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The centrality of energy transition: New global shifts and old realities for sub-Saharan Africa

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ABSTRACT

This article develops a new understanding of energy transition through a qualitative historical analysis of the links between 'so-called' global transition and histories of colonialism and capitalism in the sub-Saharan Africa. Drawing from 52 energy transition materials centered on Africa, the article critiques dominant emphasis on global transitions and proposes a multiplicity of transitions from a justice and African perspective and proposes an alternative dialogue that leverages national and regional experiences. We find that drivers of energy transition centre on capital pools and financial concentration and energy supply chains but that these ignore possible plurality of transitions – which is crucial for delivering just transitions – but plentiful evidence also exist showing that this misaligns with national visions and socio-economic and political realities. The paper shows how the current framings of energy transition contradict and are misaligned with national conditions that shape realities and possibilities. As a result, new global shifts in energy architecture, we argue, produces old socio-economic and political realities in the way the sub-Saharan Africa is being integrated in the energy transition. Thus, rather than present energy transition as a new dawn for structural transformation across the sub-region, the current structure and organisation of the transition presents historical continuities of dispossession where social formations are marginalised. We conclude that instead of portraying energy transition as a global phenomenon, emphasis should be placed on the multiplicity of transitions based on histories of colonialism and neoliberal capitalism. A variety of policy angles that can shape transitions and expansion of renewable energy sources in the region are discussed from an African perspective.

1. Introduction

Mainstream transition literature fails to grasp the concrete forms taken by existing hegemonic transitions globally. This for instance includes what transition means for countries whose histories and experiences unequally link to pioneers of green transitions. Specifically, the large-scale nature of the contemporary and globally coordinated

transition from fossil fuels to green energy sources raise questions of how African countries – the least contributors to GHG emissions but the most affected – perceive and experience the transitions. Some of these concerns, McNelly and Franz (2024) argue, relate to 'concentration on capital in large pools either under asset management of sovereign wealth funds invested on financial markets, and the de-risking' Wall Street Consensus. Yet, energy transition has frequently been viewed and

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advanced in isolation, ignoring the way different regions are integrated into the transition, including the national conditions that altogether shape outcomes. Literature glosses over the centrality of colonialism and capitalism as main drivers of anthropogenic climate change and how these have been experienced differently across African countries.

Energy transition is a structural transformation of the energy sector centering capital for new infrastructure and efficiency measures that shifts from reliance on fossil fuels to clean and more sustainable energy sources (Späth et al., 2022). Energy transition hinges on effective market mechanisms to drive electrified, efficient, interconnected and clean economies (i.e., harnessing wind, solar, electric vehicles opportunities) (Archer and Calvão, 2024). By 2050 solar energy sources will account for majority electricity demands in the world and is expected to expand even further (World Meteorological Organisation, 2022). Clean energy investments have since 2020 risen by 40 % (IEA, 2023). Recent reports show that in the Net Zero Emission, annual investment in clean energy rises to \$4 trillion by 2030, more than tripling 2021 levels. The combined size of the market for wind turbines, solar panels, lithium-ion batteries, electrolyzers and fuel cells represents a cumulative market opportunity to 2050 worth \$27 trillion. The estimated market for clean energy technology equipment such as batteries will in 2050 account for over 60 % of the total market. Whilst still ill-defined in terms of politics and material basis, energy transition arguably presents enormous market opportunities for equipment manufacturers, developers, service providers, engineering and construction companies along the entire clean energy supply chain (Mugume and Bulime, 2024; Ojekemi et al., 2022; Zakari and Khan, 2022).

It unsurprising that energy transition has emerged as an active arena for international collaboration (IEA, 2021). The Africa Energy Outlook 2022 stipulates that energy efficiency and renewables are key pillars for building Africa's new energy economy (IEA, 2022:4). The argument is that the energy transition can greatly improve energy access and livelihoods across Africa in ways that transcend purely economic benefits. A focus on various critical minerals such as lithium, nickel and cobalt in low-income countries raise important questions about Africa's integration (IEA, 2021). In Africa, this is inseparable from the livelihoods, growth and employment with demographic growth and growth in incomes further driving demand for energy services.

Investment in energy increased from 2.2 trillion USD in 2018 to 2.8 trillion in 2023, with most of this investment focused on clean energy and technologies. However, an estimated 4.7 trillion USD will be needed to meet Global demand for clean energy technologies (IEA (2023). This is further exacerbated by higher interest rate, meaning that, financing clean energy technologies has become increasingly costlier with implications for emerging markets and developing countries struggling with financing their energy transition agenda. For instance, energy poverty continues to affect SSA as 43 % of the population lack access to electricity. Africa's electricity is increasingly powered by renewable energy. Whilst Africa holds 60 % of best solar resources globally, SSA only accounts for 1 % of installed solar PV capacity. By 2030, achieving full access to clean energy in SSA calls for 1 % total global energy investment which stand at 25 billion USD per year. Current investments continue to fall short of these levels (EA, 2022).

Yet, drawing on a meta-analysis of 9597 publications across three leading energy journals, Sovacool, (2014) shows that the socio-technical transition literature is dominated by researchers from North America and Europe and predominantly focuses on the North Atlantic context. With backgrounds in engineering, energy studies, and economics, scholars of these outputs deploy quantitative methods. This strand of literature primarily focuses on policy and institutional environments necessary to implement and upscale green technology innovations and encourage investments in green technologies. However, this conceals essential elements that can visibilise African transition perspectives shaped by history and capitalism, and how African countries imagine and perceive energy transition. This gap has not been addressed by literature on degrowth (Schmelzer et al., 2022; Hickel and Slameršak,

2021); green extractivism (Wang et al., 2022; Kolie et al., 2024; Bos et al., 2024); eco-marxism (Bellamy Foster and Burkett, 2017); and the Green New Deal (Aronoff et al., 2019; Decker, 2020). Social science scholars in Europe and the United States offer different framings and entry points for analysing the green transition but their theorisation somewhat converges. Here we want to bring the lively debates of African perspectives shaped by colonialism and capitalism, and possible alternatives to the hegemonic green transition – so far glossed over in mainstream literature – to bare on our critical interrogation of the mainstream transition literature. Combining insights from the sub-Saharan transition literatures with political economy analysis of the role of inward foreign capital and elements of green extractivism, we argue that the mainstream view of energy transition converges on a gloomy note and fall in historical traps that treat African realities as appendages. We develop this argument by drawing on existing literature on energy transition, teasing out perspectives, possibilities and limitations for countries in the sub-Sahara.

Thus in this paper, it is the reflection on these realities in sub-Saharan Africa that we turn to. We seek to contribute to on-going debates about how to conceptualise the political economy processes of renewable energy transition from the perspective of sub-Saharan Africa, while also making a case for understanding the way the region is being integrated into the global energy shift on unsustainable and disadvantageous terms. This is interesting intellectually to understand economic barriers and their interlinkages to political histories and how configurations of power produce and reproduces inequalities and inequities within energy systems (Späth et al., 2022; Baker et al., 2014). The primary objective of this study is to explore and understand the centrality of energy transition, the integration of low-income countries and implications for justice from a sub-Saharan perspective. Subsidiary questions include.

