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The Kenya Slum Electrification Program. Local politics of electricity networks in Kibera

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ABSTRACT

The development of universal electricity networks remains a challenge for public authorities and energy utilities in many African cities characterized by rapid urbanization and high poverty levels. This article looks beyond the technicalities of recent electrification programs to explore the politics of introducing new socio-technical rules and practices in unplanned settlements. Our empirical study investigates the implementation of the Kenya Slum Electrification Project in Kibera, one of the most deprived areas of Nairobi, and the regularization of electricity services promoted under the scheme. Approached through a political perspective at a local micro-scale, attempts to control and regulate electricity supply and use in the slum appear to be highly conflictual and reveal considerable power struggles over this marginalized territory. The analysis confronts the socio-technical strategies of the Kenya Power and Lighting Company with the everyday tactics and resistance of subaltern actors. It allows for an in-depth understanding of electricity networks as political terrains and conflict zones, and as junctions that mediate particular socio-spatial relations. Based on our exploratory study on the negotiations surrounding the project and the circumventions by slum dwellers we suggest perspectives for addressing the local politics of slum electrification and malfunctions in their design.

1. Introduction

Within the context of the ambitious national programs “Kenya Vision 2030” and “Kenya Slum Electrification Program” (KSEP), the key goals for the Kenyan government are to reduce poverty, to promote economic growth and to reduce GHG emissions by universalizing electricity supply in the country by 2030. In Nairobi, Kenya’s state capital, energy supply in slum areas has traditionally been shaped by splintered access to formal electricity grids and a high reliance on other energy sources such as charcoal and petroleum. As the number of registered household connections in informal settlements is marginal, many urban dwellers traditionally self-organize access to electricity networks through informal connections. The government’s aim to provide for and regularize universal access to electricity is a way to align with international standards, particularly with the “Sustainable Development Goals” (objective no. 7: providing sustainable energy to all). It is a long-term process, which aims in fine at upgrading urban slums, ensuring cost recovery of network extensions, homogenizing urban space and contributing to the socio-economic development of the city and country. Kenya would thus be among the first African countries

to achieve universal electricity access.

However, these goals particularly face two challenges. First, previous attempts by the Kenya Power and Lighting Company (KPLC)¹ to align the service provision to existing standards, to push back illegal taps, reduce customer dependence on the use of charcoal and petroleum and to safeguard its cost recovery interests have been a highly politicized and controversial endeavor. They had to face heavy opposition from the informal suppliers and their local clients. Particularly in Kibera, one of the oldest and biggest informal settlements in Nairobi, such attempts have provoked riots and violence against technicians. Second, current efforts of the KSEP to roll out upgraded network and prepaid metering technologies that are difficult to tap illegally are highly controversial. Slum upgrading through network extensions has met with resistance from the inhabitants who are sometimes reluctant to leave their illegal electricity supplier. The resistance has been stronger among informal distributors and cartels that have in some cases resorted to violence to express their opposition to the state’s attempts to regain control over this service.

Based on an analysis of the KSEP, its policy ambitions and local implementation procedures, this paper aims at understanding the

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E-mail addresses: remi.debercegol@cnrs.fr (R. de Bercegol), j.monstadt@uu.nl (J. Monstadt).¹ Kenya Power and Lighting Company is a majority state-owned (50.1%) electricity transmission and distribution company which operates most of the country's network and sells electricity to over 6.2 million customers (as at July 15, 2017). < <http://www.kplc.co.ke/content/item/14/about-kenya-power> > .

political economy of slum electrification through a case study of Kibera. For this, we draw upon academic literature on urban infrastructure provision, governance and politics in cities of the Global South. In particular, we look at the socio-technical adjustments carried out by the KPLC engineers under the KSEP to stop illegal connections in poor urban settlements, such as the implementation of prepayment technology and involvement of communities. How is the scheme being shaped by KPLC to the specific scale of the slum and through which modalities? How are the new commercial relationships between the users, informal suppliers and the company being negotiated and mediated? Here, we are particularly interested in the readjustment of power relations that accompany the extension of regularized networks and the everyday practices of low-income residents shaped by the pre-existing informal suppliers and cartels of a poor neighborhood. How are users and informal suppliers counterbalancing attempts of regularization? How does the formalization of supply affect the status of urban poor in the city? The objective of this study is thus not primarily to evaluate the effectiveness, efficiency or legitimacy of this on-going national program. Instead, we aim to uncover the political negotiations and resistances surrounding the electrification process in marginalized areas. Electricity networks are thus seen as political terrains and conflict zones, and as junctions that mediate particular power relations in poor urban settlements.

Our analysis of the strategies employed by KPLC and on the tactics of resistance by the local urban poor applies a qualitative methodology undertaken in Nairobi's neighborhood of Kibera. Following a multi-level approach [1], we conducted 40 semi-structured interviews between 2015 and 2017 with different stakeholders

involved in urban electrification: various experts from the KPLC, the Ministry of Energy and Petroleum, the Energy Regulatory Commission, local technicians, local elected representatives and stakeholders from civil society (activists, NGOs) and researchers. Moreover, the assessment of grey literature, websites, official city and state documents, secondary literature and newspaper articles have played a crucial role in analyzing the specificities of the KSEP. Based on document analyses, interviews and several visits to other slum areas of Nairobi we decided to focus our research on a pilot program for the electrification of Kibera, co-funded by the World Bank's Global Partnership on Output-Based Aid (GPOBA) and closely observed by international donors and NGOs. A large part of the empirical research involved following the engineers and technicians mandated by the electricity company in their everyday routine to understand their interactions with local residents and the technical modifications they carried out. In parallel, using an ethnographic approach, we studied the ways in which the slum's illegal electricians and cartels work and sought to understand their modalities in electricity supply and how they oppose the electrification scheme on their territory. Lastly, we conducted about 40 semi-directive interviews with inhabitants from different parts of the slum to understand their energy practices. Some of these interviews were held in Kiswahili and translated in English with the help of an assistant.

