systematic reviews. Thus, the probability of any missed publications is minimal, and given the similarity of results reported by most of the studies reviewed, we anticipated that studies missed (if any) would not have any significant impact on our results.

We do acknowledge, however, that research on the subject is evolving fast, and there could papers that were not yet published at the time of this study. Thus, a similar study in the future could build on or serve as an update to this one by including articles whose publication came after this study was conducted. Also, it is plausible that studies focused on the socio-environmental impacts of clean energy projects may identify similar issues delineated as injustices in this study. However, this study focuses specifically on energy justice and just transition literature; thus, only studies that entail these keywords were targeted. Therefore, it was easier to identify and delineate the different forms of injustice because most studies presented their results thematically according to the energy justice tenets. Future research seeking to expand upon ours could consider investigating the interface between studies focusing on socio-environmental impacts and those explicitly dealing with JET.

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CRediT authorship contribution statement

Mark M. Akrofi: Writing – original draft, Visualization, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Benjamin C. McLellan:** Writing – review & editing, Supervision, Project administration, Funding acquisition. **Mahesti Okitasari:** Writing – review & editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Search strings

String	No. of publications
(TITLE-ABS-KEY ("Just energy transition" OR "energy justice" AND "renewable energy" OR "clean energy") AND AFFILCOUNTRY (africa))	28
TITLE-ABS-KEY ("just energy transition" OR "energy justice" AND "renewable energy" AND "africa")	30
TITLE-ABS-KEY ("energy justice" OR "just energy transition" AND "renewable energy" AND "Algeria" OR "Angola" OR "Benin" OR "Botswana" OR "Burkina Faso" OR burundi OR "Cabo Verde" OR "Cameroon" OR "Central African Republic" OR "Chad" OR "Comoros" OR "Congo" OR "Democratic Republic of the Congo" OR "Djibouti" OR "Egypt" OR "Equatorial Guinea" OR "Eritrea" OR "Eswatini" OR "Ethiopia" OR "Gabon" OR "Gambia" OR "Ghana" OR "Guinea" OR "Guinea-Bissau" OR "Ivory Coast" OR "Kenya" OR "Lesotho" OR "Liberia" OR "Libya" OR "Madagascar" OR "Malawi" OR "Mali" OR "Mauritania" OR "Mauritius" OR "Morocco" OR "Mozambique" OR "Namibia" OR "Niger" OR "Nigeria" OR "Rwanda" OR "Sao Tome and Principe" OR "Senegal" OR "Seychelles" OR "Sierra Leone" OR "Somalia" OR "South Africa" OR "South Sudan" OR "Sudan" OR "Tanzania" OR "Togo" OR "Tunisia" OR "Uganda" OR "Zambia" OR "Zimbabwe")	37
TITLE-ABS-KEY ("energy justice" OR "just transition" AND "renewable energy" AND "Algeria" OR "Angola" OR "Benin" OR "Botswana" OR "Burkina Faso" OR burundi OR "Cabo Verde" OR "Cameroon" OR "Central African Republic" OR "Chad" OR "Comoros" OR "Congo" OR "Democratic Republic of the Congo" OR "Djibouti" OR "Egypt" OR "Equatorial Guinea" OR "Eritrea" OR "Eswatini" OR "Ethiopia" OR "Gabon" OR "Gambia" OR "Ghana" OR "Guinea" OR "Guinea-Bissau" OR "Ivory Coast" OR "Kenya" OR "Lesotho" OR "Liberia" OR "Libya" OR "Madagascar" OR "Malawi" OR "Mali" OR "Mauritania" OR "Mauritius" OR "Morocco" OR "Mozambique" OR "Namibia" OR "Niger" OR "Nigeria" OR "Rwanda" OR "Sao Tome and Principe" OR "Senegal" OR "Seychelles" OR "Sierra Leone" OR "Somalia" OR "South Africa" OR "South Sudan" OR "Sudan" OR "Tanzania" OR "Togo" OR "Tunisia" OR "Uganda" OR "Zambia" OR "Zimbabwe")	39
(TITLE-ABS-KEY (("Just energy transition" OR "energy justice")) AND AFFILCOUNTRY (africa))	56
TITLE-ABS-KEY ("Just energy transition" OR "energy justice" AND "Africa")	89

Appendix B. Sample codes and quotations

ATLAS.ti Report

JET_Review

Quotations grouped by Codes

Filter:
Is coded with or with parents of Code "Distributive"
Report created by Mark Akrofi on Feb 14, 2024

○ Distributive: Costly requirements

Quotations:

1:43 ¶ 119 in Atlas_Data.docx

Content:

> This means that community members either have to purchase and replace specific items of electrical equipment, or rely on the DC-compatible ones supplied by the private sector utility that runs the mini-grids. Thus, there is a distributional justice deficit related to the additional costs accruing to community members who need to adapt to connect to a DC system

1:45 ¶ 128 in Atlas_Data.docx

Content:

> Capital subsidy for SHS is conditional upon households' ability to purchase BOS components

1:49 ¶ 174 in Atlas_Data.docx

Content:

> However, the majority of people living near the plant are not connected, mainly due to the high connection cost

---

○ Distributive: Grid stability vs local connectivity

Quotations:

1:42 ¶ 114 in Atlas_Data.docx

Content:

> In the Burkinabe case, the preference was to use the peri-urban territory for electricity production to stabilize the national grid, while the territory itself where the power plant was built, being under-the-grid, did not benefit

1:48 ¶ 157 in Atlas_Data.docx

Content:

> The installation process can be costly for customers and often overlooks local energy needs, as the goal is mainly to bring electricity to the district or administrative post seat to appear in government head- line metrics of increasing access, which make electrification appear more inclusive than it often is in practice

ATLAS.ti Report

JET_Review (2)

Quotations grouped by Codes

Filter:
Is coded with or with parents of Code "Lock-in/path dependency"
Report created by Mark Akrofi on Feb 21, 2024

○ Effects: Lock-in/path dependency

4 Quotations:

1:52 ¶ 58 in Atlas_Data.docx

Content:

-The state-owned electricity utility, Eskom is still reluctant to phase-out coal and invest in renewables (McDaid 2016). Thus, Eskom remains a central and powerful actor, thereby slowing down a just energy transition process.

1:64 ¶ 67 in Atlas_Data.docx

Content:

Overall, around 80 % of interviewees cited economic dependence on coal as the main techno-economic constraint slowing the transition to renewable energy

1:71 ¶ 125 in Atlas_Data.docx

Content:

During subsequent interviews, the project coordinator claimed that net- metered customers could not be credited because the PURC had not published an 'agreeable' tariff structure for full implementation of net metering policy and that agreements with customers were pending the new tariff guidelines before the conclusion of customer generation li- cense.

1:77 ¶ 162 in Atlas_Data.docx

Content:

During fieldwork, we observed that FUNAE often operates (para-doxically) in a centralized manner in installing off-grid renewables, with much of the planning and decision-making based in its Maputo headquarters. Its supply-based model has succeeded in rolling out en- ergy service projects to expand geographic coverage, but often with limited local consultation or commitment to capacity building.

. (*continued*).

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