1. What is the current understanding/framings of an Energy Transition and what are the implications?
2. What are the implications (social, economic, political, cultural elements) of the current energy transition on Sub-Saharan African countries?
3. How can an energy transition be framed and structured to ensure a just transition across energy, environmental, and climate change perspectives?

A political economy analysis can greatly help shed light on the context within which and the form energy transition is taking shape in Africa. This includes the implications of various critical factors such as deepening financialisation and related concentration of capital (Alami et al., 2021); reorganisation labour networks at global and continental level (Starosta and Charnock, 2016); and possibilities of technological leapfrogging for African countries and how sustainable this might be. This is significant given that in the West 'the energy transition has effectively been outsourced to the private sector,' with Governments relying on private firms, driven by the profit motive, to substitute carbon-free for fossil-fuel-based power generation resources' (Christophers, 2024a). An argument is made that conditions of an energy transition in SSA conceal essential elements of how Africa has previously been incorporated into global economic shifts on disadvantageous terms and those that fail to build knowledge and technological capacities shaped by histories of capitalism.

The rest of the paper is organised as follows. Section 2 discusses perspectives on energy transition, and this is followed by methods (Section 3). We discuss the current understanding and framing of energy transition in Section 4, which is followed by a discussion on the implication of this on sub-Saharan African countries (Section 5). Section 6 theorises how energy transition could be structured and organised from an African perspective. We offer final reflections in Section 7.

2. Perspectives on energy transition

Broadly speaking, energy transition refers to the shift from fossil fuel to a sustainable concept for sourcing and supplying of adequate, clean and affordable alternative energy sources (Ebhotu, 2021). The centrality of private actor investments underpinning energy transition has evoked among critical scholars, narratives about imperialism, neo-colonialism, neo-liberalism, subjugation, and extractivism (Kalt et al., 2023; Dunlap and Tornel, 2024). Concerns have arisen regarding the potential for equitable engagement with energy systems (Galvin, 2020; Wang et al., 2022) and the realization of energy sovereignty (Späth et al., 2022; Sovacool et al., 2023; Daggett, 2019; Lohmann, 2021). Ignored, the argument goes, are the realities of society and politics in developing countries, raising fears of extractive practices, and possible exploitation (Sovacool et al., 2023; Dunlap and Tornel, 2024). Within this perspective, questions about whether African countries can learn and manage their own energy sources/security, devise strategies for the transition with their own visions (Dunlap and Tornel, 2024).

The dominant narrative is that countries across the sub-Saharan Africa lack adequate capital to invest in large-scale energy projects. Inward FDI has been touted and mobilised as strategy for driving an African energy transition, but this has not been followed by a concrete agenda for a just energy transition (Müller et al., 2020). Private actors driven by capital gains have plugged themselves firmly in the energy transition agenda, advocating governance reforms. Market-oriented transition have a rich history on the sub-continent where social formations frequently fail to clawback sizeable revenue from FDI (Nölke et al., 2019; Bush, 2010). The history of capitalism and the asymmetrical nature of globalisation means that the efforts and outcomes of energy transition have been variegated. For instance, South Africa has received huge investments from the EU as part of the green transition strategy, forcing down prices but there remains internal resistance from energy monopolist and unionists (Müller and Claar, 2021). Elsewhere, oil dependent such as Angola, Gabon, and Nigeria have not actively promoted renewable energy (Müller et al., 2020). One key aspect of the energy transition point to labour implications and distribution of gains (He and Victor, 2017; Harrahill and Douglas, 2019; Jasiński et al., 2021; Svobodova et al., 2021). For countries in Africa, how the transition could be structured to minimise socio-economic dislocations through guarantees of growth and economic development remains an important but unanswered question (Neofytou et al., 2020; Oei et al., 2020; Chen et al., 2023; Doelle and Majekolagbe, 2023; Ge, 2023; Han et al., 2023; Kaijie and Jin, 2023). There are questions about accessibility to alternative clean energy sources in energy poor countries (Long and Zhang, 2012; Nwanekezie et al., 2022; McCauley et al., 2022a,b). Here, justice scholars focus on distributive, recognition, procedure, restorative perspectives of justice in transitions.

Justice scholars ask questions about fair distributions of costs, benefits, and risks associated with energy transition – distributive justice (Iwińska et al., 2021; Malakar et al., 2024; Feenstra and Özerol, 2021; Barry et al., 2020; Cha, 2020; Upham et al., 2022; MacNeil and Beauman, 2022). They raise concerns about potential job losses and possibilities of economic downturns (Malakar et al., 2024). There are calls and efforts to engage vulnerable communities that rely on industries such as coal to assess impacts of the transition, acknowledging the related complex influences (Cha, 2020; MacNeil and Beauman, 2022). Within this perspective, the socio-economic, political, and cultural impacts of the transitions on vulnerable countries is a crucial area of research.

Scholars call for the identification of disadvantaged countries, communities, recognising/advancing transitions as negotiated processes among stakeholders in decision making – recognition justice (Malakar et al., 2024). Recognition of stakeholders acknowledges local views, needs, rights, vulnerabilities, and dignity of integrated communities (Gillard et al., 2017; van Uffelen, 2022). This includes societal histories and the centrality of capitalism in the contemporary world. From an

energy justice perspective, respecting and recognising people's experiences, histories and perspectives should inform policy formulation and implementation (van Uffelen, 2022).

Justice scholars also call for participatory and inclusive engagement of stakeholders in decision making – procedural justice (Jenkins et al., 2016). They argue that fairness should underpin decision-making process about energy transition (Malakar et al., 2024). For Africa, the argument goes, energy transition procedures ought to be inclusive and present a significant chance to enhance economic development and livelihoods. Community engagement can foster ownership, acceptance and legitimacy (Jenkins et al., 2016). However, a focus on investments and market opportunities related to energy transition can discriminate and exclude communities and other stakeholders (Gibson-Wood and Wakefield, 2013). Whereas equal access to information and active participation in decision making is important (Xavier et al., 2017), these processes are not always guaranteed (Iwińska et al., 2021). In fact, energy governance continues to be viewed in isolation, ignoring equity concerns.

Scholars are asking how infrastructure and energy transformation programmes in energy transition can make up for the injustices of the past – restorative elements of justice (Hearn et al., 2021). They are critical of opportunities for granting remediation for injustice that have been inflicted on countries based on historical harms (Schormair and Gerlach, 2020). The argument is that by engaging the energy transition, actors and decisions are compelled to engage the *longue durée* of energy transition and the related implications (Heffron and McCauley, 2017). Restorative justice can underpin other forms of justice (Lacey-Barnacle, 2020). Specifically, the concerns with the unjust distributions of costs, benefits, and risks of energy transition, unjust exclusion of stakeholders in the society and discrimination in decision making can be remedied through restorative justice. These elements however require an analysis of the current framing, and centrality of an energy transition, and its implications for developing countries south of the Sahara.

