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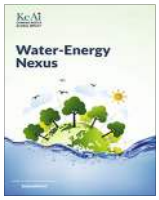

Inequalities in access to energy in informal settlements: Towards energy justice in Gqeberha and Komani in South Africa

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ABSTRACT

As South Africa continues to strive towards securing sources of sustainable energy, the needs and interests of marginalised communities in informal settlements with respect to energy should not be overlooked or ignored. Although energy is available in most informal settlements, as it is unaffordable for many residents, they frequently choose to make use of illegal connections and inexpensive but unsafe sources of energy, which undermines the objectives of the National Energy Act of 2008. One of the objectives of the National Energy Act 34 of 2008, which is articulated in Section 2 of the National Energy Act (the NEA) of South Africa, is to achieve an uninterrupted supply of energy and facilitate access to energy, to improve the quality of life of all of the people of South Africa. An evaluation of the supply of energy in the Chris Hani District Municipality and Nelson Mandela Bay Metropolitan Municipality in the province of the Eastern Cape reveals that this objective has not been met, as marginalisation in the energy economy is increasing in the informal settlements in these areas. The aim of the study on which this paper is based is to investigate the factors that contribute to the exclusion of residents in informal settlements from access to renewable energy and their implications for sustainable development in informal settlements and allowing residents full participation in the energy economy of South Africa. The study is concerned specifically with informal settlements in the Chris Hani District Municipality in Komani, which is considered to be a poor municipality, and the Nelson Mandela Metro Municipality in Gqeberha, which is considered to be a municipality that caters for the needs of relatively affluent segments of the population. This paper represents an endeavour to make an accurate assessment of access to energy in the informal settlements in the two municipalities, from the standpoint of identifying and overcoming the root causes of inequalities with respect to energy, rather than attempting to remediate their symptoms.

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1. Introduction

As cities are frequently associated by members of rural communities with opportunities for employment and the promise of an improved standard of living, they continue to attract increasing numbers of people from rural areas, towns, and villages (Monyai & Chivanga, 2020; Afeadie, 2022). It is estimated that while of the order of 13.9 % of the South African population reside in informal settlements, for Gqeberha the figure is in the region of 6.9 % (NMM, 2020) and 2.9 % for Komani (Chris Hani IDP, 2020). Although these figures reflect a long history of severe inequality in the country, they also underscore the extent to which significant majorities of the population have been excluded from participating in the mainstream economy and from having access to renewable energy (Todes & Turok, 2018). In the aftermath of decades of apartheid-era urban planning, steadily proliferating informal urban settlements serve not only to emphasise the extent to which the fabric of South African society is plagued by severe socioeconomic disparities, but also by corresponding disparities with respect to access to basic amenities and resources such as energy (Smith, 2022).

Poverty encourages many residents of informal settlements to use illegal electricity connections and unsafe sources of energy. The relatively recent phenomenon of invasions of urban land by disgruntled members of communities in informal settlements surrounding large urban centres calls into question the efficacy of government policies pertaining to urbanisation and informal settlements in particular (Nxumalo, 2016). Socioeconomic disparities and social divisions in South African cities are among the greatest in the world and are manifested in extreme social and spatial inequalities (Marcus & Marcus, 2022). As these enduring disparities have resulted in high levels of dissatisfaction concerning a lack of access to basic services, access to energy in informal settlements continues to be marked by controversy and has created many dilemmas for successive South African governments in the post-apartheid era. The inability of the existing infrastructure of South African cities to provide adequate amenities and services to all raises questions concerning the commitment of the government to resolving the "politically sensitive" problems that arise as a consequence of spatial patterns in the country, which also underscores the need for effective proactive policies to manage access to energy in informal settlements.

Households require energy as an essential service to meet basic human needs. Although electricity is the principal form of energy that is used to meet the needs of households in South Africa, it is estimated that in the region of 43 % of South Africans are energy poor. Informal settlements are populated mainly by migrants from local rural communities and unemployed foreign migrants. The energy poverty that is endemic in some rural areas is also visible in informal settlements. Responses to energy poverty in informal settlements often entail the mixed use of traditional sources of energy such as firewood and cow dung and intermediate sources such as paraffin, while modern sources in the forms of electricity, liquefied petroleum gas (LPG), and biogas are also used. Despite the high cost of energy and the inability of many residents to pay for it, energy is consumed extensively in informal settlements to provide lighting and power appliances such as electric stoves, television sets, telephones, fans, and refrigerators. The high demand for energy and the high cost of energy are among the principal factors that encourage residents of informal settlements to resort to illegal electricity connections (Butera et al., 2015). Some of the factors that hinder residents of informal settlements from having access to electricity are summarised in Table 1.

