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**A systematic literature review**

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# ENVIRONMENTAL RESEARCH ENERGY



## PAPER

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## Contextualising a multi-dimensional perspective on energy poverty for South Africa's just energy transition: a systematic literature review

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### Abstract

Energy poverty is a multifaceted and urgent issue in the Global South, especially in South Africa, where, despite an electrification rate exceeding 90%, a substantial 40% of the population still experiences energy poverty. This paper presents a systematic review of literature on energy poverty in South Africa, covering the period from 1994 to 2023. The review identifies eleven key themes that offer a multi-dimensional perspective on such energy poverty. It offers insights into addressing critical issues for advancing an equitable and just energy system. Understanding the extent and nature of energy poverty could facilitate a deeper understanding of (in)justices entrenched in South Africa's socio-technical energy system, for policymakers, practitioners and experts alike. Energy justice is employed as an analytical framework to examine the implications of energy poverty through the lenses of restorative, distributive, procedural, and recognitional justice. The analysis seeks to contribute to South Africa's just transition (JT) Framework, which currently addresses energy poverty primarily as a matter of restorative justice. South Africa's just energy transition cannot be achieved in an inclusive and transformative manner without accounting for multifaceted dynamics at the household level; here, energy poverty serves to bring about a more intersectional focus on the justice dimensions inherent in energy transitions. The findings underscore the need to address energy poverty at the household level, where it intersects with broader socio-technical dynamics. Such a multi-dimensional perspective on energy poverty in South Africa could help to inform targeted policies and initiatives to meet the specific needs of energy-poor households, while broader socio-technical changes are accelerated as part of the energy transition, thus more strongly meeting the goals spelled out in the JT Framework.

## 1. Introduction

Addressing energy poverty is essential for sustainability transitions, and aligns with the UN Sustainable Development Goal (SDG) 7, which seeks to ensure universal access to affordable and modern energy by 2030 (Becker *et al* 2021). While many initiatives focus on expanding access to modern energy and meeting minimum consumption levels, this paper highlights the importance of understanding energy poverty within South Africa's energy transition. The 2022 just transition (JT) Framework and the 2023–2027 Just Energy Transition Implementation Plan (JET IP) underscore the need to alleviate energy poverty and promote social inclusion, which occurs despite high grid access (Presidential Climate Commission 2022, The Presidency 2023). Therefore, we seek to address the limitations in the current framing of energy poverty within the JT framework and to deepen an understanding of energy poverty in the Global South more broadly, especially in contexts where mere grid access does not ensure energy security or justice. By examining interconnected political, socio-technical, and socio-economic factors, we hope to shift the focus from a narrow perspective

of energy access and affordability to a broader understanding of the systemic barriers preventing meaningful access to clean energy.

We critically examine intersecting energy (in)justices as South Africa's carbon-intensive socio-technical energy transition undergoes rapid transformation, and contribute towards a multi-dimensional perspective on energy poverty. We argue that if energy poverty is neglected, about 40% of South Africa's households stand to risk further marginalisation, and may not benefit from the opportunities opened up by the country's unfolding and accelerating energy transition. Rather, an insufficient or narrow engagement with energy poverty could actually reinforce the deep-seated inequalities and injustices entrenched in, and reinforced by, the current energy system that is highly centralised and dominated by coal (Baker and Phillips 2019). Stressing the significance of focusing on energy poverty in the national energy transition, Ledger (2021, p 6) points out that by under-emphasising what is happening in households of poor South Africans we are 'building and entrenching two parallel energy systems: a visible, clean system based on renewable energy generation to which access is effectively limited, alongside a largely, invisible, dirty and dangerous system that is the only option for millions of households'. Therefore, addressing energy poverty is crucial for understanding household energy behaviours and their role in the shift to cleaner, more affordable, and safer energy sources. We argue that engaging with a multi-dimensional perspective on energy poverty, responsive to this South African context, might lead to targeted, multi-scalar interventions that ensure that the energy transition is both just and inclusive, allowing every household to participate in and benefit from a more sustainable energy future (Middlemiss 2022).

This paper, through a systematic literature review, explores a multiplicity of dimensions shaping energy poverty in South Africa within the context of the country's national energy transition. Our review and analysis highlights the complex nature of energy poverty, influenced by, amongst other factors, inadequate housing, high unemployment, historical racial segregation, spatial integration issues, gender inequities, and the lack of inclusion of children and youth in energy studies. We synthesise 11 distinctive themes to this multi-dimensional perspective on energy poverty in South Africa. Thereafter, we highlight various justice-related concerns evident across this array of perspectives on energy poverty, that in turn, require stronger focus to achieve the commitment to a just energy transition. By identifying and analysing these dimensions, we aim to contribute towards enhancing South Africa's approach to ensuring that the energy transition is equitable and inclusive, addressing the needs of all households, particularly those most impacted by energy poverty.

The primary questions are:

1. What are the documented underlying factors and dynamics contributing to energy poverty in South Africa?
2. How do these identified energy poverty dimensions intersect with the energy justice principles?
3. What are the implications of these insights for advancing a just energy transition in South Africa?

The first question is addressed by assembling and analysing a database of sources obtained from the systematic literature review, as detailed in section 4 methodology section. The second question is explored in section 5 through a critical analysis of each of these energy poverty dimensions with respect to four principles of energy justice, namely restorative justice, recognitional justice, procedural justice, and distributive justice (Jenkins *et al* 2016, Hazrati and Heffron 2021). The third question is tackled as part of our recommendations for policy and practice to achieve a just energy transition in the conclusion, emphasising the need for a collaborative, cross-sectoral approach to addressing the multiple dimensions of energy poverty in South Africa.

The discussion to address the research questions starts in section 2, where we contextualise the South African energy transition. This is followed by section 3, which deals with the theoretical background, concentrating on the academic literature on energy poverty, energy justice, and just energy transitions. Then, the research methodology is dealt with in section 4. Thereafter in section 5 we present the key findings and analysis, providing insights into how energy poverty is framed in South Africa, and highlighting the energy justice principles that correspond with each identified dimension. Section 6 concludes with implications for policy and practice.

## **2. Context: energy poverty, energy justice, and the just energy transition in south africa**

Energy poverty, broadly characterised as inadequate access to modern energy sources necessary for essential energy services, according to the expenditure approach, affects approximately 40% of South Africa's population (Israel-akinbo *et al* 2018, Baker and Phillips 2019). Despite a high electrification rate of 94.7% (STATSSA 2023), a significant portion of South Africa's population continues to struggle with escalating

socio-economic marginalisation and is not able to leverage the benefits of such energy access. In South Africa, energy poverty involves more than just not having electricity; it often relates to affordability issues (Mohlakoana and Wolpe 2023). One theme discussed in this paper is that a lack of income is a significant barrier to accessing clean energy. Ye and Koch (2021) also emphasize the strong link between income and energy poverty in South Africa.

Inequality in South Africa is significant, with nearly 50% of the population living in poverty, and rising wealth disparity (Parr *et al* 2018, STATSSA 2022, World Bank 2023). Understanding energy poverty is crucial because, as Middlemiss (2022) points out, income inequality exacerbates the problem. Countries with greater income inequality tend to have higher levels of energy poverty, with both absolute and relative poverty contributing to this issue.

Furthermore, South Africa's historical context has a significant impact on the intersection between energy and socio-economic marginalisation, and in turn, how households experience energy poverty as defined above. During the Apartheid era, marginalised racial groups faced significant barriers to accessing electricity, with only about 30% of the population—primarily in areas previously reserved for white populations—connected to the national electricity grid (Franks and Prasad 2014, Mukumba and Chivanga 2023). In 1994, the democratic government prioritised extending grid access to previously excluded underprivileged and low-income communities (Haque *et al* 2021). This commitment to equitable electricity access led to the development of pro-poor policies, such as the White Paper on Energy (1998) and the 2001 Integrated National Electrification Programme (INEP) (The White Paper on Reconstruction and Development 1994, Department of Minerals and Energy *n.d.*).