To some scholarly debates and policies, the green transition is a socio-technical endeavour of shifting from fossil fuels to renewable energies. Initially, the centrality of transitions revolved around socio-technical energy systems shaped by a wide range of elements – institutions, actors, infrastructure and knowledges (Markard et al., 2012; Sovacool, 2014). In these early debates, McNelly and Franz (2024) note that one of the central preoccupations was identifying regulatory barriers, financial bottlenecks, and path dependencies blocking the shift from fossil fuel-based energy systems to renewable energy systems. Here scholars emphasize policies for enhancing synergistic relationships between public and private sector, innovation strategies and/or institutional frameworks supporting technological innovations that can facilitate the shift from one energy source to another (Kemp et al., 1998; Schot and Geels, 2008; Geels, 2005).

As McNelly and Franz (2024) fittingly note, the theoretical standpoint for such socio-technical perspectives on energy transitions is twofold: (1) transitions come as a result of technological innovations, and (2) that the dynamics of transitions should be seen as contained by a relatively coherent system' (pge.2). For this strand of literature, new technologies and innovative energy systems that can help to promote the transition to cleaner energy systems are central and are a question of actors, institutions, capital and policy environments. This lens, however, ignore questions of ethics, power, and politics, raising the need to integrate – more fittingly – the politics of energy transition. Even these efforts rely heavily on effective implementation of socio-technical transitions and related policy processes (Kohler, 2019; North, 1990). Scholars such as Kern and Rogge (2018) focus on policy process theories and their applicability in transition studies whilst Edmondson et al. (2019) highlight how policymaking processes can influence the rate and direction of socio-technical change towards sustainability. As McNelly and Franz note, "all these different attempts to bring power and politics into the mix share the same focus: encouraging the innovation and application of new technologies within the energy sector" (pge2).

In extension, we see idealised politics and the state that are at variance with realities in sub-Saharan Africa. Even scholars that critique politics of transitions such as [Meadowcroft \(2009\)](#) fail to offer radical retheorisation of transition, suffering from limited political space. A focus on tax regimes, planning and regulation among critical energy scholars means that public policy remains the guiding feature, and the state remains an objective of politics. As Swyngedouw (2010: 195) contends, this “forestalls the articulation of divergent, conflicting and alternative trajectories of future socio-environmental possibilities and of human-human and human-nature articulations and assemblages. It holds on to a harmonious view of Nature that can be recaptured while re-producing if not solidifying a liberal capitalist order for which there seems to be no alternative.” As a result, energy transitions remain predominantly technical exercises of changing energy systems within existing state policy structures. In Africa, these structures must contend with history and capitalism.

Politics are instrumentalised as pathway for facilitating rather than constraining energy investments. This has enabled a discourse where transitions are seen as technical, developmentalist and ‘one-size-fits-all.’ To McNelly and Franz (2024), the story of energy transition should be a story of politics – “a terrain of struggle, of political contestation” (pge 2), raising questions about structures of colonialism and capitalism that altogether contributed to the climate crisis and shape imaginaries of energy transitions. A focus on the finalisation in mainstream literature conceal possibilities of democratisation, decolonization and self-determination, including justice whilst curving up new frontiers for the extraction of critical minerals. In Africa, the energy transition interlinks with a set of complex energy systems and challenges. Colonial histories shape structure and discourses, policies and infrastructures that shape energy transitions. Fair and inclusive energy transition initiatives that account for socio-economic disparities are crucial ([Wang et al., 2022](#)).

3. Methods

We review current understanding and framings of energy transition with a particular focus on sub-Saharan Africa. We critically examine relevant studies, exploring the state of play of the energy transitions. We examine the implications of the energy transition on sub-Saharan African countries, examining the social, economic, political, and cultural aspects. We offer a holistic understanding of the multifaceted impacts of energy transitions in the region, effectively blending qualitative insights

with quantitative data to offer a comprehensive evaluation of how energy transition has been framed and structured and what this means from a justice perspective.

We retrieved data Scopus database, targeting recent publications ([Golizadeh et al., 2020](#)), Google Scholar and Web of Science ([Xue et al., 2020](#)). The retrieval process began with a combination of keywords such as “energy transition,” “energy justice,” and “drivers of energy transition,” targeting studies focused on sub-Saharan Africa. The initial search resulted in 1011 articles, and the initial selection based on the title and abstract review yielded 115 papers. A full-text review narrowed the selection to 27 papers directly relevant to sub-Saharan Africa. Papers not focused on sub-Saharan Africa were excluded. To ensure wide coverage, information, snowballing method was employed. We used both backward and forward snowballing, looking through the chosen papers’ references lists for more pertinent sources and checking the citations of these articles to find more recent works ([Taiwo et al., 2023](#)). Our iterative method enabled a thorough grasp of the literature, uncovering other sources previously overlooked during the initial search. 25 additional articles were found ($n = 52$).

We sourced grey materials from the World Bank’s World Development Indicators database, generating descriptive statistics ([Baye et al., 2021](#); [Apergi et al., 2024](#)). This dataset spans the period from 1990 to 2021, providing a comprehensive coverage. We generated insight on distribution of access to electricity, clean fuels and technology in SSA. The time series data includes critical metrics such as the percentage of the population with access to electricity and the percentage with access to clean fuels and technologies for cooking. The extensive duration of the dataset allows for a robust analysis of trends and patterns over three decades, offering valuable insights into the effectiveness of policies and energy justices as currently framed.

We relied on content analysis of text as they relate to our primary question. Broad thematic areas were generated that formed the basis for addressing specific questions. Similar thematic areas were collapsed and merged for brevity and effectiveness in the generation of arguments. The actual analysis is based on primary ($n = 25$) and secondary sources.

4. Current understanding and framings of energy transition?

The dominant understanding in the current energy transition is that this is a global transition. Unlike previous energy transitions, the current one has been shaped by concentrated pools of private capital to be disbursed accordingly in financial markets and under the auspices of

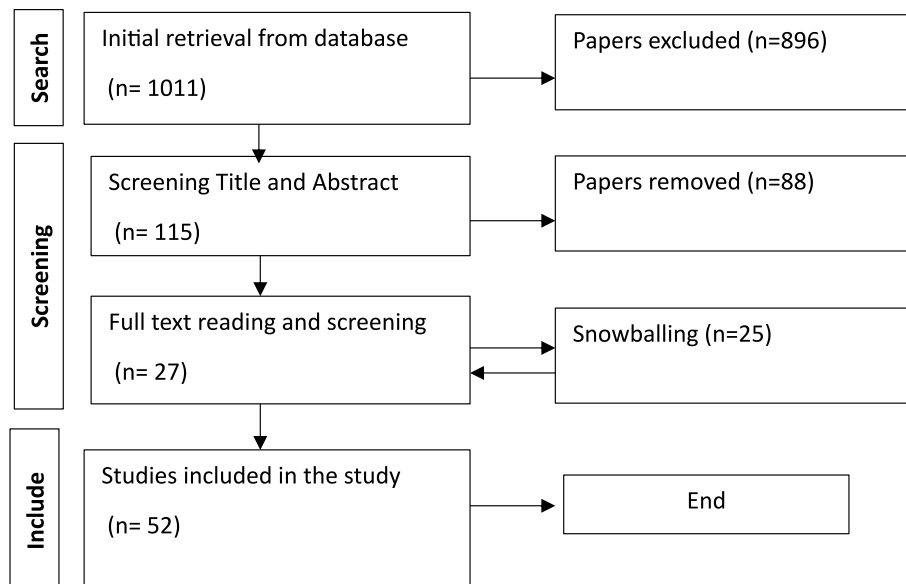


Fig. 1. Publication retrieval flow diagram.