Our investigation thus addresses the on-going regularization process of electricity services in Nairobi's slums. Most importantly, it provides an opportunity to understand the emergence of new urban norms in slums, their negotiation and their impact on everyday practices within the framework of a national electrification scheme. The paper begins with an introduction of the current policy on electrification in cities in Africa and, more specifically, of academic debates of slum electrification in the Global South. These sections are followed by an in-depth case study on the modalities of access to electricity in Nairobi and Kibera and by a section which explores the specific socio-technical modifications of the slum electrification project. We conclude by suggesting a critical reading of this project by analyzing the contrasted effects of the state's renewed approach to slum neighborhoods like Kibera and by providing perspectives for addressing the local politics of slum electrification.

2. Questioning the modalities of electrification in poor urban settlements

2.1. Energy infrastructure in African cities

Although Africa currently has the lowest urbanization levels of all global regions, "Africa's Urban Revolution" [2] is expected to go along with over 700 million new urban dwellers by 2030 [3]. The extension of power grids to connect the areas, which were historically relegated to the margins of the network is seen as one of the key vantage points to reduce poverty, to promote sustainable economic growth, inclusiveness and social well-being and to combat climate change, air pollution and deforestation. According to the Africa energy outlook, bioenergy, mostly fuel wood and charcoal, accounts for more than 60% of the energy demand in sub-Saharan Africa which grew by around 45% from 2000 to 2012 [4]. Sub-Saharan Africa's overall electricity access rate was at 35% in 2014, and 63% of the city dwellers had access to electricity [5].

So far, the solutions for the provision of electricity services in African cities have been largely reproducing models developed in the global North, which were transferred to Africa since colonial times [6]. For a long time, a "networked city", integrated and ordered by universal networks, centrally planned and managed by a single public utility and offering a uniform service in a given area, has been considered as being consubstantial to the development of "modern" cities [7]. Due to the presence of a historically segregated service provision targeting a minority of the urban population, the ideal of a universal network access for all urban residents has never been attained [8: 1843] and large urban areas have remained with splintered access to infrastructure networks.

As African cities showed a deviance from this hegemonic model, they were often described in terms of failures, developmental delays or "incomplete modernities" [9]. In order to go beyond conventional deficiency analyses and simplistic blueprints of either "appropriate" or conventional networked solutions, postcolonial critiques argue that more attention should be drawn to the dynamic and creative ways in which African cities actually work [10–12]. Accordingly, a number of studies have argued to take "as a starting point not the failure of urban services and the institutions responsible for their delivery, but the vitality and multiplicity of actual delivery systems which, despite policy announcements and reforms, and notwithstanding imported models, survive and contribute to the functioning of cities" [6: 434].

2.2. Electrification of the urban poor in the Global South

Although research on the socio-technical modalities in providing essential services in the Global South is by now a well-established field of urban research, its focus has hitherto been mostly on drinking water [13,7] and only marginally on electricity because water services are considered essential for sustaining life and good health. In most cases, studies on electricity have remained restricted to rural electrification or have generally focused on national energy policies with no specific reference to their place-based impact. Given the demographic importance and rapid growth of "slum urbanism" [14] in Africa and in the global South and also recent urban energy transitions, an emerging academic debate has recently started to address urban energy systems in cities in sub-Saharan Africa [15–18].

As stated by Baruah [19] in cities where slum dwellers have no legal entitlements, the poor have no choice but to find alternatives in response to unmet demands for basic services, such as water and electricity. For slum dwellers, accessing the service is thus the result of a constant process of improvisation [20], which includes tapping illegally into the formal supply. However, this illegal electricity is unreliable and unsafe, sometimes causing electrocution or fire accidents due to inadequate wiring [21,22]. Furthermore, illegal suppliers weaken the poor, stigmatize them as thief, and impact their entitlements to secure

land tenure through proper electricity bill. In this context, increasing attention has been paid to illegal providers in African cities, the user's tinkering with electricity networks or to prepayment technologies in order to formalize access to the network.

The recent efforts of urban and national governments to normalize electricity supply of poor neighborhoods and recent electrification programs in cities across the South have stimulated a lively debate. Particularly, prepaid technologies have been promoted as a panacea to the electrification problems in sub-Saharan Africa as they improve the users' control of their expenses, reduce the bureaucracies that typically come with electricity billing, and also facilitate a reliable and efficient recovery of investment costs in the extension, operation and maintenance of electricity grids [23]. Particularly at the scale of settlements where addressing systems are often missing, where residents often move and where collecting debts is challenging, prepayment is seen as an "appropriate technology" for utility companies to recover their costs. Moreover, prepayment has the advantage of allowing the offer to be "differentiated", by adapting a specifically modified service to suit a specific space, within a wider and composite area [24].

However, several studies have highlighted the politics of recent ambitions to reintegrate marginalized areas into the city through electrification programs and the regularization of electricity access (e.g. [25,26]). These studies point to discriminatory impacts of prepaid technologies on the urban poor. While on the one hand, their illegal access to electricity becomes restricted, at the same time, on the other hand, they cannot afford the regular electricity tariffs and are thus excluded from various electricity-based amenities of "modern" urban life (e.g. [25–28]). In her study of favelas in Rio, Pilo shows "how the means of recognizing city dwellers 'by the network' are materially and symbolically reshaped by commercial processes implemented through a top-down approach" [26: 6]. For the poorest users, prepayment has been described as aiming to discipline and punish "unruly" citizens for illegal access to power networks [29] or by introducing a relationship of suspicion in which (automatic) disconnection is the norm [30]. Taking a more positive stand, Baptista [17] demonstrates through the example of Maputo, how prepayment systems become a productive juncture in the experience of urban energy in cities of the South that facilitate negotiations of user-provider relationships, enable comfort and convenience associated with urban living and, indeed, help to increase electrification rates in poor neighborhoods, but rarely address the prevailing urban inequalities. Overall, these studies show that the physical connectivity to the formal electricity grid does not necessarily guarantee access to electricity, but can, on the contrary, constitute a new factor of exclusion of poor customers and neighborhoods [18: 9] if not complemented by adequate tariff structures (e.g. affordable lifeline tariffs for the urban poor).