Table 1
Factors that restrict the ability of residents of informal settlements to have access to electricity.

Distance of informal settlements from the main grid	Settlements located far away from the main grid are either costly or impossible to connect to it.
Illegal connections	As large numbers of residents of informal settlements are not willing to pay for electricity and rely on illegal connections, it becomes difficult and unprofitable to connect informal settlements to the main energy grid.
Income poverty	As many of the residents of informal settlements are either unemployed or earn little income, the cost of electricity is unaffordable.

Residents of informal settlements suffer the economic consequences of insufficient energy for productive income-generating activities and fulfilling other fundamental needs such as education and maintaining health, which ably demonstrates the positive correlation between income poverty and energy poverty. Most energy poor households rely largely on unsafe and unhealthy sources of energy, such as paraffin, coal, and biomass, because they unable to afford reliable and safe energy. Access to energy is determined not only by its availability, but also by its affordability, which, in turn, is determined by income levels and socioeconomic status. As a direct consequence, the residents of informal settlements in both the Chris Hani District Municipality and the Nelson Mandela Bay Metropolitan Municipality are adversely affected (Monyai & Chivanga, 2020). In an attempt to enable poor households to afford to make use of electricity once they have been connected to the grid, the government of South Africa introduced its Free Basic Electricity (FBE) policy in 2003, which allows disadvantaged households 50kw of free electricity per month to meet basic energy needs (Masekameni, Kasangana, Makonese, & Mbonane, 2018). Despite the introduction of the policy, access to free basic electricity is still not available to all indigent households (Simmons, 2020). The FBE is funded by the central government, through the Local Government Equitable Share grant, which is an unconditional grant that is disbursed to municipalities for the provision of basic services to households, and also through cross-subsidisation by high-end users such as industry and wealthy residential customers (Moatshe, 2018).

South African cities and towns such as Komani and Gqeberha are often characterised by socioeconomically determined distributions of population groups, with marginalised poor communities living on their peripheries. Marginalised groups have limited access to the amenities and services that are made available to other residents, such as access to clean energy (Runsten, Fuso Nerini, & Tait, 2018). As women in households are the primary users of energy, their central role needs to be accorded an equally central position in advocacy for sustainable development in energy poor and socioeconomically poor communities in South Africa (Sustainable Energy Africa, 2015). Although promoting the use of clean energy sources represents a meaningful step towards achieving energy justice, striving to do so without giving due consideration to the economic circumstances of energy poor communities and the types of energy sources that they are able to afford and their ways of life is likely to undermine fatally any meaningful efforts to accord social justice to them. Energy justice entails enabling communities to have access to safe, affordable, and sustainable energy, which is hindered by the relatively high cost of electricity (Department of Energy, 2012). As a consequence, poor households rely primarily on candles, paraffin, firewood, or gas to light their homes and provide energy for cooking (Department of Energy, 2017). Although solar energy inverters are used in some instances, owing to the high installation costs of photovoltaic tech-

nology, poor households are often obliged to use unclean sources of energy such as firewood.

2. Inequalities with respect to household energy in informal settlements

While it needs to be acknowledged that interventions have been implemented to alleviate energy poverty, success has nonetheless been limited to date and poor households continue to be obliged to rely on firewood and paraffin. Interventions have tended to be concerned with technical considerations, rather than practical solutions for making safe energy available to poor communities. Practicable interventions, such as encouraging the use of improved indigenous wood burning stoves that are equipped with chimneys that render them safe to use and reduce carbon dioxide emissions, and instruction in the correct use of gas stoves are needed for households that are unable to afford electricity or solar panels. Although inhaling the smoke and fumes that result from burning firewood is injurious to health, people who perceive that they have no alternative options will inevitably continue to place their health and that of their families at risk by burning firewood without any means of diverting the resulting smoke and fumes away.