Wall Street Consensus (McNelly and Franz, 2024). However, this understanding is problematic for several reasons in countries in Africa specifically that: 1) it remains hegemonic, and 2) glosses over histories of colonialism and capitalism in sub-Saharan Africa, and how this has shaped poverty and underdevelopment and low industrial capacities which ipso facto affect the depth of energy investments needed. The core elements of the energy transition relate to mitigation efforts, deployed alongside the vision to promote long-term environmental sustainability.

Presenting energy transition as global conceals essential elements. Of how histories of colonialism and capitalism shape African economies and raises risks of integration on unequal terms. Some of this relates to the nature of energy poverty in the region and the state of play of infrastructure and energy networks. Combustible biomass, albeit a less expensive renewable energy source, emits a lot of carbon-dioxide and is primarily used in many sub-Saharan African nations for cooking and heating (da Silva et al., 2018). Although biomass is a renewable resource, using it emits significant amounts of GHGs that are harmful for the environment and human health (Baye et al., 2021). How the transition could guarantee less expensive and more environmentally friendly biomass substitutes for poor communities, and climate vulnerable populations is less clear if not less emphasised in current debates. More widely, the existing reliance on biomass highlights the socioeconomic obstacles associated with switching to more sustainable energy sources. Here, a fair energy transition needs to tackle these obstacles by guaranteeing that substitute energy sources are not only ecologically sound but also reasonably priced for the local populace. These should equally leverage rather than dislocate social and cultural factors in adapting communities (Bainton et al., 2021.).

Most sub-Sahara African countries rely on firewood, charcoal, and other conventional fuels for cooking, including cow dung or agricultural waste (Matavel et al., 2023). A call for rapid transition to clean energy (e.g., SDG, 2023; Phogole et al., 2022a,b; Murshed, 2022) would thus be unrealistic without considering the vulnerability of households dependent on unclean energy for cooking and other uses. This relates to a wider lack of access to electricity in larger part of the sub-Sahara region (Grant et al., 2021; Emodi et al., 2022). This raises the need for a gradual and cautious implementation of the energy transition than the rapid push for transition seen in some countries such as South Africa, which threatens to dislocate national capacities, labour relations and policy sovereignty. Despite this hype, coal dominates the energy mix with state-owned utility Eskom suffering capacity challenges. Whilst key players influence policy formulation have an incentive to support coal, there is evidence the support for renewable energy-based power production gaining traction but tis not sufficiently represented in policies (Hanto et al., 2022). Framing energy transition as a global feature insufficiently addresses the immediate needs of populations in SSA lacking access to clean energy and facing histories of economic marginalisation (Murshed, 2022). A just energy transition must offer affordable and appropriate alternatives considering the peculiarity of the populace lacking access to basic energy sources across sub-Saharan Africa. Poverty, unemployment, and insufficient energy infrastructure are common features in the region. Yet, the current debates focus predominantly on investments and market imperatives (Pelletier et al., 2021; Phogole et al., 2022a,b; Pavanelli et al., 2023). A fair energy transition requires inclusion of stakeholders into decision-making away from top-down framings imposed on actors. This must be followed by a clear reflection on the negative impacts of the transition and what this means for vulnerable communities.

Sub-Saharan Africa's energy transition endeavours are being shaped by financial and economic gains, driving raw material exports (Dingru et al., 2023). Recent reports reveal mining operations in South Africa for critical minerals in energy transition infrastructure are affecting natural resources and ecosystems (Sun et al., 2023). The demand for critical metals is expected to rise sharply worldwide until 2050 (Cole, 2023). Scholars are divided on the economic growth potential of green transitions (Nyoni and Phiri, 2020). Energy security is a challenge for the

sub-region which is compounded by low capital mobilisation (Chireshe, 2021). The argument is that the region lacks sufficient capacity to invest in renewable energy technologies and industries. The case of South Africa shows that the push for a rapid energy transition can make it more difficult to overcome challenges of outdated infrastructure, misappropriation of funds from energy projects, poor maintenance, and frequent infrastructure breakdowns (Hanto et al., 2022; Ebhota, 2021). The assumption that renewable energy can be a catalyst for sustained economic growth requires comprehensive policies that can address the just distribution of resources for energy infrastructure, recognising the region's unique historical and contemporary challenges. For African countries, energy justice should prioritise building economic and development capacities in adjusting countries that could expand local socio-economic opportunities and industrial capacities.

For instance, Nyoni and Phiri (2020) have shown that South Africa energy transition is at variance with future economic opportunities and livelihoods. Despite reduced renewable energy prices, achieved amidst resistance from energy monopolists (Müller and Claar, 2021), the lack of significant positive livelihood impacts for South African populations contradicts the assumption that energy transitions automatically stimulate economic growth in sub-Saharan Africa. Green transitions lacking consideration for national and local interests are inherently limited. National labour unions express concerns that the energy transition vision is perceived as an externally imposed agenda. Prioritising economic gains as opposed to broad-based efforts around accessible, affordable, and adequate clean energy is being seen as unjust. This is pitted against arguments that developed country historical dependency on coal. The formal economy is widely recognised for its marked male-bias. In sub-Sahara Africa, policies about energy supply, demand, and prices often reinforce labour market practices that persistently discriminate against women in financial compensation and hiring practices (Njoh et al., 2022). Gender intersects and influence the way energy transition should be imagined and implemented (Muza and Debnath, 2021).

Energy transition in Sub-Saharan Africa highlights the importance of politics, power, equity, and socioeconomic imperatives. The electricity sector is thus a site of struggle over ownership, governance, and access (Hanto et al., 2022; Bouzarovski et al., 2017; Lockwood et al., 2017). Here technologies are never neutral, and this highlights the influence of disruptive technologies against established power structures. (Baker and Phillips, 2019). However, the sub-Sahara Africa energy sector have a long-standing history on liberalisation of state ownership of electricity (Sen, 2014). Liberalisation of the sector was predicated on World Bank loan conditionalities (Grant et al., 2021) and the passive continuous failure of state to adequately investment in energy infrastructure (Baker and Burton, 2018). Nonetheless, the evolution of disruptive technologies is challenging the existing state owned and centralised electricity policy for decentralised energy infrastructure policy (Verbong and Geels,

Table 4.1
Carbon efficient sub-Sahara Countries and energy transition drivers.