2.3. *Apprehending the local politics of slum electrification*

Faced with the specific constraints of slums, electricity companies adapt locally ("specialize and spatialize", [31, p. 5] their interventions through socio-technical approach, not only with prepayment technologies for example, but also through the involvement of local communities to design and co-produce a service which is adapted to the scale of implementation. This is based in part on "project approaches that value the neighborhood scale for its supposed virtues of social homogeneity, citizen foothold, and local democracy" [31: 6]. Since local intermediaries (such as grassroots communities, NGOs, religious missions) are usually more familiar with slum communities' ability to pay, they are suitably placed to coproduce pro-poor slum electrification programs [19,15,32]. This institutional coproduction is understood here as the provision of public urban services through regular, long-term and mainly informal arrangements between state agencies and groups of inhabitants [33].

Contrary to its seemingly post-political character that is shaped by a consensus on economic growth, poverty reduction and environmental

sustainability, we make the hypothesis that urban electrification program in slums is not a politically neutral process: it entails far more than merely providing electricity to the poor. On the contrary, it translates the reconfiguration of power in marginalized areas. The power rationalities encapsulated in the specific methods of electrification reveal the political economy of the slum. This is evident through the interactions between institutions and the governed to reach an unstable socio-political compromise for the supply of electricity. Adopting a political economy approach applied to urban settings and state spatial regulations [34–36], we rely on a theoretical understanding of scales of interventions, defined here as socially produced arenas [37: 1] "where sociospatial power relations are contested and compromises are negotiated and regulated" [36: 140]. Looking at the implementation of the KSEP in Kibera, this perspective allows to reveal the role of subaltern actors [38, p. 2], understood here as local communities involved in the scheme at a micro scale, who can play an important role as intermediaries (and sometimes barriers) between users and utilities. In the case of the KSEP, the involvement of local communities (including ex-cartels members) is indeed a major component of the electrification scheme in Kibera. As our following study shows, such strategies employed by the state authorities are, however, undermined by the illegal suppliers' and their customers' tactics of resistance.

Therefore, by demarcating urban spaces in accessing electrification, these unstable arrangements contribute not only to the coproduction of the service but also to the emergence of intra-urban territories within the same city. According to Sack's analysis [39, p. 19], we use the concept of "territory" to define a geographic area whose delimiting process and control aim to exercise power over a population, phenomena or relationships [39: 19]. In that sense, the state's spatial intervention, such as electrification, can be understood as process of "territorialization" by the State through regularization of infrastructure. Seen through these lenses, electrification programs thus translate the state's ambition to order urban space, to regularize entrepreneurial and user activities and to extend its territorial powers and authority to slum areas. Therefore, one of the major challenges is to uncover the new local politics created by the regularization of electricity networks in the slum and to understand the effects on marginalized territories integrated into formal electricity management.

3. Beyond "world class" ambitions: Nairobi's splintered electricity networks

Nairobi has been the site of a socioeconomic contradiction for more than a century [40]. On the one hand, European settlers, planners and elites have long sought to transform Nairobi into a city of world importance. Kenya's capital is a major economic and political hub in East Africa. The government's current plans for "Nairobi Metro 2030" are designed to develop the capital into a world-class city-region through massive improvements in infrastructure, considerable reforms of its governance structure, and significant investments [40]. On the other hand, urban realities for the majority of its citizens differ considerably from its leaders' grand ambitions. In 2009, 60% of Nairobi's population lived in slums that occupy only 5% of its total land but the growth of slums is unprecedented [3]. With projected annual growth rates of 5.26% between 2010 and 2025, Nairobi's population living in slums is expected to double between 2010 and 2025 [3].

As Nairobi's largest and most populous slum, Kibera covers an area of 250 ha near the city center and it is, according to some estimates,² the largest and most densely populated slum of Africa. Kibera is made up of 13 villages and is a melting pot of vested interests of central as

² While Kenya's 2009 census has estimated the total population to be 170,000 inhabitants, other sources suggest that Kibera is home to 500,000 to well over 1,000,000 residents [44].

well as local state-actors, quasi-legal landlords and urban dwellers from multi-ethnic backgrounds [41]. The Kenyan government claims land ownership of the whole slum area, it refuses to officially acknowledge the settlement and has for a long time denied the provision of basic services in this settlement [42]. Similar to other slum areas in Nairobi, Kibera is dramatically underserved. The provision of infrastructure services is highly inadequate with only 22% of slum households having water connections and poor sanitary infrastructures leading to severe water and vector borne diseases [3: 11]. As Myers [40] points out, like most of the informal settlements, Kibera has its “own rules of operation” which can be interpreted as an expression of a creative and entrepreneurial “self-help city”, but also “as a further manifestation of longer-term processes of the production and reproduction of poverty and inequality” [40: 332]. For a long time, “government response to the growth of informal housing veered from profound indifference to ruthless demolition, depending on the political moment” [40: 333].

In 2003, the Kenyan government agreed with UN-Habitat on the Kenya Slum Upgrading Project (KENSUP) covering Kenya’s three largest cities, and starting with Nairobi’s largest slum, Kibera. KENSUP’s aim is to improve the livelihoods of at least 5.3 million urban slum dwellers by the year 2020 at an estimated cost of \$ 13 billion [43]. It is funded by the UN-HABITAT and World Bank Cities Alliance and the government of Kenya. It is complemented by another slum upgrading program funded by a contingent of international development institutions. The program’s main objectives include shelter improvement and affordable housing projects, infrastructure upgrade through making inroads into the settlements in an attempt to facelift the housing and sanitary conditions (for details cf. [44,42,45]). In addition, Kenya adopted a new constitution that guarantees every citizen the right to “accessible and adequate housing,” and to reasonable standards of sanitation [46].