Despite the extensive rollout of grid capacity to support electrification and increase connection rates, it soon became evident that universal grid access did not automatically ensure sufficient electricity consumption for newly connected households. To address this, the Free Basic Electricity (FBE) policy was introduced in 2003 to improve electricity affordability for low-income households (Department of Minerals and Energy 2003). Additionally, the Free Basic Alternative Energy (FBAE) Policy was introduced in 2007 for areas where grid electricity was not possible. It aimed to enhance access to and affordability of alternative energy sources (paraffin, solar home systems, gel fuel, etc.) for such households (Mohlakoana 2014).

Looking forward, the National Development Plan (NDP) 2030 envisions universal electrification for South Africa, acknowledging that achieving this goal will require the adoption of distributed energy systems such as solar home systems and microgrids (National Planning Commission 2012).

South Africa's unfolding energy transition is driven by a combination of global and local factors, including commitments to carbon neutrality, decarbonisation and power sector reform, declining costs of renewable energy technologies, persistent loadshedding due to a national electricity supply crisis, and rising electricity tariffs, all of which have encouraged the adoption of PV systems across residential, commercial, and industrial sectors (Scholtz *et al* 2017, Parr *et al* 2018). These developments reinforce the transformation of South Africa's energy system to one centred on renewable-energy-based electricity generation (Parr *et al* 2018). While the focus of the energy transition often centres on broader systemic changes, for example, decarbonising electricity generation capacity or reforming the policy and regulatory environment, the lens of energy poverty brings attention to the barriers households face in accessing affordable energy and energy services.

South Africa's JT Framework guides the shift from fossil fuels to renewable energy, incorporating justice principles to ensure a fair and inclusive transition (Presidential Climate Commission 2022). Since COP26 in 2021, the country has committed to moving away from coal, aiming to reduce inequalities and provide equal opportunities in the transition (McCauley and Heffron 2018, Xaba 2023). The policy commitments to just energy transitions serve to link the energy poverty and energy justice literatures and concepts. More specifically, attentiveness to (in)justices, including an explicit focus on household dynamics, has the potential to safeguard marginalised and vulnerable households and communities as the national energy transition accelerates.

By focusing on distributive, procedural, and restorative justice, the JT Framework promotes fair and inclusive energy policy, that addresses access and affordability while ensuring the benefits of the transition are shared equitably across society. In this JT Framework, energy poverty is mentioned under the restorative justice pillar, focusing on correcting energy access inequities and ensuring that everyone, regardless of socio-economic status, has access to safe, affordable, and sustainable energy (Presidential Climate Commission 2022, The Presidency 2023). However, in this article we critically engage with this framing, by paying attention to a multiplicity of dimensions and perspectives on energy poverty, and in turn, highlighting pertinent justice considerations beyond restorative justice.

### 3. Theoretical background

#### 3.1. Energy poverty and universal energy access

While energy poverty has predominantly been an academic and policy concern in the Global North (Boardman 2012, Romero *et al* 2018, Sy and Mokaddem 2022), it is now becoming a prominent topic in national debates around energy transitions in the Global South, including the unfolding just energy transition in South Africa (Presidential Climate Commission 2022).

For instance, Sy and Mokaddem (2022) carried out a thorough review of how energy poverty is defined and measured in the Global South, emphasising the complexity of this issue and its occurrence in both rural and urban settings. This aligns with our findings, as our database includes papers that address energy poverty in both of these contexts, including informal settlements and backyard dwellings.

In the Global South, energy poverty is often defined as not having access to modern energy sources (Sy and Mokaddem 2022). This mainly stems from issues like poor infrastructure, failing energy markets, and difficult socio-economic conditions (Sy and Mokaddem 2022). The 11 themes unveiled in this paper aim to show that energy poverty in the Global South, particularly in a country like South Africa, is complex, even though access to grid electricity is nearly universal. Adjei-Mantey *et al* (2024) point out that while tackling energy poverty in the Global South is essential, it presents unique challenges for policymakers due to its complex nature and various contributing factors.

Therefore the technocratic framing of energy poverty in the global south, Samarakoon (2019) typically addresses the fact that using traditional approaches to tackling energy poverty—such as expanding access through national electrification programmes—are often insufficient as they tend to fail to capture the household and socio-economic challenges that can hinder access to energy (Fjeldstad *et al* 2005, Conway *et al* 2019, Koranteng 2020).

#### 3.2. Justice in energy transitions

The principles of energy justice take into account the complicated nature of energy systems, which involve different groups and organizations, and they emphasize the importance of local contexts (Huang and Castan Broto 2018).

Energy justice emphasises fair sharing of energy benefits and costs, and promoting inclusive decision-making to ensure safe, affordable, and sustainable energy for all (Mccauley *et al* 2013, Sovacool *et al* 2016). It proposes equitable resource distribution and participation in decision-making (Piggot *et al* 2019) and recognizes energy as a basic human right essential for well-being (Ramirez and Böhm 2021). Ultimately, energy justice seeks to enable access to energy, that supports decent living and active engagement in energy system changes (Carley and Konisky 2020, Sheridan *et al* 2020).

This paper uses an analytical framework based on the four key dimensions of energy justice: distributive, procedural, recognitional, and restorative justice (Mccauley *et al* 2013, Lacey-Barnacle *et al* 2020, Velasco-Herrejon and Bauwens 2020).

- (i) **Distributive justice** is about making sure that the benefits and costs of the energy system are shared fairly among different groups of people, considering factors like race, gender, and income. This relates to not just who has access to energy infrastructure, but also who can afford energy services. It highlights how much choice people have in accessing these benefits (Jenkins *et al* 2016, Sheridan *et al* 2020).
- (ii) **Procedural justice** focuses on how people can access and influence the decision-making processes that determine how energy infrastructure and services are distributed, including laws, policies, and regulations. It ensures that everyone involved can participate effectively by considering local knowledge, sharing information, and representing different groups. Procedural justice requires that participation should be meaningful, with clear information and suitable ways for people to engage (Jenkins *et al* 2016).
- (iii) **Recognitional justice** is about acknowledging the rights of different groups within the energy system. It goes beyond just accepting these groups, to ensuring they are fairly represented and have equal political rights. This approach accommodates diverse viewpoints based on social, cultural, ethnic, racial, and gender differences. Recognising these groups is important because not doing so can lead to injustices and the loss of valuable knowledge and insights from marginalized communities (Sovacool and Dworkin 2015, Jenkins *et al* 2016, Müller *et al* 2021).
- (iv) **Restorative justice** deals with the unfair treatment of communities or groups caused by changes in energy systems. It aims to fix these injustices and includes actions that prevent similar issues from happening in the future (Lacey-Barnacle *et al* 2020, Hazrati and Heffron 2021, Gafa *et al* 2022, Yvonne Chivanga 2023).

Using energy justice as an analytical tool, as discussed in section 5, has helped to expand our understanding of energy poverty in South Africa. This issue is often seen mainly as a matter of restoring justice and distributing energy resources, focusing on providing access to modern and sustainable energy services and how affordable these services are for previously disadvantaged groups. Instead, we propose using energy justice as an analytical tool allows us to reframe energy poverty, stressing the need to consider the structural, political, and economic factors that contribute to or worsen energy poverty, rather than just relying on technical solutions (Sovacool and Dworkin 2015, Finley-Brook and Holloman 2016, Hazrati and Heffron 2021, Gafa *et al* 2022, Chipango and To 2024).