S/ N	Country	Environmental indicator 1	Energy transition influencers in sub-Sahara Africa
1	Benin	CO2 efficient	Donor driven
2	Burkina Faso	CO2 efficient	Donor driven
3	Burundi	CO2 efficient	Market driven
4	Congo, D.R.	CO2 efficient	State driven
5	Cote D'Ivoire	CO2 efficient	Donor driven
6	Ethiopia	CO2 efficient	State driven
7	Malawi	CO2 efficient	State driven
8	Mali	CO2 efficient	State driven
9	Rwanda	CO2 efficient	Donor driven
10	Tanzania	CO2 efficient	State driven
11	Uganda	CO2 efficient	State and Donor driven
12	Zambia	CO2 efficient	State and Donor driven

2010). What is unclear is how new energy supply chains can address energy poverty across the region – and whether this is fundamentally what this is all about.

The over reliance on external fund for renewable energy initiative in the sub-Sahara Africa has raised questions around neo-colonialism, and subjugation (Dunlap and Tornel, 2024). For instance, despite small contribution to global greenhouses emission in the region when compared to industrialised countries, rapid energy transition initiatives are deeply rooted in the agenda of global bodies such as, United Nations, World bank et al., (Karekezi, 2002; Phogole et al., 2022a,b; Murshed, 2022). The energy transition in South Africa have been made possible by funding from the EU, which raises questions about the nature of the vision and that this might be asymptotic to local aspirations. There are several factors that remains challenging to African countries. Some of this relates to country risk factors, including institutional and legal systems for the deployment of RES (Khan et al., 2022). There are concerns of corruption, bureaucratic procedures, cronyism, lack of innovation and mechanisms and poor synchronisation systems (Wiredu et al., 2023). More broadly, without the necessary infrastructural capacity, the African countries will fail to maximise market opportunities – related to RES. And a focus on policy and investment barriers is not enough without a consideration of historical trajectories and complex politics shaping national transitions.

5. What are the implications of energy transition on Sub-Saharan African countries

As with previous development propositions, Africa is again in uncharted territories facing a daunting prospect. A reliance on non-RES sources of energy such as coals and wood for domestic and industrial activities alongside a transition towards RES could present even more development challenges (Adeleye et al., 2021). A marriage between RES and prospects for economic development and industrialisation is rarely conflated, and seriously interrogated. The heavy presence of carbon inefficient industries on the regional is telling, but this should inform transition pathways.

Table 4.1 illustrates the region's low carbon efficiency, with only a few countries, such as Benin, Burkina Faso, Burundi, Congo, Dem. Rep., Cote D'ivoire, Ethiopia, Malawi, Mali, Rwanda, Tanzania, Uganda, and Zambia, described as carbon efficient, largely due to their considerable consumption of renewable energy (Baye et al., 2021). However, these countries predominantly rely on renewable energy from traditional sources and fossil fuels, which serve as a cheaper alternative to cleaner forms of renewable energy consumption (Ergun et al., 2019). The reliance on traditional and fossil fuels in this region implies that a rapid transition could worsen prevalent energy poverty.

Private investors and donors play a significant role in driving energy transition policy in this region. For instance, the World Bank is a major

driver of energy transition in carbon-efficient countries such as Burkina Faso, Ethiopia, Malawi, Rwanda, Tanzania, Uganda, and Zambia. Meanwhile, among the carbon-efficient countries, such as Benin and Mali, state actors such as ECOWAS and the African Development Bank drive energy transition policy formation and implementation (Müller et al., 2020). It is easy to see how policies for accessing funds for energy investments can drive external agendas and misalign with peculiarities of the region and countries (Grant et al., 2021; Baker and Burton, 2018). There are also implications of framing investments as facing the same transition problem.

According to Baye et al. (2021) countries such as Angola, Cameroon, Gabon, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, Togo and Zimbabwe are carbon less efficient. Like the carbon efficient countries (Table 4.2), these have mostly been influenced by foreign donor entities such as World bank, European donors, Japanese donor, USAID, UNDP, IMF, and Africa development bank. Most often these do not reflect the histories and experiences of the regions/countries (Müller et al., 2020). The dependence on transitional approaches that do not reflect histories and experiences of capitalism mean that local capacities remain ignored, entrenching accumulation by dispossession (Müller et al., 2020; Pelletier et al., 2021; Phogole et al., 2022a,b; Pavanelli et al., 2023). The state over dependence on donors and private entities have previously encouraged extrativism and this is likely to be the case (Müller et al., 2020; Kalt et al., 2023). International resource sourcing strategies are complex and resource-led development models by the international financial institutions has produced disastrous outcomes in Africa (Bainton et al., 2021; Ebhota, 2021). There are questions of how the current energy transition, driven by different set of push factors can generate neocolonial dependencies, global inequalities, and unequal ecological exchange (Kalt et al., 2023). In SSA, extractive activities associated with mining practices negatively affect community water access and are linked to high poverty levels in host areas (Cole, 2023; Dingru et al., 2023). Furthermore, mine dust, including PM 2.5 and PM 10 particles, poses significant health risks to populations living within 1 km of the mining sites (Ebhota, 2021). Energy transition is more likely to make more visible gaps in environment policy and regulations.

Energy access and utilisation should be a key aspect of energy transition (see Fig. 1). As shown in Fig. 2, despite the region's vast renewable energy potential and trade in natural resources, most development indicators are lacking. The sub-Saharan Africa region has made little progress in improving electricity access over the years, including expanding their industrial capacities. The energy transition advances extraction of raw materials and exploitation of markets for energy technologies (Bainton et al., 2021; Ebhota, 2021; Kalt et al., 2023; Dingru et al., 2023; Giwa et al., 2023). The current framing of the energy transition is distributively-unjust, as it limits the region's industrialisation and economic growth.

A critical examination of access to electricity in sub-Saharan African countries is essential to grasp the implications of the current framing of energy transition. According to World Bank data depicted in Fig. 3, only Gabon, Cape Verde, and South Africa boast over 90 % access to electricity among their populations. Conversely, nations like Togo, Congo, Zimbabwe, and others have less than 50 % access. Overall, most sub-Saharan African countries have less than 60 % of their population with access to electricity. In Nigeria, the widespread use of gasoline-fuelled generator sets as a reliable power source poses significant environmental and health risks due to their emissions (Giwa et al., 2023). Also, heavy reliance on wood fuel for cooking, heating, and lighting in Malawi, a country with some of the lowest rates of power access in Sub-Saharan Africa, results in indoor air pollution, grave health risks, and extensive deforestation (McCauley et al., 2022a,b). In addition, a rural Zambian district without electricity, a battery system with 100 % photovoltaic (PV) power is achievable. However, the high initial capital cost of solar energy projects in Zambia, compared to diesel-based facilities, leads off-grid villages to opt for diesel power plants (Mulenga

Table 4.2

Carbon inefficient sub-Sahara Countries and donor driven energy transition drivers.