While electricity supply was not the key priority in these pro-poor initiatives, the situation changed with the national government’s “Kenya Vision 2030” strategy to transform Kenya into a middle-income economy until 2030 [47], followed by the “Nairobi Metro 2030” plan to develop Nairobi into a “world-class African metropolis” [47,48]. Complementary to prominently featuring neoliberal urban planning approaches (see [40: 338]), increased investment efforts into electricity infrastructures were considered as key facilitator of Nairobi’s transformation into a regional and global service center and hub for business, industry, and tourism. The “Kenya Slum Electrification Project” (KSEP) established in 2011 and targeting the persistently low access rates in informal settlements responds to the same logic. However, as the following section shows, Nairobi’s splintered landscapes of electricity supply and use were far removed from governmental “world class” ambitions and the initial slum electrification programs showed limited success.

3.1. A marker between the networked city and the slum city

3.1.1. Nairobi’s electrical segregation

According to the last 2009 Census, only 68.4% of the country’s urbanites and 5.2% of the rural population had household connections with access to electricity (cf. Table 1). This urban-rural imbalance can partly be seen as British colonial legacy, as the colonizers mostly lived in cities. Nevertheless, it is also a result of the considerably high costs of connections in low-density peripheries. In Nairobi, 72.3% of the population used electricity as their main source of light. Nonetheless, as is the case of the other public services—like water, sanitation or waste—Nairobi’s electricity topologies are highly splintered privileging a minority of urban residents living in the wealthy neighborhoods. In colonial times, the indigenous population was relegated to informal settlements without electricity and had to resort to traditional energy sources like wood and charcoal. After independence, this segregation persisted. Although the provision of electricity no longer followed racial criteria established by the colonial administration, legal connections to

Table 1

Population below poverty line and access to electricity.

Source: Kenya National Bureau of Statistics [49].^a

Constituency	Population	% of population below poverty line	% of access to electricity
Kenya	37,565,589*	45.2%	22.9%***
Rural	25,843,785	50.5%	5.2%
Urban	11,721,814	33.5%	51.4%
Nairobi	3,068,835**	21.8%	72.3%
Kibera	201,293	32.2%	59.6%

Nb *46,749 million in 2015 **3768 million (estimation UN 2015^b) ***55% in 2017 according to KPLC.

^a Based on 2009 Kenya Population and Housing Census – to be updated in 2019.

^b <https://esa.un.org/>.

poor energy users in informal settlements were often denied due to missing land tenure, limited ability to pay for high tariffs and problems for KPLC to recover its costs. Kibera constituency, for example, had the lowest level of electrification with only 59.6% in 2009 whereas the level of access was considerably higher in wealthy neighborhoods, e.g. in Embakasi West Constituency the access rate level was at 88%. Access to energy is thus highly fragmented and clearly demarcated between the formal planned city that enjoys a high level of basic service provision and the slum areas.

3.1.2. Electricity poaching

For the KPLC, the parastatal agency responsible for the distribution of electricity, the unplanned city is problematic in terms of the management of the electricity network. As the inhabitants have great difficulty to fulfill the stipulated conditions to obtain legal access to KPLC’s electricity service (legal residential status and land tenure, ability to pay for connection fees and security deposit) the majority of the slum population has to resort to various, often illegal, tactics to gain access to energy [51]. Excluded from the formal sector, these neighborhoods access electricity informally through connections shared either with neighbors/owners or by buying electricity from resellers who illegally connect to the low voltage distribution grid [52]. In practice, the ability to connect illegally to the electricity infrastructure technically depends on the proximity to KPLC’s low voltage distribution lines: the existence of illegal connections varies consequently depending on the slums, and even within slums, some neighborhoods are better connected than others. As stated by a resident: “hopefully, I could make the connection to the neighboring transformer just next by. Remote families are much less fortunate when their wire breaks down, far away from their home” (household interview, March 2015). This practice of “poaching” was technically facilitated by inter-community exchanges and skills provided by the “Indian” workforce from Parklands, one neighborhood in Nairobi with a significant population of people of Asian descent. They were settled in by the British colonizers and some of them were initially trained to work on the electricity supply. Over the years, they have and still continue to train Africans in poaching skills: “I learnt everything from my friend Prakash while we were working together in the 90s, I’m now an expert” dixit an informal supplier about his training. Our survey shows that most of the time, it involves direct connection to the transformers (“hooking”), which allows the poachers to supply to a large number of clients. We encountered that some resellers also manage to obtain a legal connection and to bypass the KPLC meter in a way that KPLC is unable to monitor the actual electricity use. The electricity obtained in this case is sold to a smaller group of clients owing to limited network capacity. Finally, at the individual level, the KPLC meter is regularly tampered to reduce the billable amounts (during the survey, poachers explained us diverse techniques to do so, depending on the type of meter – March 2015).

The problem is not limited to “non-technical” losses for KPLC and

the challenges it faces to recover costs and to manage electricity loads. This “unregulated” electrification does not follow regular safety and insulation standards. Moreover, the electricity distribution and overloading of cables is poorly handled, as a result of which incidents of electrocution and electrical-based fires in the high-density settlements, mostly built of inflammable materials, make most slum dwellers particularly vulnerable [51].

3.2. Electricity supply in Kibera

3.2.1. Responses by Kenya Power and Lighting Company

For a long time KPLC, the parastatal utility responsible for electricity distribution, did not provide electricity connections to the slum areas as it would allow for an implicit recognition of their tenure: “It’s difficult to supply an informal settlement as most inhabitants can’t prove their residency and are thus considered as illegal squatters” (KPLC regional manager, September 2016). However, since the end of the 1990s, the liberalization reforms in the sector have increased the need to provide a more reliable service in order to reduce technical (to better manage demand peaks) and financial losses (to recover the costs of electricity provision).