## 4. Research methodology

We employed a two-step methodological approach to explore a multi-dimensional perspective on energy poverty in South Africa. The first step entailed systematically compiling and then analysing a database of 152 academic articles and grey literature on energy poverty in South Africa. This resulted in the identification of 11 themes capturing an array of contextual dimensions of energy poverty. The second step entailed an analysis of how the 11 identified themes intersected with four principles of energy justice, distributive justice, procedural justice, recognitional justice and restorative justice. Below we unpack the first step of the research methodology, namely, the systematic literature review.

### 4.1. Systematic literature review on energy poverty in South Africa

The first step in the research involved creating a database by conducting a systematic review of all studies on energy poverty in South Africa from 1994 to 2023. This helped understand how energy poverty has been defined and has evolved over time. The primary aim of a systematic literature review is to gather data from different sources and integrate existing research using transparent and dependable methods (García-Holgado *et al* 2020). For this study, the database includes both academic literature and grey literature, which encompasses publications from NGOs, practitioners, and research theses, to capture a wide range of perspectives on energy poverty in South Africa. Including grey literature is important as it emphasises practical application and implementation.

The systematic literature review used a detailed framework called Search, Appraisal, Synthesis, and Analysis (SALSA), along with snowballing techniques to find additional relevant sources (García-Holgado *et al* 2020). The SALSA framework provided a clear and step-by-step process to help identify important publications within the search area. The snowballing technique helped find other relevant articles by looking at the references cited in the publications gathered through SALSA. By combining these two methods, the review reduced bias from the search process and ensured that the literature survey was clear and could be repeated.

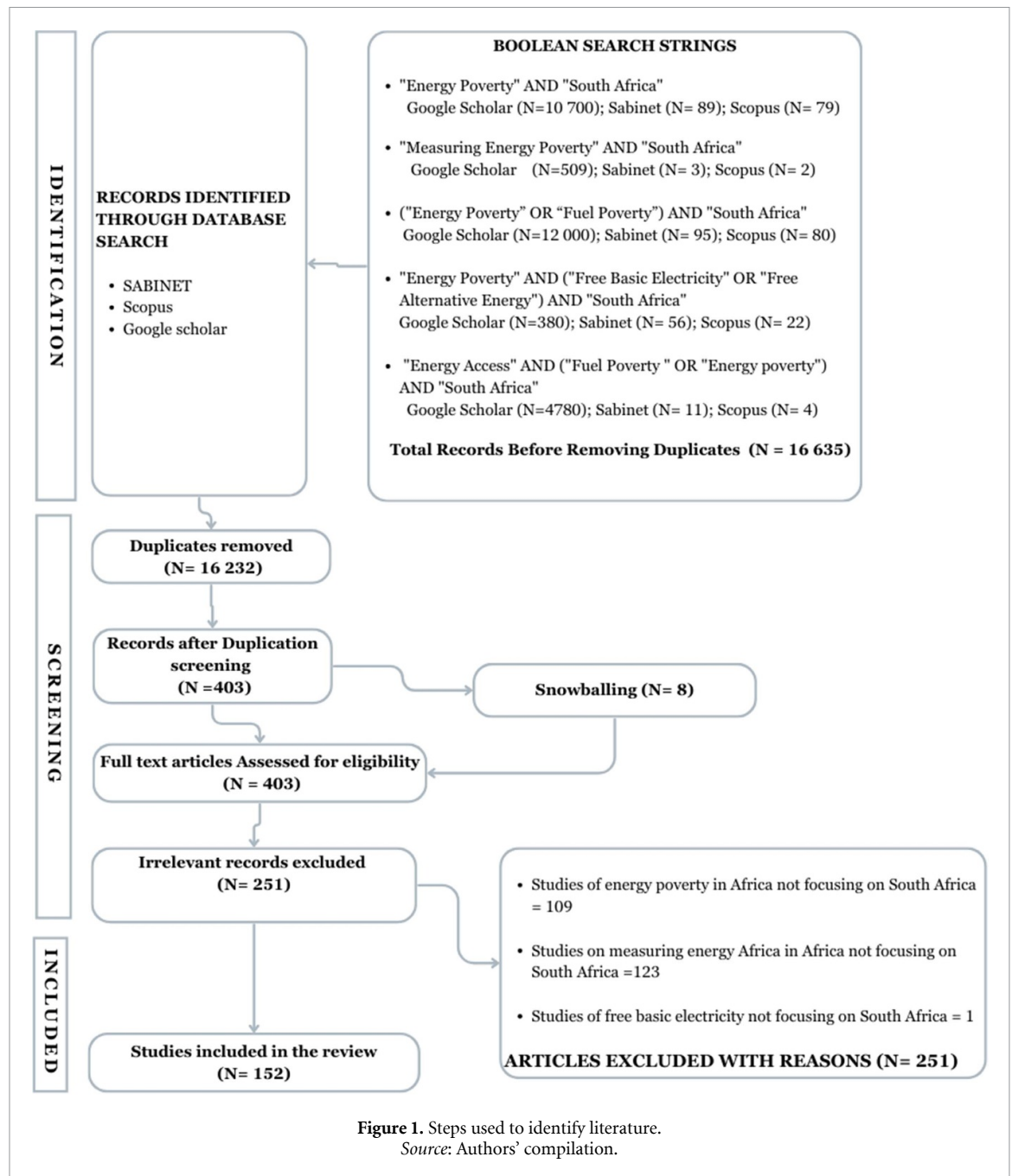
The Preferred Reporting Items for Systematic Reviews and Meta-Analyses chart in figure 1 shows the steps for finding, checking, and choosing the literature used in the systematic review (Lame 2019, Nightingale 2009).

#### 4.1.1. Defining the search criteria

A basic search criterion was established to create a systematic guide for including or excluding sources. We used online scholarly databases (Sabinet, Google Scholar, and Scopus) to search specifically for literature on energy poverty in South Africa between 1994 and 2023. Titles and abstracts were screened to determine their inclusion or exclusion before analysing the results of the keyword search. Search results were limited to English language only. The search query used was: 'energy poverty' AND 'South Africa' AND 'measuring energy poverty' AND 'energy transition'. Three additional search strings were utilised to identify potentially relevant publications: ('energy poverty' OR 'fuel poverty') AND 'South Africa'; 'energy poverty' AND ('free basic electricity' OR 'free basic alternative energy') AND 'South Africa'; 'energy access' AND ('fuel poverty' OR 'energy poverty') AND 'South Africa'. The terms 'free basic electricity' and 'free basic alternative energy' were considered relevant based on both a cursory literature review and the authors' knowledge of the field and the significance of policy instruments relating thereto in South Africa.

#### 4.1.2. Appraisal and snowballing technique

The reviewed publications include both academic literature and grey literature, as mentioned, to gather different viewpoints on energy poverty in South Africa. During the assessment phase, we screened titles, abstracts, and keywords, finding 233 out of 403 publications to be irrelevant. This left us with 152 publications that were relevant to our research. We included sources that focused on the South African context and featured case studies or analyses of energy poverty. Exclusion criteria encompassed papers where South Africa was mentioned but not as the primary focus, references to the FBE policy in relation to South



Africa without being the central subject, and cases where full-text access was unavailable. Snowball sampling was used to identify additional relevant publications, which resulted in the addition of a further 8 sources.

We created an overview of the entire database to better understand its features by sorting the sources based on various criteria, such as publication year, authors' affiliations, types of publications, and locations.

During the synthesis process, we organised and classified 83 peer-reviewed articles, 5 book chapters, 42 practitioner reports, 5 policy briefs, and 17 theses. Table 1 below shows the breakdown of the publications included in the database from the systematic literature review.