S/ N	Country	Environmental indicator 2	Energy transition influencers in sub-Sahara Africa
1	Angola	less CO2 efficient	State driven
7	Cameroon	less CO2 efficient	State driven
18	Gabon	less CO2 efficient	Donor driven
20	Ghana	less CO2 efficient	State driven
23	Kenya	less CO2 efficient	State driven
26	Madagascar	less CO2 efficient	Donor driven
31	Mozambique	less CO2 efficient	Donor driven
32	Namibia	less CO2 efficient	Donor driven
34	Nigeria	less CO2 efficient	State driven
37	Senegal	less CO2 efficient	Donor driven
41	South Africa	less CO2 efficient	State driven
45	Togo	less CO2 efficient	Donor driven
48	Zimbabwe	less CO2 efficient	State driven

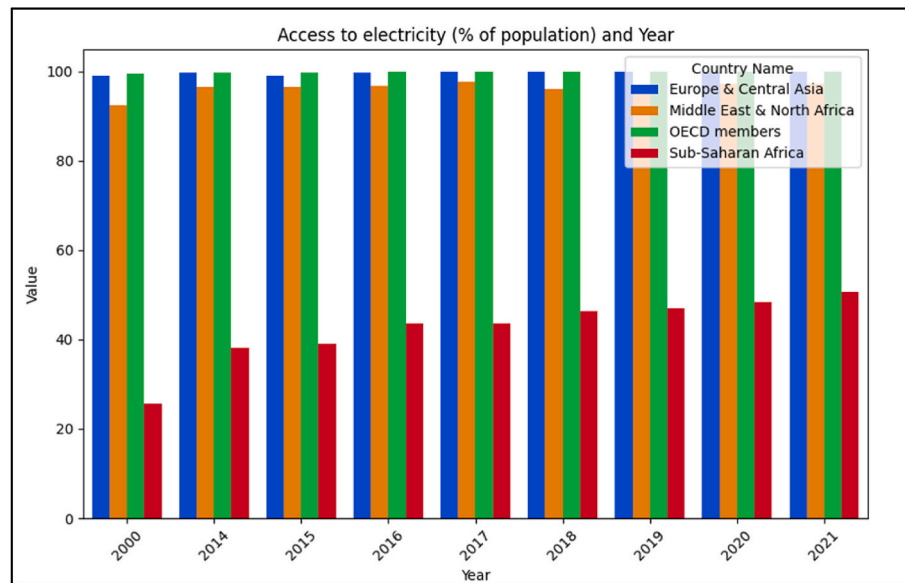


Fig. 2. Percentage population with access to electricity **Data source: Glossary | DataBank (worldbank.org).

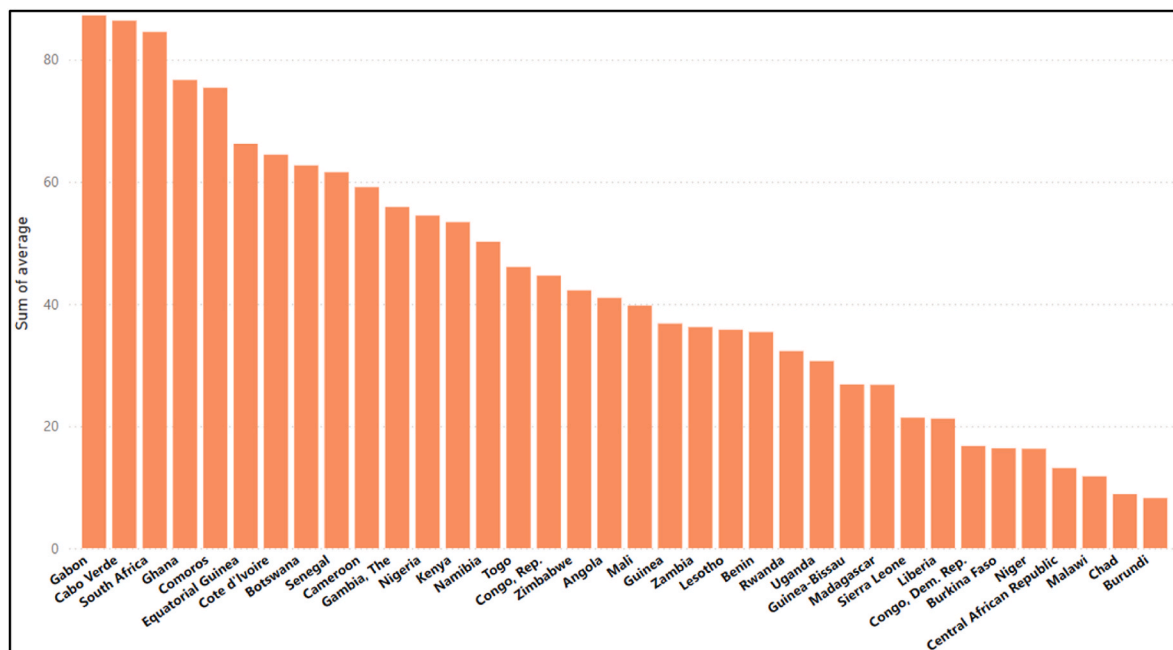


Fig. 3. Access to electricity (% of population) in sub-Saharan Africa countries **Data source: Glossary | DataBank (worldbank.org).

et al., 2023). We see a region faced with power shortages partly due to inadequate infrastructure and poor governance. These realities are more likely to worsen through the global energy transition (Ebhot, 2021). This implies that for energy transition to be fair issues of access to electricity should be central – one that defines transition from an African perspective.

For instance, integrating existing fossil-fuelled power systems with renewable energy technologies is considered cost-effective and straightforward pathway to solving energy access in sub-Saharan Africa (Mukhtar et al., 2023). However, the region faces challenges such as limited job creation due to automation by extractive companies and a shortage of renewable technical expertise and manufacturing infrastructure (Ebhot, 2021; Koepke et al., 2023). Achieving equitable access to electricity requires increased investment in green innovations tailored to the region's specific needs of job creation, access to electricity and

industrialisation while leveraging international financial resources (Musah et al., 2024). A procedural and recognition justice response to these energy challenges is feasible but must be built upon recognising local players and inclusive governance structures which will lead to more effective investment systems. (Mukhtar et al., 2023).