However, as it is difficult to count the number of illegal users, technically, it becomes extremely difficult to manage the flow of current in an infrastructure that is not calibrated for over-consumption and this leads to a deterioration of the transformers and the cables particularly during peak demand periods.

“Transformers are calibrated for a certain level of consumption and uncontrolled connections are damaging the infrastructure” [51]. Financially, the illegal use of electricity leads to commercial losses to the company. This has become a bigger issue following the partial privatisation of the company and its listing on the local stock exchange (since the 2000s the power market was opened to independent power producers and KPLC was partially privatized with the government still holding the majority share of 51%). This move has been criticized by legal users who indirectly cross-subsidize the illegal consumption (“It’s unfair: they steal and we have to pay for them” (dixit a resident of Kenyatta Market, a formal neighborhood next to the Kibera Slum, regularly affected by transformer breakdowns, March 2015)).

It also becomes a political issue given that one of the key goals of the national development project under the “Vision 2030” is to provide electricity to the entire population of the country, including those who live in slums. Formalizing access to electricity network was increasingly seen as a key to attain “world-class” standards, in line with the UN millennium goals and, later, the “Sustainable Development Goals”. After having reduced the cost of electricity connections,³ the process of electrifying Nairobi’s slums and the adoption of a national slum electrification program in 2007 thus reflects a new phase in upgrading these neighborhoods that follows the earlier slum upgrading programs, such as KENSUP.⁴ KPLC’s initial “Slum connectivity pilot 1” (2007) in Kibera installed “load limiters” that automatically restrict consumption to 40 kWh per month, for a flat rate of about 300 KES (2.9 US\$) per house. The network connection costs, subsidized by KPLC and the international donors, were no more than 1160 KES (approx. 11.2 US\$).

The restrictions were not appreciated by the inhabitants who vandalized the load limiters, and refused to pay. Moreover, KPLC disconnected the illegal power connections, only to find them up again just

³ For example, the “StimaLoan” (by the Equity Bank Kenya) allows customers to repay the connection fee over up to 24 months. “Umme Pajoma” and the “Last Mile Connectivity” program are other initiatives set up by KPLC to connect households within a 600 m radius of a transformer. The households can form a group to request a group connection, which reduces individual connection costs. These programs have contributed to considerably reducing the connection costs from 33,000 KES (318 US\$) to 15,000 KES (145 US\$) for regular customers.

⁴ Although these programs focused mainly on drinking water and sanitation and social infrastructures, they have indirectly facilitated electrification, particularly by addressing land tenure (cf. [50: 23–25]).

a few days later. Above all, KPLC’s attempts to prevent illegal taps were faced with considerable opposition from the cartels and their clients, leading to riots and violence against the technicians who tried to install meters. The situation deteriorated to such an extent that the KPLC technicians were unable to enter certain slums (Kibera, Mathere, Korogaocho) without police protection (access was limited to the main roads, as the police refused to enter the slum alleys). Finally, this tentative of regularization has been counter-productive because it indirectly facilitated an increase in poaching of the network.

3.2.2. Practices of the “Kibera Power and Lighting Company”

In Kibera, some “entrepreneurs” have established informal cartels, colloquially called “Kibera Power Lighting Company”, to provide electricity to the slum dwellers. In the early 1980s, the very first installation of transformers near the slum to supply the adjoining planned neighborhoods developed by the National Housing Corporation provided a business opportunity to resellers. They began to illegally supply electricity to large groups of several hundred families: “at the beginning, we were only few resellers and I had almost one thousand customers for myself” (dixit one of the oldest reseller that we followed in Kibera, in March 2015). This caused a connection overload which led to a rapid deterioration of the equipment that was not calibrated for such intensive usage. The situation deteriorated to the extent that the service provider KPLC had to finally install other lines to reduce pressure on a single installation. In fact, it seemed to be impossible to prevent illegal connections and the service provider was forced to tolerate a more or less “laissez-faire” situation, to reduce the deterioration of the infrastructure and the violence against its technicians (KPLC regional manager, September 2016). As more and more transformers were installed, not only around slums but sometimes even within neighborhoods during occasional electrification programs, the number of resellers also increased: “More people begun to supply during the 1990s, it was hard to keep my customers and I had to share my business with others” (old reseller, Kibera – March 2015). They provided connections to smaller groups of users, 20–30 households on an average, or up to a maximum of one hundred clients. A smaller group size facilitates the collection of payments and the maintenance of a good and continuous quality service allowing to run a TV, radio, electric cook-stove, refrigerator etc. Our survey shows that in 2016, users connected in this manner generally paid between 250 and 500 KES (2.4–4.8 US\$) for the monthly flat rate, depending on the quality of the electricity supply. The resellers charge an upfront connection fee and offer payment flexibility, which is facilitated by the close relationships with their clients. For a long time, the cost of illegal electricity was thus much cheaper than that provided by the KPLC, amounting to about KES 500, 1000 or 1500 KES for a monthly consumption of 37 kWh, 69 kWh and 94 kWh, respectively. The system functions both thanks to the neighborhood relationships that ensure a certain flexibility in the payment modalities and also because the informal suppliers can take immediate actions on the inhabitants who do not pay (by disconnecting the electricity supply at any time).

The research undertaken in Kibera reveals that this situation is so well established that the poachers have managed to stabilize an informal contractual relationship by constituting a “cartel of associated suppliers” for each transformer, and by corrupting the KPLC technicians responsible for maintaining the transformers by paying them a large fee (20,000 KES in 2016, or 195 US\$). This gives the cartels free access to the transformer to create connections for their own groups of clients. The poachers perceive the power transformer to be under their ownership as they manage to establish an (informal) purchase contract with a KPLC employee (“this is ours, we paid for it!” dixit one main reseller of Kibera – March 2015). As a result, an informal electricity oligarchy has gradually established which is in the hands of a small and powerful cartel maintaining a territorial control in Kibera. This has indirectly increased the marginalization of the slum within the networked city and its stigmatization as illegal squatters.