Introducing photovoltaic technology without providing adequate instruction to users and subsequent monitoring of their ability to use it correctly and effectively and providing access to grid electricity to people who are unable to afford to buy electricity continuously are both exercises in futility, as doing so reflects a concern with energy justice that is not matched with a corresponding concern for social justice. Instead, the root cause of energy poverty needs to be overcome, which is income poverty. In addition, awareness campaigns to encourage saving energy are needed in communities, to reduce inequalities with respect to access to energy. At present, insufficient attention is accorded to saving electricity in households and the agricultural sector. Policies need to be formulated that include monitoring and analysing patterns of consumption and selecting technology to maximise the efficient consumption of energy and minimise wastage. As a response to the inherent inequalities in accessibility to the distribution of resources in South Africa, the government has given an undertaking that by 2025, 97 % of the population, from the wealthiest to the poorest, will have access to grid energy and 3 % to the solar home system (Runsten et al., 2018).

As it is articulated in the National Development Plan Vision 2030, the privileges of minorities in all facets of development have become the rights of all citizens since the attainment of democracy in 1994, including access to safe, efficient, and clean energy. Nonetheless, energy poverty remains highly prevalent in informal settlements. As most informal settlements are situated on the peripheries of towns and cities, many do not have formal access to electricity that is distributed by either Eskom or local municipalities. As a consequence, many residents of informal settlements obtain access to electricity through illegal connections (Baker & Phillips, 2019), although there is now a national drive to electrify informal settlements.

As informal settlements have evolved in a spontaneous and unplanned manner in the vicinity of both the Gqeberha and Komani municipalities, they lack infrastructure for basic services such as electricity (Benson, 2020). Although energy policies are formulated to provide grid connections to structures that comply with building regulations, dwellers in informal settlements are obliged to resort to hazardous alternatives such as illegal electricity connections, which frequently result in electrocutions (Fuzile, 2017). Illegal connections also contribute to the debt of municipalities, as the cost of illegally used electricity in settlements cannot be recovered. Municipalities regularly dispatch inspectors to remove illegal connections, but the results of attempts to curb the practice are usually short-lived, although the removal of illegal connections has prompted service delivery protests (Khubisa, 2017). Ever-escalating increases in the populations of informal settlements place correspondingly increasing demands on available energy, but there is a dearth of practical planning to accommodate projected energy requirements, particularly the requirements of lower income groups.

Several factors act as constraints with respect to the availability and accessibility of energy in the Nelson Mandela Bay Metropolitan Municipality and the Chris Hani District Municipality, namely, safety and health, cost, alignment of spheres of policy, housing design, and illegal connections. In many cases, illegal connections contribute to the collapse of networks and also entail unsustainable costs to monitor closely (Sustainable Energy Africa, 2015). Both municipalities are adversely affected in this respect and it is estimated that of 20 000 illegal connections in the Nelson Mandela Bay Metropolitan Municipality, only 800 were remedied by replacing them with cheaper alternatives.

It is also estimated that of the order of 35 % of households in informal settlements in urban areas make extensive use of non-renewable energy sources, such as blankets and warm clothing, to compensate for a lack of sources of energy to provide space heating. As the availability of biomass in these areas is relatively limited, residents of informal settlements are obliged to rely largely on electricity, paraffin, and firewood for energy, although the use of hazardous fuels significantly increases the risk of fires. In addition, as the dwellings in densely populated informal settlements are likely to be constructed from poor quality building materials, illegal connections expose residents to severe hazards (Sustainable Energy Report, 2016).

The diversification of sources of energy in South Africa is crucial to meeting several developmental goals and increasing the security of the energy supply. Demand for energy is expected to increase by from 30 to 50 % in the next two decades (Norouzi, 2022). At present, the range of sources of energy is dominated by those that are generated from fossil fuels, namely, coal, oil, and gas. South Africa is starting to follow the global trend of alternative energy solutions in its policy to develop renewable energy solutions, as is evident from the formulation and implementation of the Renewable Energy Independent Power Producer Procurement Programme. Energy supply networks also operate in areas in which informal settlements are located, in the form of small and micro traders who sell paraffin and gas. It has been reported that there has been a slight decrease of in the region of 10 % from 2007 to 2017 in the numbers of households that are not connected to the electricity grid, while other municipalities have investigated the feasibility of introducing solar home systems for off-grid electrification of informal settlements in urban areas.