Fig. 4 illustrates the stark disparity in access to clean energy for cooking between Sub-Saharan Africa and other regions such as the OECD, Middle East, North Africa, Europe, and Central Asia. Over 80 % of the Sub-Saharan population lacks access to clean cooking energy. This inequity highlights histories, poor investments and weak governance systems overtime (da Silva et al., 2018; Baye et al., 2021). Women and girls are particularly affected, as household chores and cooking with fossil or solid fuels expose them to harmful emissions, impacting their wellbeing (Winther, 2015). Beyond health implications, the burden of sourcing cooking energy falls on women and girls, detracting from

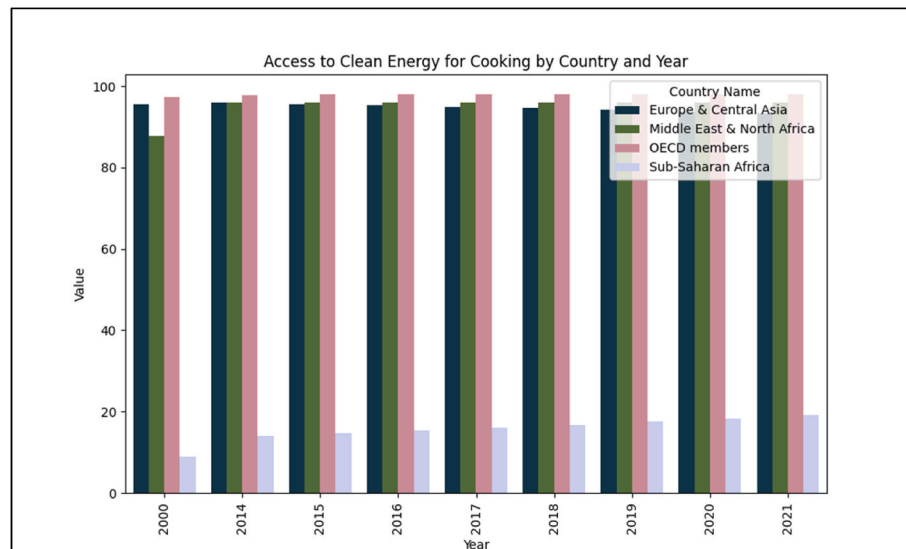


Fig. 4. Percentage population with access to clean energy for cooking **Data source: Glossary | DataBank (worldbank.org).

opportunities such as education, employment and empowerment (Njoh et al., 2022). This underscores deep-rooted socio-cultural and economic challenges facing the region (McCauley et al., 2022a,b). This distributive injustice as observed in the region has implications such as on persistent energy poverty, energy insecurity, which has health implications (Johansson et al., 2012). Integrating equity can ensure that are recognition justice is entrenched in the energy transition policies.

Fig. 5 shows countries most impacted by the unfair distribution of clean energy in the Sub-Saharan Africa. In these countries, less than 20 % of the population has access to clean energy and technology for cooking. Majority of the population depend on fossil fuel for cooking, exposing themselves to harmful gases Grant et al., 2021). Transition to clean energy for cooking will require targeted investment in renewable energy (Mukhtar et al., 2023). However, a one size fit all approach seen in anglophone literature can create unjust distribution (McCauley et al., 2022a,b). Lack of Recognition justice in domesticating clean energy technologies for cooking impedes the region from developing appropriate energy visions that can guarantee access to affordable renewable energy (Baye et al., 2021; Gasparatos et al., 2022).

6. How can energy transition be framed and structured for countries across sub-saharan africa?

The current framing of energy transition in Sub-Saharan Africa has significant implications for the integration of African countries and consequences for resources. In this section, we reflect on how energy transition can be framed and structured to create an inclusive model that seeks fairness. Fairness in this context refers to a just transition that encompasses energy, environmental, and climate justice from an African perspective (Bainton et al., 2021). Achieving this requires the integration of distributive, procedural, and restorative constructs to emphasize past, present, and trajectories of energy transition (McCauley and Hefron, 2018). This means that the current framing needs be reorganised and expanded to include the concept of recognition of histories of colonialism and the workings of capitalism on the continent (Gillard et al., 2017; van Uffelen, 2022). This includes the role and importance of international financial institutions in creating economic conditions for energy transition.

This enlarged concept that integrates of distributive, procedural, recognition and restorative is crucial. Possibilities of unintentionally worsening already-existing injustices should be considered. For example, the procedural component of justice makes ensuring that decision-making procedures are transparent and inclusive, giving

impacted populations a voice in the policies that affect their daily lives is important in appreciating differing worldviews (Jenkins et al., 2016). This could be achieved by democratisation and decentralization of energy sources, increasing local environmental engagement and management (McCauley et al., 2022). The goal of distributive justice should be to ensure that marginalised communities are not disproportionately affected by the energy transition, distributing benefits and costs equally (Iwińska et al., 2021; Malakar et al., 2024). Restoring the rights of individuals who have been historically disadvantaged should be the goal of restorative justice, which tackles historical injustices (Schormair and Gerlach, 2020). Making sure that the energy transition process respects and recognises the contributions of all stakeholders, and advance democratic energy transition processes into frameworks. This all-encompassing framework should improve the sustainability and efficacy of energy transition programmes in the region from a genuine justice perspective (McCauley et al., 2022).

A focus on the most vulnerable, women and children wellbeing should allow for a comprehensive approach. Consideration should be made to ensure that energy transition does not facilitate new forms of socio-cultural and economic vulnerabilities (Grant et al., 2021; Matavel et al., 2023). Energy poverty can affect opportunities for education and empowerment (Njoh et al., 2022), but energy transition should consider pre-existing inequalities. The disproportionate access to clean cooking technologies as observed must be addressed by strategically granting access to education and training opportunities and to develop appropriate energy technologies socially, culturally and economically.

Sub-Saharan Africa needs a comprehensive framework that addresses, affordability and access to technologies. Due to the region's widespread lack of access to power, deliberate efforts must be made to electrify rural areas, with funds specifically distributed to the creation of sustainable energy solutions suited to the requirements of each region. To meet the socio-cultural variety throughout a country, a one-size-fits-all strategy to rural electrification is insufficient. Sen (2014) emphasises that these broad approaches fall short in taking into consideration the unique needs and circumstances of various communities. Elements of distributive justice can be observed in countries like Benin, Botswana, Ethiopia, Madagascar, Uganda, Nigeria, Malawi, Mozambique, Rwanda, and Zambia, where efforts have been made to improve access to rural electrification (Müller et al. (2020)). Initiatives in these countries include funding for off-grid electrification projects, which aim to extend electricity access to remote areas. Müller et al. (2020) note that these efforts, while commendable, often fall short of fully addressing rural consumption needs. One significant challenge is the underestimation and