4. The implementation of the Kenya Slum Electrification Program in Kibera

Owing to the fruitless attempts to regularize electricity services, KPLC was gradually forced to adjust its actions to accommodate local housing conditions, urban morphologies and practices in the Kibera slum. Consequently, a second phase of the KSEP, co-funded by the Global Partnership on Output-Based Aid (GPOBA) and the World Bank's International Development Association, was initiated in 2014 [53]. Under the aegis of the World Bank, South–South seminars and exchanges were organized between operators from different countries. The aim of sharing of experiences between engineers was to capitalize knowledge on how to counter resistance to the regularization of electricity services: not only by reducing the technical opportunities for fraud and by ensuring cost recovery for distribution companies, but also by reducing the potential acts of poaching and vandalism (World Bank officer, Nairobi, September 2016). KPLC reworked its strategy in order to obtain the users' support, by collaborating with local leaders and by hiring local technicians in the formalization process of service provision.

4.1. The involvement of local intermediaries and communities

4.1.1. Integration of local powers

The originality of the program is based on a strong socio-managerial component that involves community participation. The head of KPLC customer services explained that this involves explaining the benefits of a legal electricity supply (safety, reliability, and affordability) and not disconnecting the illegal connections before the legal connections are installed (interviewed in Kibera in September 2016). This program also targets the (new) elected local representatives. Indeed, the 2010 constitutional reform introduced a devolution of power by decentralizing a range of functions, including energy planning at the county government level. This allows the population to pass on information regarding its energy needs through the county's elected representatives, the members of the county assembly (MCA). These devolution reforms, implemented in 2013, turned out to be a major institutional asset for KPLC as they offered a precious local relay center to facilitate communication with the communities and their inclusion in the electrification strategy.

In order to relaunch the pilot regularization project, the KPLC head of customer services thus approached the four MCA from the slum district and managed to obtain the support of one of them. This provided KPLC with a local intermediary, which is a precondition to being able to enter the slum and initiate discussions with the neighborhood community leaders. According to him, three MCA refused to support KPLC given the political risks engendered by unpopular perceptions of the previous interventions to disconnect illegal taps. However, the fourth MCA, on the contrary, saw it as an opportunity for his political career by successfully handling an innovative electrification project which, for the first time, would allow local communities to actively participate. At the same time, with the upcoming 2017 elections, the same elected representative bartered his support for KPLC, by threatening to sabotage the project if KPLC did not provide him with additional funds (under the corporate social responsibility provisions) to build easily visible amenities: “if KPLC is not helping me, I'll tell my people to remove all their meters. They came here thanks to me and they are nothing without me” (MCA, Kibera, March 2015). The funds were destined for the construction of a football field for the youth and large cloth sheds for the vegetable sellers in the main street which would help the MCA retain the support of the local community. This intermediary allowed the project to progress and, in the face of the upcoming elections, the elected representative had now vested political interests in making the project successful.

The local elected representative explained how he suggested the names of some of the electricity cartel leaders to KPLC. The authority and influence of these leaders over the slum was already established

and they would act in all likelihood as powerful opponents to the legal electrification in the light of the economic losses they would have to face in the future. A study by Marjori [51] evaluated that if invited, 84% of the informal resellers would agree to work officially with KPLC and that they would even pay KPLC for the electricity consumed. Similar to other cities (e.g. Lydec in Casablanca cf. [27]), the subversive power of the professional poachers was defused by integrating them into the formalized process of electricity supply. In fact, these resellers became mediators between the inhabitants and the service provider. It is hence they who led the negotiations with the community leaders, began a dialogue with the households and negotiated with the members of the opposing cartels. The public authorities and the service provider's agents were aware of this conversion. Nonetheless, they did not seek to oppose this transformation that was quite well perceived by some of the inhabitants, although this remains a double-edged sword: “We know that it's dangerous, but negotiating with the cartels was the only way to enter the slums to regularize the electricity networks” (KPLC Head of customer service, March 2015). Institutionalizing the role of those formerly responsible for electricity theft also paradoxically contributed to acknowledging and stabilizing their powers, which means that KPLC is sometimes simply seen as one electricity providers among others that surrounds itself with a gang. As a result, for the inhabitants the difference between the cartels and KPLC became increasingly blurred.

4.1.2. The integration of local communities

Beyond the integration of cartels, KPLC favored a community-based approach in regularizing the electricity services. This allowed them to limit potential objections. The operator took advantage of the “National Youth Service” program that offers unemployed youths days of paid work for community welfare works (construction of roads, toilets, waste collection, etc.) to gain youth support. Under the scheme, 48 inhabitants, the majority of whom are unemployed youths, were recruited to carry out manual renovation work on the electricity network, such as installing new electric poles and participating in operations for disconnection. This social aspect was positively perceived by the inhabitants. It gave the local youth access to a social status that distanced it from inactivity, illegal business and the violence of banditry: “it's really good that KPLC provides job to these boys, now they are busy at work and can sustain their family rather than wasting time in the streets” (Kibera resident, Mars 2015). It also allowed the youth to reduce the cartels hold on the area, which was thus weakened. In addition, KPLC promised to create some permanent contracts for the young recruits after the regularization of service wherein the youth would receive a formal training as electricians to ensure the maintenance of the newly installed networks. They also promised to recruit about a hundred additional employees. According to the head of customer service, KPLC planned to provide decentralized maintenance by setting up local antennas (four offices to be built in Kibera) to liaise with the resident-clients. Theoretically, each office would employ three people on a permanent basis, with a dedicated person for site security, general management and management of the network maintenance teams each. These offices were under construction during our fieldwork surveys, but paradoxically, the structures were built of temporary materials reflecting the slum's ambiguous land occupation status.