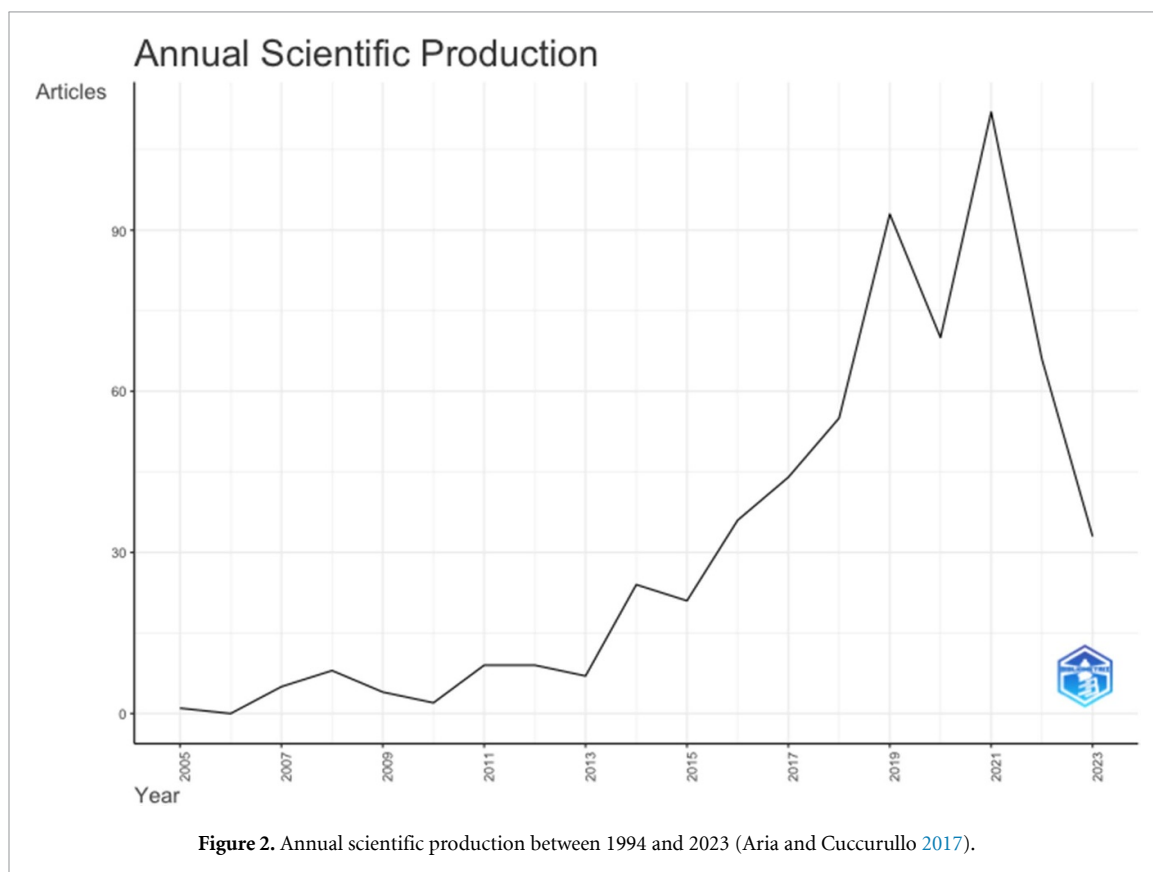
Of the 152 publications reviewed (including both grey and academic literature), 30 papers concentrated on energy poverty in rural areas, while 41 papers explored the urban environment, including informal settlements and backyard dwellings. The spatial configuration in South Africa, shaped by enduring historical segregation policies from the apartheid era, still manifests in contemporary energy poverty. Some sources also highlighted instances of informal electricity connections in urban areas, particularly in peripheral locations where informal housing prevails. Understanding these trends is crucial, as energy poverty exists in both rural and urban areas of South Africa, each presenting unique challenges.

To understand the patterns of author affiliations and publication years, we used a tool called Biblioshiny. This tool helped us examine the 83 peer-reviewed articles in our database (Aria and Cuccurullo 2017).

**Table 1.** Breakdown of sources in database.

Data sources	Number
Book chapters	5
Peer reviewed articles	83
Reports	42
Theses	17
Policy briefs	5
<b>Total</b>	<b>152</b>

Source: Authors' compilation.



However, one limitation of this tool is that it relies on specific databases like Scopus and Sabinet, which means it may miss some publications found on Google Scholar.

From the peer-reviewed articles analysed through Biblioshiny, we found that energy poverty research in South Africa is especially well represented in the *Energy Policy* journal. South African universities and research institutions are key players in this field, with the University of Johannesburg and the South African Medical Research Council leading the way in producing knowledge about energy poverty.

Figure 2 shows how the 83 peer-reviewed publications are spread out over the years. There were very few publications between 1994 and 2015, but since then, there has been a noticeable and steady increase in research on energy poverty in South Africa, especially after the SDGs were introduced in 2015. While the eight Millennium Development Goals (MDGs) did not specifically focus on energy, it was acknowledged that having access to sustainable and clean energy was essential for achieving all of the MDGs (The International Bank for Reconstruction and Development 2005). Notably, the number of relevant academic publications has risen sharply since 2021, likely because the Presidential Climate Commission released South Africa's Just Energy Transition Framework in 2022.

#### 4.1.3. Reflective thematic analysis

After compiling the database, we conducted a qualitative data analysis. We used reflective thematic analysis to find and explore patterns or themes in the literature on energy poverty in South Africa (Byrne 2022). This involved systematically coding and organising the data to identify recurring themes related to our research question. Using ATLAS.ti, we identified 11 codes (see table 2) that represent the main themes or

**Table 2.** Compilation of the 11 themes which form part of the multi dimensionality of energy poverty in South Africa and their intersection with the justice principles.

Dimensions/themes	Overall framing	Specific aspects	Justice principles
Electrification policy response	Policies to redress electrification rates to remedy apartheid exclusion and achieve universal access	Policy instruments to redress historical exclusion from access to grid electricity Policy commitments to achieve universal energy access via decarbonisation initiatives and supply-side interventions	Restorative justice Distributive justice Procedural justice
Electricity affordability	Affordability of electricity for low-income households, determined and compounded by tariff structures and subsidy packages	Rising costs of electricity above consumer inflation rate further exacerbate affordability for low- income households Households revert to traditional energy sources due to inability to afford electricity Inclining block tariff structures have unintended consequences for larger low-income households' electricity affordability FBE subsidy is not sufficient for low-income households' energy needs and does not account for household dynamics	Procedural Justice Recognitional Justice Distributive Justice
Spatial and urbanisation challenges	Historic spatial segregation and rapid urbanisation compounds and further complicates the conventional approaches, scale and pace of grid expansion, electrification and service delivery efforts by municipalities	Pace and scale of urbanisation surpasses municipalities' ability to provide grid electricity Regulatory and bureaucratic procedures hamper the conventional approach to grid expansion, which is increasingly costly Urbanisation via the expansion of informal settlements in areas where service delivery and infrastructure development is restricted or prohibited	Distributive Justice Restorative justice
Health and safety concerns	Health impacts for low -income households due to the use of traditional and unsafe energy sources in informal settlements	Affordability issues lead to energy stacking, where households rely on unsafe traditional fuel sources Health impacts due to indoor air pollution and unsafe traditional fuel sources include electrocution, respiratory illness and poisoning Damage to property and dwellings often due to shack fires	Distributive Justice
Socio-economic inequalities	Increasing socio-economic disparities and escalating rates poverty and inequalities in South Africa	High unemployment and poverty result in low- income households not being able to afford electricity Low -income households face difficult choices in meeting household needs resulting in negative trade-offs between nutrition and energy	Distributive Justice Recognitional Justice
Racial and ethnic divisions	Enduring historical racial and ethnic disparities in access to energy and socio-economic opportunities	Previously disadvantaged groups historically marginalised and excluded still struggle disproportionately to access employment and socio-economic opportunities	Distributive Justice Restorative justice Procedural justice

(Continued.)

Table 2. (Continued.)

