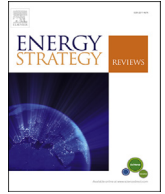




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Energy provision in South African informal urban Settlements - A multi-criteria sustainability analysis

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ABSTRACT

In South Africa, as in much of sub-Saharan Africa, strong urbanization trends lead to people settling in ever less suitable informal locations, which are often considered ineligible for basic service provision. This study explores how access to basic energy services can be provided to informal urban households in South Africa that are ineligible for grid electrification. This is done through a multi-criteria sustainability analysis of current and alternative ways of accessing energy services. The case of the Western Cape Province is explored, showing that barriers for electrification can be overcome in some cases, given that there is political will at the local level to do so. When electrification is unviable, off-grid electricity alternatives combined with support for access to modern cooking fuels may provide short or medium-term solutions. This study further suggests that governmental efforts of meeting basic energy needs must be persistently oriented and structured towards access to energy services, as opposed to supply of electricity.

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1. Introduction

One in three urban dwellers in the global South (over 900 million) lives in slum areas or informal settlement. In Africa, the share is more than half (61.7%) and by 2050, its urban population is projected to have increased from 400 million to 1.2 billion [50,51]. South Africa (RSA) has had strong urbanization trends for decades and the policies of the Apartheid era has contributed to the challenges cities face in addressing them, contributing to a large part of the urban poor population living in informal settlements [48,55].¹ The informal settlement population constitutes at least 4.4 million people, thus representing 10% of the

total population and growing at a faster rate (3.5%) than that in formal housing (2.5%) [10,56]. A considerable number of the informal settlements do not have electricity access at all, or have illegal and hazardous access through theft [20].

1.1. The case of the Western Cape Province of South Africa

In the Western Cape (WeC) Province 16% of households live in informal dwellings and out of those, 89% are connected to the mains electricity supply [39]. Located in that province, Cape Town is one of the cities in RSA with highest residential access to electricity [41]. However, as a relatively wealthy municipality and still not fully electrified it provides an interesting case study for studying the challenges of service provision in the informal urban context. In Cape Town, 16.5% live in informal housing [40]. Among the informal households, electricity access differs. It has been estimated that 80–85% of Cape Town informal households situated on municipal land have electricity access, while the same number for all informal households, also including those on private land is only 60% [21]. According to the latest community survey however, only 6% (approximately 70 000 households) do not have access to electricity via their own meter [41].

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¹ Statistics South Africa defines informal settlements as unplanned settlements on land which has not been surveyed or proclaimed as residential, that consist mainly of informal dwellings. Informal dwellings are in turn defined as makeshift structures not approved by a local authority and not intended as a permanent dwelling [39]. Informal dwellings also include those located in backyards of formal properties, so called backyard dwellings [56]. This phenomenon consists of families renting land in the backyard of another household, thus affording an income to the latter [21]. These areas may be located on formal or informal land, in buildings that do not meet official standards and planning [55].

1.2. Energy access policies in South Africa

Access to electricity is acknowledged by the Department of Energy (DoE) as a constitutional right of every South African citizen, regardless of location [10]; p. 6). It is worth noting that although electricity is not explicitly expressed as a basic right in the constitution itself, it is strongly implied by various statutes in RSA law [21]. In 2004 the South African electrification program consequently set an ambitious target of universal access to electricity by 2012, providing 5 million connections by 2005 [5]. Uncertainties regarding how the goal was formulated and insufficient means later led to the setting of a new target of 97% access by 2025 [6,38]. While grid electrification has earlier been limited to formal housing, it is now considered the primary means for energy provision in informal settlements [10]. However, due to the varying settings and informal features of these settlements, not all households or settlements are considered eligible for grid connection.

For an informal settlement to be eligible for grid electrification it must be close to existing infrastructure and situated so that electrification is feasible. The area is further not to be targeted for upgrading, redevelopment or relocation within three years. Unsuitable and impermanent locations of settlements decrease the likelihood of subsidization. Further elements of the location of a settlement which cause it to be considered unsuitable are proximity to high voltage lines, on a road or rail reserve, on a flood-prone area or flood plain, on a storm water retention or detention pond, on private land, on unstable land or on land associated with environmental issues or health and safety hazards. Backyard dwellings cannot be subsidized for electrification by the Department of Energy (DoE) due to requiring additional upgrading of network infrastructure, which is considered as double funding of households which will eventually require relocating [10]. This causes what could be called a blind spot of the energy access policies [21], often leading such households to steal electricity from the grid or to buy it from neighbors through extension cords. These practices compromise the safety of the households and the stability of service delivery for both the households and the local electricity network as a whole [21]. This suggests that additional measures to grid connection should be considered to better address the diverse features of informal settlements [43].