Lastly, a nodal “protection team” of 12 inhabitants was set up to accompany and protect the KPLC technicians. This protection team is managed by a well known/reputed and respected local leader of the slum. He enjoys a positive leadership position within the local communities, thanks to his “integrity” and his activities as a pastor with a neighborhood church (the “Truth church”). He is the essential link in KPLC's strategy although he remains, on paper, a contractor subordinate to the orders of the KPLC engineers. He receives a salary of 12,000 KES/month (117 US\$), the same salary as other members of the “protection team” who collaborate with the KPLC engineers. The role of the protection team is to assist in carrying out regularization procedures by reducing “resistance” to the regularization process in advance. This

consists essentially of facilitating the disconnection work, or co-ordination work with the young recruits, protecting the engineers and the technicians through daily dialogue with the inhabitants and a delicate negotiation exercise with the cartels to reduce the emergence of conflict as far as possible: “We explain to the people why they should quit the cartels. It’s a difficult process as we have to face sometimes violent opposition but it’s an essential task to ensure the viability of the system and, overall, the recognition of Kibera” dixit the head of the protection team (March 2015, Kibera).

4.2. The adjustment of technology

4.2.1. Protection and simplification

Accompanying this socio-managerial component is the modification of technology which is inspired by engineering experiences conducted in Brazilian favelas and the Indian or Moroccan slums facing similar issues: “Despite regional differences, comparable situations have been encountered in other part of the world, which have inspired us. We understood that we needed to adapt our technology to address the specific constraints faced by our teams of engineers in slums like Kibera” (KPLC head of customer services, September 2016). The Kenyan engineers installed meters with anti-tampering functionalities locked in protection boxes, and placed high up, at the top of the electric pylons. Similarly, to a feasible extent, the low voltage distribution networks are replaced by high voltage lines, which make poaching by direct “hooking” from line much more difficult and dangerous. If low voltage lines are requisite, they are located above the high-voltage lines (whereas they are usually positioned below) and this makes access very dangerous. Lastly, to prevent the theft of copper electrical wiring from the utility, it has been replaced by aluminum wiring, a low-cost material that transmits electrical current well and has a low resale value [27]. Copper wiring was regularly cut, stolen and resold on informal markets to be melted down and recycled particularly to make kitchen utensils.

In dwellings, KPLC has installed so-called “ready boards” for inside every connected household. This installation simplifies the connection as a single board provides a socket for a bulb, a switch, and power outlets to connect electrical devices. The principle of individual consumption and fair billing seems to be fundamental and requires a technical environment within which each line, particularly the meter, is protected from potential secondary connections.

4.2.2. The token principle

The centerpiece of KPLC’s technical strategy is the prepayment technology, commonly called “token” in Kenya. KPLC currently plans to extend it to all its users across the country. Rather than having to follow procedures to contest and pay their monthly bill, users can easily buy tokens to prepay their consumption at an equipped “dukhan” (commodity shop), a KPLC ATM or through mobile payment (M-Pesa, Airtel). The users obtain a digital receipt on payment. The latter provides a number to be entered on the meter’s keyboard to release the corresponding number of units. Each new customer was granted a free start-up credit of 30 kWh as incentive to switch electricity connections from cartels to KPLC. A “lifeline” tariff which applies to the first 50 kWh with monthly electricity costs of approximately KES 275 or around US\$ 2.7 for 50 kWh.⁵ Since a majority of users cannot pay the connection fee of KES 1160 directly after the installation of meters, the fee can be repaid through the purchase of prepaid tokens spread over a period of 12 months (KES 100/month). In case the meter is not recharged again, a circuit breaker installed inside the meter automatically cuts off the

electricity flow. This technology allows the service provider to introduce commercial standards, while avoiding potential personal conflict, which is normally the case in the usual disconnection procedure for unpaid bills. In order to prevent attempts to vandalize the equipment, the meter has been split into two separate components. Only the digital pad that serves to enter the numerical code provided on the token is accessible to the user (installed on a wall inside or outside the dwelling, with others neighbor’s digital pads on the same panel to reduce costs) while the actual meter and the automated circuit breaker are, in fact, situated in a locked protective box that is difficult to access, at the top of the pylon, to avoid tampering.

5. Uncovering the local political economy of slum electrification

5.1. Affirmation of state hegemonic power over slum dwellers

Electrification in Kibera, a marginalized territory, takes place in a context of a well-established poaching culture and practices. On the one hand, the cartels’ control is strongly rooted in the urban poor’s limited ability to pay formal electricity tariffs, their habituation to the condition of flat rates and more flexible modes of payment. In this context, KPLC has to adapt its interventions to the scale of Kibera, to allow its territorial extension. The strategic recruitment of local intermediaries (informal resellers and technicians, leaders or elected representatives and youth organizations) is a way to enter the slum to get access to relevant local knowledge, to communicate with, and convince inhabitants of the validity of the project. It allows to facilitate the extension of networks and installation of prepayment technologies and to counter potential insurrection and conflict with the proponents of established local energy regimes. This strategy, which has been framed by KPLC as “community-based approach”, together with the technological adjustment of energy supply (inviolable meters, replacement of low voltage networks, calibrated transformers, aluminum wiring, advanced metering, “ready boards”) and its payment modalities (prepayment, lifeline tariffs, subsidized connection fees) allowed KPLC to enforce the implementation of its slum electrification project.