Dimensions/themes	Overall framing	Specific aspects	Justice principles
Gender inequalities	Women bear the bulk of the responsibilities and burdens of households' activities and their energy needs	Burden of sourcing energy to fulfil household tasks and responsibilities such as cooking, cleaning and child rearing fall predominantly to women, compared to men Women affected disproportionately by indoor air pollution through use of traditional energy services to perform household tasks Women often financially burdened for ensuring access to energy to support household energy needs, compared to men	Distributive Justice Recognitional Justice
Children and youth development	Impacts for children and youth for lack of energy access or exposure to traditional and unsafe energy sources	Loadshedding negatively impacts youth and children by disrupting access to and quality of education and learning Time taken by girl children to source energy sources may further exacerbate the gender gaps in education attainment Voice of children not sufficiently acknowledged in energy policy and planning	Distributive Justice Recognitional Justice
Municipal finance	Developmental role of municipalities is increasingly undermined as the energy transition scales up	Municipal revenue model, tariff structures and subsidy packages that allow for cross-subsidisation under threat as higher income households shift to adopting renewable energy technologies and implementing energy efficiency measures	Procedural Justice Recognitional Justice
Electricity subsidies	Shortcomings and limitations of national government policies supporting subsidisation of low-income households	Unclear criteria and complicated procedures for low-income households accessing FBE/FBAE subsidies FBE subsidy not applied uniformly or consistently across all municipalities in the country; further compounded by the specific financial and regulatory circumstances of the municipality Distribution licence affecting a particular community impacts their access to the subsidy—Eskom versus municipality service area	Procedural Justice Recognitional Justice
Energy efficiency	Energy efficiency interventions are under emphasised, not supported and often unviable	Energy efficiency interventions targeted at low-income households not well recognised by national government Energy efficiency measures such as ceilings retrofits and energy efficient appliances not subsidised or scaled up Lack of affordable and dignified housing negatively impacts thermal comfort	Procedural Justice Recognitional Justice

Source: Authors' compilation.

dimensionality on energy poverty, which informed the discussion section of the paper. The coding process considered the knowledge and experiences of the lead author, who is actively working on energy poverty issues at the Cape Town Metropolitan Municipality while also pursuing a PhD. Throughout this reflective process, the researchers acknowledged their own roles and perspectives, recognising how their experiences, beliefs, and knowledge in the field of energy poverty could shape their interpretation of the data.

## 5. Findings and Discussion: 11 themes that highlight the multi-dimensional perspectives on energy poverty in South Africa

Having contextualised the energy transition in South Africa, as well as the country's commitment to a JT Framework, we now turn to present and analyse the 11 interconnected dimensions (table 2) that emerged from the systematic literature review. Each of the eleven dimensions identified helps to frame an expanded and responsive understanding of energy poverty in South Africa, and in turn, serves as an entry point to inform policy action to advance energy poverty alleviation. First, we describe these 11 dimensions and then consider each of these in terms of the principles of energy justice, namely, restorative, procedural, recognitional and distributive justice (Jenkins *et al* 2016, Hazrati and Heffron 2021). The following discussion outlines each theme and its connection to the multidimensional nature of energy poverty in South Africa and elements of energy justice relevant to each theme. It is important to outline that one theme may relate to various energy justice principles.

### 5.1. Electrification policy responses

South Africa's current energy poverty policies focus on expanding grid access, influenced by apartheid, when only 30% of people had electricity (Franks and Prasad 2014, Mukumba and Chivanga 2023). These efforts, driven by restorative justice, prioritised historically disadvantaged communities. In 1994, the Reconstruction and Development Programme (RDP) aimed to provide equal access to services. From 1994–1998, Eskom and municipalities electrified 2.5 million households. The National Energy Regulator of South Africa (NERSA) led the development of the INEP from 1999–2001, which Eskom implemented (Knox *et al* 2018).

Concerns about affordability led to the introduction of the FBE Policy in 2003, offering 50 kWh of free electricity to low-income households. In rural areas, the 2007 FBAE Policy focused on affordable alternative energy, whilst the NDP 2030 still aims for universal access to electricity. The JET Framework and Investment Plan (2023–2027) aims to address energy poverty through decarbonisation and renewable energy distribution.

This policy shift reflected above appears to broaden its focus to include restorative justice, while also emphasising distributive justice by ensuring affordability is not a barrier to accessing clean energy. Additionally, it prioritises procedural justice by implementing policies that ensure historically disadvantaged communities benefit from renewable energy, and empowering local governments to distribute it.

### 5.2. Electricity affordability

As stated, South Africa's electrification rate is 94.7% (STATSSA 2023). Despite this extensive reach, affordability is a challenge for an increasing number of households in the country, driven and compounded by tariff structures and subsidy packages. Due to high levels of poverty and inequality a significant portion of South African households are classified as low-income and are disproportionately affected by rising electricity prices. For example, between 1994 and 1998, the average electricity price increase in South Africa was lower than the consumer inflation rate, partly due to government policies aimed at keeping tariffs as low as possible for poorer communities, and partly because Eskom had an oversupply of electricity during the 1990s. However, when electricity supply challenges (including load shedding) began in 2007, tariffs saw a sharp increase of 653% by 2022, while inflation during this period was 129%. This translates to a fourfold increase in electricity tariffs in real terms over 14 yrs (Moolman 2024). These complexities around the affordability of electricity highlight a key issue of absence of restorative justice, as historically disadvantaged groups, who have long faced marginalisation, continue to be excluded from reliable access to electricity due to affordability barriers. From a distributive justice perspective, the inability to afford electricity forces many households to rely on traditional energy sources like paraffin for cooking and heating, even when they have access to the grid (Mohlakoana and Wolpe 2023). This points to the unequal distribution of energy resources and the disproportionate burden placed on low-income households, who, despite being connected to the grid, cannot fully benefit from modern energy services due to cost and affordability barriers.

The introduction of the 50 kWh FBE subsidy in 2003 was intended to make electricity more affordable for low-income households. However, the distributive justice concerns demonstrated in a study by Earthlife

(2010) found that the 50 kWh allocation is insufficient to meet the growing energy needs of these households and requires updating. The study highlights that a household of five people typically requires between 320 and 420 kWh per month, with even higher energy demands in winter (Earthlife 2010, Borchardt 2023). Even a conservative estimate, such as cooking one meal a day on a hot plate, suggests that a base requirement of 200 kWh per month is necessary to meet basic needs and promote social development. This disjunction between support mechanisms and household dynamics can be seen from a recognitional justice perspective, since current policies fail to recognise realities in low-income households. Several studies (Kimemia and Annegarn 2011, Makonese *et al* 2012, Masekameni *et al* 2018, Ledger 2021) also emphasise that larger low-income households benefit less from the 50 kWh FBE allocation, resulting in an inequitable distribution.

Affordability issues, touching on distributive injustices, are further compounded by electricity tariff structures. For example, the inclining block tariff structure was designed to benefit low-income households by allowing municipalities to cross-subsidise their electricity costs with revenue generated from electricity sales to wealthier households who typically consume more energy and pay higher rates. While this system aims to promote affordability, it can have unintended consequences for larger households, ultimately making electricity less affordable for them. For example, backyard tenants (typically consisting of low-income households living in informal housing behind or attached to a main house) often access electricity through extension cords connected to the primary household's meter (Lemanski 2009). As a result, the primary household's energy consumption increases, pushing them into higher tariff brackets and raising their monthly electricity costs. These household dynamics can result in higher overall consumption which in turn leads to higher payments under the tariff structure (Cantoni *et al* 2022, Hermanus *et al* 2022). Further undermining the intended support mechanisms built into the tariff structure is the fact that households sharing a single meter, (in case where there are backyard dwellers), often exceed the FBE threshold thus losing access to the subsidy (Knox *et al* 2018).

The tariff structure raises issues related to both recognitional justice and procedural justice. It is crucial to recognise and acknowledge the diverse types of households in South Africa affected by these structures—particularly backyard dwellers—whose unique energy needs and circumstances must be considered. Procedural justice concerns involve ensuring that community representatives are included in decision-making and engagement processes, with access to relevant information on tariffs, so that their insights into household dynamics can be properly considered.