In addition to the electrification program there are a range of other energy policies also targeted at low-income households. The Free Basic Electricity (FBE) policy, aimed at assuring electricity access to the poorest households, imply that 50 kWh is to be considered basic access to electricity. As a comparison, low-income households in SA in general use on average 150 kWh of electricity per month [14,22]. The Free Basic Alternative Energy (FBAE) policy subsidizes other energy carriers such as paraffin and LPG. The FBAE policy tends in practice to be reserved for rural areas and there is little experience of it being applied in urban unelectrified settings [21]. Rural households that are unlikely to be reached by grid electrification in the medium term are targeted to be provided with electricity access through the non-grid electrification policy. Solar Home Systems (SHS) with a power output of approximately 250 Wh/day are seen to be adequate for these households, implying a medium-term access level [11]. The solution is, however, currently limited to rural settings and does not typically cover urban informal settlements [11]. The policy for providing SHS to rural areas also require concessionaires to provide fuels for cooking such as paraffin and LPG [11]. It is however unlikely that the challenges around paraffin safety will be easily overcome in RSA and stakeholders have expressed a preference for transitioning to modern alternatives such as LPG or electricity [46].

1.3. Existing literature

Previous research on this topic includes work by Ref. [37] that builds the foundation of a framework intended to assist in identifying and addressing barriers to meeting the energy needs of the informal sector in RSA [14]. investigates the practice of informal re-selling of electricity [26]. assess the relationship between the risk of household energy accidents, household income and energy poverty in South Africa and suggest that household energy transitions that displace paraffin with LPG and candles with electricity or solar power can help reduce the incidence and burden of these accidents. This is done through a review of past and current initiatives and national as well as international strategies [38]. reviews policies aimed at addressing urban energy poverty in South Africa [21]. looks at demand and supply side barriers for various options for modern cooking through a case study of a settlement in Cape Town [43]. discusses the limitations of the grid electrification approach in the current urban context [25]. investigates the application of SHS as a part of incremental upgrading of informal settlements based on a project in the Eastern Cape Province and [30] briefly examine alternative energy options for informal settlements in the city of Johannesburg, RSA. Internationally, best practices from case studies of informal settlements in four countries have been identified [12,13] [45]. provides a locally informed framework for measuring energy access in South Africa as a response to the dominance of metrics with universal applicability in the literature [27]. assesses the different levels of uncertainty that affect the analysis of electrification of informal urban settlements and the implementation of upgrading policies and points to how the focus on technical uncertainty draws attention from the debate on the socio-political challenges of informal settlement upgrading [8]. engage with the complexities of upgrading interventions through a comparison of three upgrading projects, and suggest that however critical the provision of basic services is, it needs complementing with support from social and economic programs. Most recently [44], provides an overview of some key issues with the current electrification program with respect to informal settlements, along with some practical recommendations for the city of Cape Town. Academic literature on the subject is however scarce. More specifically, there is a lack of an overview of significant factors in providing sustainable access to energy services in general in the context, to serve as a foundation for further exploration of this increasingly significant development in the broader context. In this study, we explore how access to basic energy services can be sustainably provided to South African informal households that are ineligible for grid electrification. This is explored through analyzing options with a selection of criteria.

2. Method

This study set out to evaluate the suitability of various energy access alternatives for urban informal households that are not eligible for grid electrification, using Cape Town, South Africa as a case study. For structuring the analysis of the alternatives, this study utilized an adaptation of the approach of [17]; as seen in Fig. 1. That study elaborates a Multi-Criteria Decision Analysis (MCDA) to derive a final quantitative index score for each of the compared options. In this work however, such a quantitative index was omitted as important aspects of provision of access to energy services in this context were related to dynamic political and social factors. Therefore, an overview of noteworthy aspects of sustainability among the alternatives is presented in an overall comparison (denoted as Multi-Criteria Sustainability Analysis or MCSA here), complemented with a discussion of barriers and opportunities related to these dynamics.

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