Households in informal settlements in urban areas of both municipalities mainly use paraffin, rather than firewood, for heating, owing to a general lack of availability of the latter. The Nelson Mandela Bay Metropolitan Municipality has formulated short-, medium-, and long-term developmental plans to provide safe and reliable electricity to all of its residents. It intends to partner with independent producers of power to produce sustainable energy, of which in the region of 30 % is intended to be obtained from alternative sustainable sources (Nelson Mandela Bay Municipality Integrated Development Plan, 2020). This strategy complements the Energy Mix Master Plan of 2020, whose aim is to curb the use of fossil fuels and reduce reliance on the Eskom grid, in order to decrease the cost of energy to consumers. The energy mix balances biomass, solar or photovoltaic, biogas, and wind energy. In addition, the Electricity and Energy Directorate of the Nelson Mandela Bay Metropolitan Municipality has invited appro-

priately qualified service providers to participate in the installation of solar photovoltaic rooftop systems to meet the needs of citizens who reside within its jurisdiction (Nelson Mandela Bay Municipality Integrated Development Plan, 2020).

The energy landscape has undergone profound changes in both municipalities and the province of the Eastern Cape as a whole. Technological advances, increased affordability, and the ever-increasing cost of grid electricity have encouraged growing numbers of households to install photovoltaic technology in their homes, despite the costs that doing so entails. Replacing electrical geysers with solar power and using liquefied petroleum gas for cooking and heating homes (Nelson Mandela Bay Municipality Integrated Development Plan, 2020) substantially reduces dependence on increasingly expensive electricity in relatively affluent households, while fuels such as wood, paraffin, and coal are widely used for cooking and heating in low-income areas and informal settlements, particularly in winter (Chris Hani District Municipality, 2018). Although members of households in low-income communities often acknowledge that domestic fuels could be injurious to their health and well-being, they continue to use these fuels because they cannot afford to use alternative energy sources to meet their needs (Monyai & Chivanga, 2020).

As it can be seen in Fig. 1, wood is more widely used for cooking than electricity in the Eastern Cape and the extents to which electricity is used in urban and rural areas are significantly different, while paraffin is still used for cooking in both urban and rural areas.

The inability of Eskom to provide a continuous and reliable supply of electricity and the threat of continued load shedding requires innovation to cater for the day-to-day management of electricity and energy. As Eskom remains the principal supplier of electricity in South Africa, measures need to be taken to reduce the burden on the electricity that it is able to generate. In 2019, a decision was taken by the Minister of Mineral Resources and Energy to integrate new strategies to diversify the generation and supply of energy (DEA, 2019).

3. Research methodology

Document analysis, a qualitative research method that entails reanalysing existing data that has been collected and analysed by researchers for other purposes (Rubin & Babbie, 2016; Chivanga, 2016), was used to analyse the data that is analysed in this paper. The use of existing data differentiates it from procedures that are followed to analyse primary data (Johnston, 2014). Conversely, document analysis, like the procedures that are followed to analyse primary data, requires specific systematic procedures to be followed to perform accurate and relevant analyses of data (Johnston, 2014).

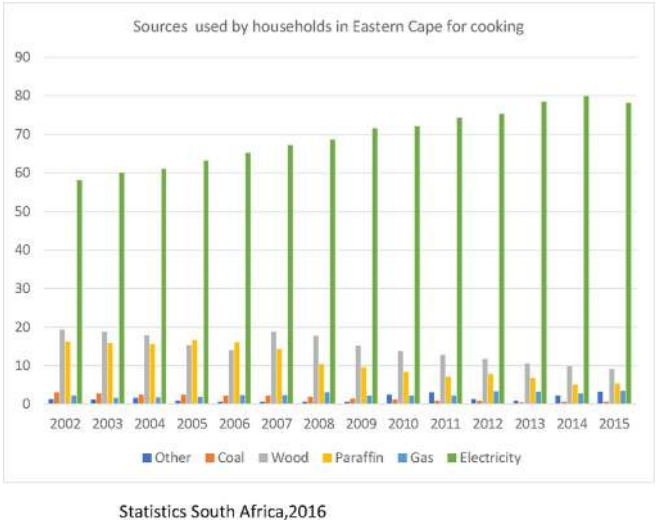

Fig. 1. Summary of distributions of energy sources in the province of the Eastern Cape.

The document analysis was guided by the following objectives:

- To identify the factors that militate against residents of informal settlements having access to energy.
- To identify the implications of exclusion from access to energy for residents of informal settlements in South Africa.
- To determine the extent to which residents of informal settlements have access to renewable energy in Gqeberha and Komani in South Africa.

The following research questions were formulated to guide the conducting of the study on which this paper is based:

- What are the factors that have contributed to residents of informal settlements in South Africa being excluded from having access to renewable energy?
- What are the implications and consequences of their exclusion?
- To what extent do residents of informal settlements in Gqeberha and Komani in South Africa have access to renewable energy at present?