### 5.3. Spatial and urbanisation challenges

Historic spatial segregation from apartheid-era racial segregation policies, as well as rapid urbanisation, compound and further complicate the conventional approaches, scale and pace of grid expansion, electrification and service delivery efforts by municipalities. This legacy persists, deepening socio-economic and political marginalisation in townships historically designated for black and coloured communities under apartheid. Today, these townships, characterised by rapid urban growth and inadequate infrastructure, continue to house the urban poor, who remain severely affected by energy poverty (Knox *et al* 2018). This highlights both restorative justice and distributive concerns regarding the persistent disparities in electricity access and infrastructure investment affecting historically marginalised areas. This is especially pertinent as access to grid electricity is impeded by spatial challenges, such as the high informality in these townships.

On the other hand, rapid urbanisation poses significant challenges for municipalities in their efforts to provide grid connections (Conway *et al* 2019). The need to upgrade or extend electricity infrastructure, coupled with bureaucratic delays and financial constraints, makes it difficult for municipalities to deliver timely and reliable grid connections to the fast growing urban populations.

Additionally, urbanisation in South Africa often results in low-income households settling on unsuitable land on the outskirts of the city core (South African Cities Network 2022). The National Electrification Guidelines often prevent informal dwellings located on private or unstable land, as well as in restricted development zones like floodplains and road or rail reserves, from being electrified (Scott *et al* 2005, Gaunt *et al* 2012, Knox *et al* 2018). Therefore, households located in these types of informal settlements categorised as unsuitable for electrification remain unconnected to the grid, and in turn they miss out on the available electricity subsidies, discounted tariffs, and FBE allocations, exacerbating their vulnerability to energy poverty (Caprotti *et al* 2021, Cantoni *et al* 2022). Highlighting the recognitional and distributive justice concerns, these households' lack of access to energy subsidies forces them to rely on alternative energy sources such as paraffin, kerosene, coal, or biomass, and in some instances, illegal electricity connections (Wolpe and Reddy 2010).

## 5.4. Health and safety concerns

The highest levels of indoor pollution in South Africa are found in low-income households, due to the burning of solid fuels (Langerman *et al* 2018). A study by Masekameni *et al* (2018) revealed that many low-income residents prefer energy stacking over solely relying on electricity. This means households use a mix of fuels depending on their needs and affordability (Mohlakoana and Annecke 2008). For instance, rural households often rely on wood and plant residues for cooking and heating, while urban households may use electricity alongside paraffin and coal. In some areas, coal is burned in a metal drum called an 'mbaula' for cooking and heating (Kimemia and Annegarn 2011, Uhunamure *et al* 2017). Paraffin is another common fuel, especially in households without electricity (Visagie 2008). In informal settlements, households without electricity frequently resort to illegal connections, known as 'izinyoka,' as a coping mechanism (Mhlanga and Garidzirai 2020, Okyere and Lin 2023).

Distributive justice concerns relating to health and safety are outlined in van Niekerk *et al*, a 2022 study which indicates that this reliance on traditional energy sources like paraffin, wood, and illegal electricity connections poses significant health and safety risks. Illegal connections often result in fatal accidents, such as children being electrocuted by exposed wires, while paraffin use is linked to burns, poisoning, and toxic fume inhalation. Most informal areas frequently experience fires related to wood burning, candle-related incidents and sparks from illegal electricity connections (Kimemia *et al* 2021, van Niekerk *et al* 2022).

Household air pollution (HAP) from these solid fuels remains a critical health issue in South Africa, contributing significantly to mortality and morbidity. Research by Roomaney *et al* (2022) estimates that HAP causes around 8862 deaths annually in South Africa, with diseases such as lower respiratory infections, ischemic heart disease, chronic obstructive pulmonary disease, stroke, and lung cancer being major contributors (Roomaney *et al* 2022). Furthermore, recognitional justice concerns children's vulnerability as they face increased risks of pneumonia due to HAP exposure, which is a leading cause of death among young children (Sole 2015, Roomaney *et al* 2022). Furthermore, distributive justice concerns arise as shack fires in informal settlements further compound these health risks, resulting in fatalities and leaving survivors with enduring physical, psychological, and socio-economic challenges (Kimemia *et al* 2021, van Niekerk *et al* 2022, Borchardt 2023).

## 5.5. Socio-economic inequities

South Africa faces significant poverty driven by high youth unemployment, with 45.5% of young people (aged 15–34) unemployed in early 2024, most lacking a matric qualification (South African Government communication 2024). Many rural families struggle with unemployment and inconsistent income, leading them to rely on free firewood for energy (Chidembo *et al* 2022). Some use electricity as their primary source of energy, with paraffin as a backup due to cost concerns (Van Lente *et al* 2003). In both rural and low-income urban areas, firewood remains common due to its affordability (Mgwambani *et al* 2018, Chidembo *et al* 2022). Additionally the lack of income, and poverty, also lead households to buy cheaper, second-hand appliances, ignoring energy efficiency (Reynolds 2012, Uhunamure *et al* 2017, Wolpe and Reddy 2018). This situation highlights distributive justice concerns, as youth and rural populations are disproportionately affected by high unemployment and limited access to affordable electricity. It also underscores recognitional justice issues related to the lack of choice for unemployed individuals and the limited involvement of youth in energy-related decisions.

Affording modern energy sources, particularly electricity, presents significant challenges for households in both rural and urban informal areas, due to limited and inconsistent income. Research by Ye *et al* (2020) reveals that low-income households often restrict their energy usage, to allocate their limited funds towards essential needs like food. Concurrently, Ledger (2021) points out that the lack of access to affordable energy forces many low-income households to rely on less nutritious food options that require less energy to prepare. This coping mechanism, intended to conserve energy costs, exacerbates existing inequalities by limiting access to healthier, more energy-intensive food options. As a result, these households face a dual burden of financial constraints and inadequate nutrition, further entrenching socio-economic disparities.

Ye and Koch (2021) find a clear link between income poverty and energy poverty, with households below the upper-bound poverty line experiencing higher levels of energy poverty. Kimemia and van Niekerk (2017) note that households below a certain energy poverty threshold face increased risk of energy-related accidents. Thus, initiatives focused on job creation and income have significant potential to alleviate multidimensional energy poverty (Oyekale and Molelekoa 2023).

## 5.6. Racial and ethnic divisions

Ethnicity and race play a crucial role in energy poverty, deeply influenced by the country's history of racial segregation under apartheid rule (Mhlanga and Garidzirai 2020, Okyere and Lin 2023). Before 1994, apartheid laws systematically denied the black population's access to energy services, resulting in enduring disparities. Presently, non-white South Africans, predominantly black, face a significantly higher prevalence of energy poverty, approximately 11.5% more than their white counterparts (Koomson *et al* 2022, Okyere and Lin 2023). Despite comprising the largest demographic, the demand for electricity among black South Africans ranks third, highlighting pervasive energy poverty in many black households (Mhlanga and Garidzirai 2020, Oyekale and Molelekoa 2023).

These disparities are compounded by substandard housing conditions, with a disproportionate number of poor homes belonging to black populations, often situated in informal settlements lacking electricity access (Koomson *et al* 2022). Additionally, higher rates of poverty, lower educational attainment, and larger family sizes among black South Africans exacerbate these inequalities (Koomson and Churchill 2022, Ngarava *et al* 2022). The enduring disparity between white and black racial groups underscores the urgent need for equitable energy policies to address these deep-rooted inequities (Ismail and Khembo 2015).

This highlights concerns of distributive justice, as low-income households from previously disadvantaged groups are disproportionately affected by energy poverty. It also underscores restorative justice issues, revealing how enduring racial inequalities from apartheid continue to affect energy access. Procedural justice concerns are evident in the need to include previously disadvantaged groups in policy-making processes and ensure that information is accessible to support informed decision-making, considering varying education levels.