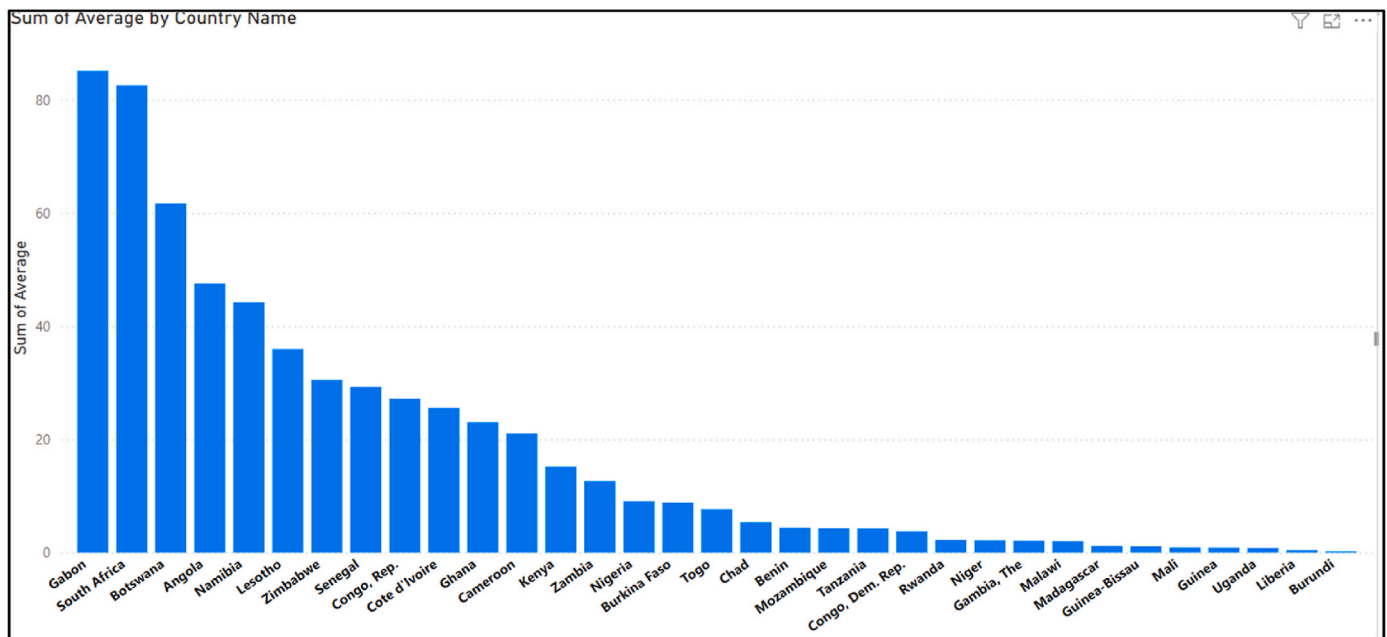


Fig. 5. Access to cooking energy and technologies (% of population) in sub-Sahra Africa countries **Data source: Glossary | DataBank (worldbank.org).

under-representation of rural consumption needs in both national and international off-grid electrification initiatives (Koepeke et al., 2023). This gap highlights the importance of recognition justice and procedural justice, acknowledging and addressing the specific needs and circumstances of rural populations (Kumar et al., 2021). However, more needs to be done. Effective rural electrification strategies must involve local communities in the planning and decision-making processes, ensuring that their voices are heard, and their needs are adequately represented.

7. Conclusion and policy implications

The current energy transition has proceeded without due consideration of what this means from a sub-Saharan African perspective. This review paper frequently returned to the centrality of an energy transition and implications for developing countries in Africa. Energy transition has been advanced as climate mitigation. Research into the implications of the transition for SSA countries remains an active area of research. However, ignored in dominant narratives are regional and national politics, presenting energy transition as global and as a technical adjustment rather than a set of difficult political and economic choices to be negotiated nationally and locally at overlapping scales. The energy transition should not be developmentalist in nature (although this is surely part of) or 'one-size-fits-all' that homogenises countries. Reflecting on the histories of colonialism and neoliberal capitalism, our study suggests energy transition risks producing structural dependency at macro levels and dislocations at local levels. Organisational learning and spill overs at firm levels are not guaranteed. We argue that energy transition as currently framed risks eroding present capacities among sub-Saharan African countries, raising new development fragilities. Some of this relates to how the transition itself is structured and organised from an economic and growth perspective, ignoring troubled histories of colonialism and experiences of capitalism. The role of local agency is crucial, which raises the need for a cautious, gradual and prudent approach to energy transition on the sub-continent (DellaValle and Czako, 2022). More widely, it is possible that the current approaches to transition can generate epistemic injustice for the working-class communities most impacted by the immediate changes in the transitioning sub-sectors.

In the global south, familiar funding mechanisms focusing on

institutional investments in public-private partnerships through credit enhancement of project bonds, and infrastructure loans have emerged, affecting the way we understand the delivery of development (Akinsola et al., 2022). Building on Ferguson's (1996) work on the anti-politics machine, Taggart and Power (2024: 2) contend that 'efforts to make Development contexts legible and attractive to private finance [...] reflects and induces a transformation in the rationalities within the traditional Development regime'. Here we see historical pitfalls in where Development as we know it is rendered investible and where state and non-state actors as development actors are made to fall in line – creating new practices, rationalities and discourses of development (McNelly and Franz, 2024). Here, energy transition becomes a shorthand for a set of countries, defined by their ability to disburse resources to Africa in the name of climate justice, have the ability to define their own habitus (its own practices, customs, vernaculars, and hierarchies), whilst the role of *low-income resource rich countries* such as those in Africa is appendagised. Framed in this way, we argue that the transition might not necessarily be about solving a problem per se (although that is still a central concern).

In Africa, there is need to account for histories and how transition efforts shape diverse institutional landscapes and configurations of state-capital relations, and what this means for poor local communities. Countries in Africa are once again in some imaginary race aimed at attracting inward foreign investments as pathway for transforming their economies - this is hardly new. At the heart of this engagement is the need for national states to follow the *so-called* internationally accepted policy and legal practices that facilitate rather than constrain capital. Although this means increased state interventions, any opportunities that emerge out of these processes are but by chance. Specifically, and drawn from McNelly and Franz (2024) this glosses over struggles by marginalised peoples and communities that aim to assert the right to life, with all the social, cultural, economic and political trappings that this entails. For Africa, the possibility for genuine political reactions from below is effectively thwarted and alternative pathways to the current hegemonic transition urgent. Although necessary, a focus on 'democratisation, deprivatization, decentralization, de-concentration, or decolonization is arguably fit for purpose. Building new social relations requires extending these concepts to reflect on what sort of energy futures can be imagined from an African perspective and what this

mean for struggling communities. This potentially expands inventories of possibility when climate science touches the ground (Manda et al., 2024).

Within the context of financialisation, efforts are geared towards opening new extractive frontiers linked to green transitions. Recent works reveals upgrading the Lobito Corridor railway, which runs through Angola, Zambia and the Democratic Republic of the Congo (DRC) is designed to better integrate Europe and the United States into critical raw material (CRM) supply chains, but that Africa's Lobito Corridor benefits may be exaggerated (Oxford Analytica, 2024). This is significant as this reflects schemes do not offer any paradigm shift or opportunities for low-income mineral rich countries to clawback sizeable revenues from such projects. As with Bertinat and Chemes (2021) cited in McNelly and Franz (2024), this expresses "the way in which the capitalist system tries to take advantage of the civilizational crisis for a new cycle of accumulation and control." Energy transition that fails or does not seriously attempt to disrupt the dynamics of the current socio-technical and hegemonic transition is but a fantasy. Only a serious social science agenda that can interrogate and question the actual form of the current energy transition will have a chance of delivering equity and just forms of green transition. Policies should map out national level trajectories of energy transition and specific implications for different communities.

CRedit authorship contribution statement

Simon Manda: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sambo Lyson Zulu:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Toyin Ebenezer Adeyemi:** Writing – original draft, Investigation, Formal analysis, Data curation.

Declaration of competing interest

We have no conflict of interest to declare.

Data availability

Data will be made available on request.

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