The first step of performing the analysis entailed the selection and reviewing of relevant accredited articles, textbooks, education websites, and policy documents, to assemble an appropriate body of relevant literature to subject to document analysis, with the specific aims of accomplishing the objectives that have been articulated and contributing to the existing body of knowledge pertaining to overcoming inequalities with respect to access to energy in informal settlements.

The literature review was confined to material that provided contemporary data pertaining to the degree of access that residents of informal settlements in South Africa had to energy. Searches were conducted of the database of the Department of Higher Education and Training (DHET) and other databases that contained relevant published scientific material by recognised experts in the field of renewable energy, such as Sciencelo, Scopus, ISI, the Norwegian list, and IBSS, from 2014 to 2022. A technique that was akin to snowball sampling was used to locate potentially relevant literature, which entailed perusing the lists of references that were appended to relevant documents. Using the technique also permitted the broadest possible overall understanding of the research topic to be developed. Keywords such as "renewable energy technologies", "informal settlements", "inequalities in access to energy", "sustainable development", and "energy poverty" were used to conduct searches to select relevant articles, policy documents, and book chapters purposively, while documents that were found to be not sufficiently relevant were excluded. The abstracts of potentially relevant documents were used to determine whether they should be included in or excluded from the study. Documents whose abstracts were found to be sufficiently relevant were downloaded and the screening of the abstracts resulted in approximately 20 documents being considered to be relevant to the study, which were subsequently reviewed and analysed. On the basis of a critical analysis of these documents, recommendations were made for facilitating inclusive access to renewable energy for residents of informal settlements, which are discussed in the following sections and the conclusion of this paper.

4. Investing in energy in Gqeberha and Komani in South Africa

4.1. Providing adequate resources for expanding sources of energy

Sufficient resources need to be provided to support the expansion of sustainable sources of energy, rather than attempting to rely on short-term solutions, as sustainable solutions, such as expanding the range of sustainable sources of energy, have the greatest potential for overcoming energy poverty permanently.

4.2. The necessity of reviewing the free basic electricity policy

The reviewing of the Free Basic Electricity policy is necessitated by the need to determine whether the two state grants through which it is implemented are sufficiently adequate to enable municipalities to meet their payment obligations to Eskom. Secondly, it also needs to be determined whether the numbers of grants that are allocated are able to keep pace with the continuous expansion of informal settlements in size. Thirdly, adequate monitoring and evaluation are required to ensure that the allocation of grants is sufficiently rigorously managed, a crucial consideration in the light of widespread reports of mismanagement in municipalities throughout the country.

4.3. Eskom as a dominant supplier of energy

As a dominant supplier of electricity, Eskom enjoys an unfettered monopoly in the market. Consequently, it is imperative that the government should allow suppliers of alternative energy from the private sector to enter the market, to allow consumers to increase the range of options with respect to energy that are available to them and benefit from a competitive market. Doing so would not only ease the burden that results in the need to impose load shedding on consumers, but also enable the country to reduce its carbon footprint in the global drive to combat climate change and global warming.

5. Conclusion

Access to energy that is based on socioeconomic status and location continues to contribute to the gross disparities that are found in post-apartheid South Africa. Its pervasive effects amount to discrimination with respect to access to energy against residents of informal settlements and the maintaining of the socioeconomic disparities of the past, despite the removal of institutionalised apartheid. The interests of marginalised communities in informal settlements are effectively pitted against those of a troika of the historically concentrated distribution of wealth of the past, the new and politically connected black middle class, and the professional elite. The inevitable conclusion is that as it is incumbent on the government to fulfil its promise to provide a better life for all South Africans, it is imperative that the marginalisation of particular sections of the population should end and communities that are obliged to live at the peripheries of towns and cities should no longer be deprived of the social and economic opportunities that accompany their development. The wide disparities that persist in post-apartheid society, including grossly disparate access to energy, effectively reinforce inequalities in respects such as access to land and gainful employment. The low levels of development of human capital and the poor quality of social services that are extended to them serve to render residents of informal settlements politically invisible and voiceless. As it is possible to contend, with a great deal of justification, that democracy functions only when the voice of the people is heeded by governments, it is also possible to contend, with equal justification, that the conditions under which the residents of informal settlements continue to be obliged to live represent an accurate litmus test for determining the extent to which democracy has been achieved in post-apartheid South Africa.

Declaration of Competing Interest

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

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