## 5.7. Gender inequalities

In South Africa, and in particular in low-income households, women are predominantly responsible for fulfilling tasks and responsibilities such as cooking, child rearing and cleaning (Kimemia and Annegarn 2011, Fakier 2018, Ngarava *et al* 2022). As a result, their energy usage often differs from that of men. This disproportionate burden on women raises issues of recognitional justice, which concerns the acknowledgement of gender differences and the unique needs of women when delivering energy services. It also emphasises the importance of valuing women's contributions and ensuring their voices are heard in energy policy design and implementation. This would ensure that the inclusion of women's perspectives and experiences are included therein. This can also be viewed as a distributive injustice issue since women are predominantly responsible for ensuring that household needs are met. In households that rely on unsafe traditional energy sources such as biomass, the time and energy women spend on accessing these further exacerbates distributive injustices. For example, HSRC (2004) details that in many instances women in rural areas devote up to 205 min daily to this activity.

Additionally, women are disproportionately affected by indoor air pollution through use of traditional energy sources to perform household tasks (Matinga *et al* 2011, Borchardt 2023). Seeing these health burdens affecting women as distributive injustices highlights how the negative impacts of socio-technical energy systems often affect marginalised and vulnerable actors, such as women. Not only must women's distinct energy needs and voices be acknowledged (recognitional justice), but the uneven distribution of health risks and the socio-economic factors (distributive justice) that exacerbate these disparities must also be addressed to ensure a just energy transition.

Women in low-income households are often financially burdened for ensuring access to energy to support household energy needs, compared to men—a key issue in terms of distributive justice. As Ngarava *et al* (2022), highlight, reliable income sources are essential for households to afford clean energy. However, men typically have greater access to stable income through regular employment, whereas female-headed households typically rely on a mix of income sources, which can be unstable and result in lack of income to purchase clean energy. Ningi *et al* (2022), mention that in this instance social grants and energy subsidies have been found to play a vital role in enabling energy security for women.

Other negative distributive injustices include the burden for women to quickly settle energy bills because of their household roles such as cooking which require energy to be available, and therefore if they are cut off from the electricity supply due to non-payment, they are not able to fulfil these household and nurturing roles (Okyere and Lin 2023). Addressing these array of distributive injustices linked to gender disparities around energy poverty in South Africa emphasises that the introduction of clean and modern renewable energy technologies should account for and respond to the disproportionate burden on women (Fakier 2018).

## 5.8. Children and youth development

Loadshedding negatively impacts youth and children by disrupting access to and quality of education and learning, raising significant distributive justice concerns as it highlights the unequal distribution of reliable energy access across socio-economic groups, especially vulnerable groups like children. The lack of choice for youth and children in accessing reliable energy directly impacts their educational opportunities and broader development. Although the majority of children and young people live in homes connected to the grid, many from low-income households are particularly affected by load shedding, as they often lack access to alternative electricity sources. This leaves them unable to power essential devices, such as computers, which are crucial for their learning. This underscores that having access to a modern alternative energy source, such as a household solar system, is just as crucial as being connected to the grid. Dangor *et al* (2023) found that the lack of electricity during load shedding hindered students' ability to participate in remote or distance learning via the internet or radio. Without access to alternative energy sources, these students face a dual burden: disrupted education and exposure to physical risks from unsafe energy substitutes as the absence of reliable electricity forces children to rely on unsafe fuel sources, such as candles, to study late into the night, posing additional risks to their safety and wellbeing.

The absence of access to modern energy services has further gender implications, as young girls often collect firewood, leading to late attendance or missed school, resulting in difficulties catching up with schoolwork and insufficient time for post-school studying (Dangor *et al* 2023). Longe (2021) emphasises that this adversely affects their academic performance compared to their male counterparts, who do not bear the same responsibilities. If this persists among girls, it will further widen the literacy gap between men and women, exacerbating distributive injustices in access to quality education and gender inequities.

Energy studies and interventions often consider the needs of households, but the voices of children frequently go unheard, highlighting issues of recognitional justice. As Lusinga and de Groot (2019) point out, many energy use studies focus on homeowners or adults, neglecting the perspectives of children. This lack of inclusion highlights broader distributive justice concerns, as children's specific energy needs are often misunderstood, leading to a gap in interventions designed to address their requirements.

## 5.9. Municipal finances

The municipal revenue model, tariff structures, and subsidy packages that facilitate cross-subsidisation are under threat as higher-income households increasingly adopt renewable energy technologies and implement energy efficiency measures. This shift raises concerns related to distributive justice, specifically regarding the ability of municipalities to continue subsidising low-income households, as high-income households transition to small-scale embedded generation (SSEG) and energy efficiency measures.

Local governments in South Africa play a key developmental role due to their proximity to communities and their constitutional responsibility to provide basic services. Municipalities use cross-subsidisation, drawing funds from industries and wealthier residential customers to offer subsidised tariffs to low-income households through the inclining block tariff system. For instance, in Cape Town, industrial customers subsidise the lifeline tariff, aiding poorer residents (Hermanus *et al* 2022).

However, as more high-energy users implement energy-efficiency measures and adopt rooftop solar, municipal revenue from these users declines. This shift undermines the ability to cross-subsidise electricity tariffs for low-income households and affects funding for essential public services (Bobbins *et al* 2023).

The adoption of SSEG by affluent residents, who can afford renewable energy services, further reduces municipal electricity revenue from these high-income users. This reduction jeopardises the financial support needed for low-income individuals and other public services, potentially exacerbating racial and socioeconomic disparities in South Africa's energy transition. To address this, new financing models for municipalities must be developed to ensure continued support (Hermanus 2021, Hermanus *et al* 2022).

Procedural justice concerns arise in relation to the widespread adoption of prepaid meters by municipalities, primarily aimed at improving debt collection from households. Kambule and Nwulu (2021) highlight that this approach may worsen energy poverty for low-income households (Borchardt 2023, Okyere and Lin 2023). Households facing income instability often struggle to afford prepaid vouchers, leading to frequent periods without electricity. Furthermore, the unit cost of electricity for prepaid meter users is often higher than for those using traditional meters, disproportionately affecting those who are already economically disadvantaged.

While proponents of prepaid meters argue that they offer households better control over their electricity consumption, allowing them to manage their usage more efficiently and potentially reduce overall consumption, this benefit may be outweighed by the financial strain on poorer households (Makonese *et al*

2012). Procedural justice issues arise as the mechanisms used to manage energy access may further marginalise low-income households by limiting their ability to secure consistent, affordable energy.

### 5.10. Electricity subsidies

The FBE subsidy aims to make electricity more affordable for low-income households, yet its distribution faces significant challenges. However, since its inception, the policy has remained unchanged, struggling to adapt to the diverse socio-economic conditions among low-income households (Kambule *et al* 2019). This raises concerns related to recognitional justice, as the policy does not adequately consider the specific needs and circumstances of these households.

Furthermore, procedural justice concerns arise due to the inconsistent implementation of the FBE subsidy across municipalities. These situations occur where both the municipality and Eskom are responsible for the distributions of electricity. For example, residents in the Cape Town metropolitan area who are in the city supply areas access 60–25 kWh per month depending on their consumption, and the allocation is automatic for all qualifying residents that have a prepaid meter. Residents in the Eskom supply area access 50 kWh depending on their consumption, but residents need to register to access FBE (City of Cape Town 2022). In such cases, residents of the same municipality have a disparity in how they access their FBE allocation (Ledger and Rampedi 2022).

In many cases, deserving households are excluded from FBE because of complex eligibility criteria, which often prioritise homeowners or those meeting specific income thresholds (Mvondo and Mago 2010, SERI 2013, Ye *et al* 2018, Ledger and Rampedi 2022, Okyere and Lin 2023, SALGA 2023). For instance, numerous municipalities require annual re-registration, disadvantaging tenants and those unaware of deadlines (Ledger 2021). These procedural inconsistencies create barriers for low-income households, where administrative hurdles prevent access to essential subsidies like FBE. Without reform to address these gaps, the FBE Policy risks failing in fulfilment of its original mandate to ensure equitable access to affordable electricity for all low-income households, thereby worsening energy poverty.

### 5.11. Energy efficiency

Energy efficiency interventions targeting low-income households are not well recognised by the national government. Kambule *et al* (2019) note that progress in adopting these has been slow, partly due to the lack of government support for energy-efficient upgrades and limited consideration of appliances during purchases. This raises procedural justice concerns as there is a lack of subsidies to scale energy efficiency measures and appliances for low-income households. Knox *et al* (2018) emphasise the importance of promoting energy-saving measures to improve the effectiveness of the available electricity subsidies provided to low-income households.

Programmes such as the distribution of free compact fluorescent lights and the Solar Water Heater Programme in the early 2000's were introduced to mitigate energy demand issues caused by electricity supply challenges from the national utility, Eskom. However, these initiatives did not fully address the broader benefits of energy efficiency for households. This is evidenced by the difficulties many low-income households faced with solar water geysers, largely due to inadequate local maintenance capacity and high costs (Fakier 2018). Studies by Curry *et al* (2017) reveal that while these programmes aimed to reduce demand and promote energy efficiency, they fell short in supporting long-term, effective maintenance and broader energy efficiency improvements for the most vulnerable households (Tyabashe 2018, Kambule and Nwulu 2021, Tang *et al* 2022).

Additionally, the lack of affordable and dignified housing significantly affects thermal comfort, particularly for those residing in informal housing, highlighting issues of distributive justice, despite evidence that climate change and extreme temperatures will exacerbate these challenges. For example, the Western Cape ceilings retrofit project aimed to enhance the thermal efficiency of government-subsidised homes built between 1994 and 2005 by adding ceilings and insulation. A post-implementation study found that this retrofit significantly improved thermal comfort and reduced energy use for heating and cooling (ESMAP 2012). Following this, there was advocacy for new low-cost government-subsidised housing to adhere to energy efficiency standards, addressing issues such as poor building orientation, uninsulated walls and roofs, lack of ceilings, and air leakage from poorly fitted windows and doors (Muringathuparambil 2016). This issue further highlights concerns about recognitional justice, particularly in acknowledging the needs of residents in informal settlements, where energy poverty persists due to inefficient housing. Zinc-sheet structures result in homes becoming unbearably hot or cold. Although innovations like UV-reflective cool paint have been tested to improve thermal comfort, they have not been widely implemented (D. University of Cape Town 2015, Terhune 2017, Kimemia *et al* 2020).

## 6. Conclusion

In this paper we conducted a systematic literature review on energy poverty in South Africa between 1994 and 2023, employing the energy justice framework as an analytical tool to underscore the significance of addressing energy poverty for achieving a fair and equitable transition to sustainable energy. As part of the systematic literature review process, we identified and analysed eleven emerging themes and examined how these perspectives advance a multi-dimensional understanding of energy poverty in South Africa. In doing so, we have highlighted and examined key literatures that have documented different entry points to understanding energy poverty in South Africa. Our analysis of this literature contributes to firstly, reframing and broadening discussions around energy poverty to centre everyday practices and households, and secondly, to more closely considering the justice dimensions of the unfolding energy transition. By utilising the principles of energy justice, we have gained valuable insights into the complexities of energy poverty within the context of South Africa's just energy transition.

Put simply, energy justice illuminates how energy poverty is much broader than simply increasing energy access or contributing towards decarbonisation of socio-technical energy systems. It highlights restorative concerns related to historical injustices, procedural issues concerning access to subsidies, distributive impacts on young people and low-income households, and recognitional issues such as gender disparities and access to energy in informal settlements. This multifaceted understanding underscores that expanding electricity grid access alone cannot adequately resolve energy poverty, challenging previous assumptions. As awareness grows about how injustices are perpetuated or exacerbated by the energy transition in South Africa and other Global South contexts, there is an urgent need to scrutinise these inequities more closely. Understanding the dimensions of energy poverty through the lens of energy justice reinforces the notion that the energy transition encompasses broader societal considerations beyond decarbonisation efforts.

The analysis demonstrates how energy poverty is intertwined with and intensified by broader structural and systemic societal challenges. The 11 dimensions also demonstrate how multiple sectors and actors have the potential to contribute to alleviating energy poverty by providing incremental and integrated interventions to this complex and multi-dimensional phenomenon. Such an orientation to understanding energy poverty, that builds on the principles of energy justice, can empower policymakers to develop targeted approaches to support energy poverty alleviation.

The paper has three key areas of contribution:

1. **Empirical relevance:** Energy poverty is a frequently discussed yet often ambiguous and contested concept in South Africa. This paper seeks to critically analyse how academics, practitioners, and experts define the factors contributing to energy poverty, aiming to clarify some of the complexity around this phenomenon and move towards a shared understanding of a multi-dimensional perspective on energy poverty.
2. **Conceptual relevance:** Originally developed in the Global North, the concept of energy poverty requires adaptation to diverse contexts across the Global South, especially South Africa. This paper contributes by bridging the gap between energy poverty and energy justice in academic literature and policy, by considering household dynamics more comprehensively within discussions of just energy transitions.
3. **Policy relevance:** South Africa's JET Framework addresses energy poverty alleviation and incorporates several energy justice principles. This paper elucidates the specific dimensions of energy poverty within the JET Framework and explores how these can be better understood through an energy justice lens, highlighting potential interventions made possible by a closer focus on different implications of the dimensions of energy policy evident in the literature.

Broadening the framing of energy poverty within South Africa's JT Framework beyond the principle of restorative justice, our analysis of the themes shaping the dimensions of energy poverty has led to the following key recommendations for policy and practice:

To enhance **recognitional justice** in South Africa's just energy transition, it is essential to integrate women, the urban poor, such as backyard dwellers and informal settlement residents, as well as youth and children, into energy policy planning. This ensures their perspectives and needs are acknowledged, allowing the energy transition to benefit these currently marginalised groups. For example, clean cooking initiatives rolled out in Global South contexts are tailored to relieve these burdens on women and open up opportunities for them to participate in socio-economic activities. These can be supported through efforts to fairly recognise and include women in decision making processes around such socio-technical interventions, in ways that are appropriate and sensitive to contexts.

In terms of **restorative justice**, South Africa's historical context must be considered and continue to be centred, particularly as disparities such as the lack of spatial integration persist. These historical inequities continue to affect previously disadvantaged groups, leaving them more vulnerable to energy poverty.

Strengthening **procedural justice**, it is crucial that information and consultation on tariffs and access to energy subsidies, such as FBE and FBAE, is clear and easily accessible to households. Additionally, the views of these households should be integrated into the formulation of related policies.

Regarding **distributive justice**, there must be a focus on ensuring everyone has access to clean and affordable energy by removing barriers to subsidies and protecting municipalities' ability to cross-subsidise electricity. Interim energy solutions that are easily deployable in rapidly urbanising areas together with energy efficiency interventions should be considered. Furthermore, the burden of energy costs must be shared equitably, preventing the poor from reverting to traditional energy sources.

While presented in a linear manner, the analysis highlights the intersectionality of the themes shaping the dimensions of energy poverty in South Africa. Effectively addressing energy poverty requires a systemic approach that acknowledges these interconnected factors, ensuring sustainable solutions that tackle the root causes of energy poverty in South Africa, and elsewhere in the Global South. It is essential to recognise that current strategies focusing solely on electricity access and affordability may overlook structural elements contributing to energy poverty.

## Data availability statement

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