The regularization of electricity services thus transforms the power relationships between the formal parastatal distribution company, state authorities and international organizations and the informal energy suppliers and users in the Kibera slum. On the one hand, KPLC’s strategy reflects a “pragmatic turn” [6] in adjusting the network to slum conditions, lowering technical standards (e.g. ready boards, aluminum wires), recruiting former members of the cartels, adjusting the payment modalities for slum dwellers and, overall, in acknowledging slum dwellers as customers. On the other hand, the regularization project can be interpreted as an attempt to create, formalize and enforce a hegemonic socio-spatial and socio-technical order in deviant geographical contexts (see in particular [25] about electrification in favelas), by disciplining the users. ‘Regularising’ electricity service establishes power relationships between the public service provider and the inhabitants that slip into the daily practices of electricity consumption.

Within this commercial relationship, users become active “clients”, rather than entering into a civil relationship of rights and duties between citizens and the public service providers ([30, p. 913], on water prepayments in South Africa). Hence, here like in other similar regularization contexts, the electrification of Kibera translates the state’s “techno-political” power [30] via a standardisation of the network, the disconnection of illegal connections and the installation of prepayment meters to establish a strict commercial relationship between the user and the utilities.

5.2. Network citizenship of poor energy users

Regaining control over electricity supply is a way for the State to affirm its political presence. In bringing back marginalized areas within the norms, the State asserts users as subject to its power and under its

⁵ Apart from a fixed charge of KES 150, the lifeline tariff was at KES 2.50/unit for the first 50 units, while domestic customers who use 51–1500 units are charged KES 12.75/unit and thereafter KES 20.57/unit (Source: <https://stima.regulusweb.com>; Accessed 20 July 201

territorial control. The electrification can be perceived as an implicit recognition of the land tenure of slum dwellers and more symbolically, of their status as urban citizens. Some of the KPLC engineers we interviewed were in fact concerned about this: “We don’t know if what we are doing is good as these households do not have regular land titles, but we are doing it” (KPLC headquarter, Nairobi, September 2016). Access to legal electricity supply is thus a practical feature of the emergence of a “right in the city” [54] or a material dimension of urban citizenship through a “network citizenship” including ideas of solidarity between users through the subscription to collective services [55: 5]. Indeed, some slum dwellers interviewed in Kibera see it as an implicit recognition of their existence by the government, and more symbolically, of their status as citizen despite the illegality of their tenure. Beyond Kibera, this argument is regularly claimed by slum dwellers under similar regularization scheme: “people who have lived on the margins of society all their lives are eager to embrace all such symbols of “official” recognition because they strengthen their right of residence in their homes and communities and provide a certain level of protection from eviction” [19].

However, the network extensions and the formalization of electricity supply has also paradoxical impacts. While KPLC’s tariff rebates create a competitive advantage for the cartels in the electricity use bracket of up to 50 kWh/month, the cartels can offer electricity at flat rates of around KES 250–500/month. The regularization of electricity services thus makes electricity use beyond the first 50 units unaffordable for many slum dwellers and many meters are, in fact, not vending any units and remain unused. The formalization of electricity services paradoxically stimulates the demand of non-electrical sources that the inhabitants see as more affordable on a daily basis. While the use of electric cookers has become common with the cartel’s flat rate, they have become unaffordable due to the quantitative restrictions to 50 kWh within the lifeline tariffs. Hence, we observe a greater hybridization of existing practices. Multiple channels of energy supply are employed in complex ways, each for a specific purpose, such that legal electricity rather complements the use of charcoal, kerosene or illegal supply than leading to its abandonment. Many users therefore prefer to return to cooking with charcoal, which is cheaper than using electrical energy and natural gas. For heating a cup of tea/milk/water, the inhabitants choose a fuel/paraffin stove, despite the higher cost in the long run. In reality, legal electricity connections are only used for lighting, in a simple manner, with one or two incandescent bulbs, and if equipped, for television or radio. Although formally connected to the networks, many users are still dependent on the illegal supply by the cartels. These counter-intuitive results shed some light on the traditional ‘energy ladder’ versus ‘fuel stock’ debate. It can be ascertained that users rely on their energy mix not only for cultural reasons (the use of traditional sources remains rooted in practices) but also mainly due to economic factors (access to legal electricity comes at a price that forces the beneficiaries to restrict their consumption).

In the context of a deprived territory, neglected for years, the extension of the public electricity service embodies the ambivalence of legal access to a service that creates inequality between users based on their ability to pay. Despite the KSEP’s efforts and investments to reintegrate relegated zones into the formal network and of universalizing access to electricity services, the national program paradoxically tends to formalize socio-spatial exclusion. Lastly, because of the restricted access to electricity that the prepayment system offers, poor urban settlements remain marginalized with households in the dark, while wealthier neighborhoods of the city are lit up.

5.3. Resistance from the “Kibera Power and Lighting Company”

After years of struggle, the program marks a strategic change in bringing electricity to Kibera and other poor urban neighborhoods. Within just one year, KPLC claimed to have gone from 5000 connections in the pilot phase to over 150,000 (KPLC head of customer service,

Nairobi, March 2016). However, this high connectivity rate is insufficient in itself to ensure the success of the project. The incapacity of many of users to recharge their meter ultimately reinforces the legitimacy of the more affordable supply ensured by cartels.

In addition, the local technicians, youth and members of protection teams reported their increasing dissatisfaction with the KPLC. None of them has been formally employed by the company. They are hired on the basis of noncommittal verbal service agreements at low salaries without social benefits despite the fact that they lay the groundwork of electrification and exposed themselves to threats and violence by the cartels. Thus, some technicians have quit the program after a few months and some of them have joined the cartels again.

Moreover, the KPLC territorial strategies have to face various tactics of resistance by the cartels trying to defend their markets by exploiting the system’s weaknesses and user dependency on their services. To sustain the informal system used by the “Kibera PLC” and to win back customers, a far more elaborate tactic of poaching has been established. It involves tampering with the reputedly inaccessible, inviolable meter. To do this, the cartels bribed the technicians mandated by KPLC to set up the system and to discover the technical subtleties of the meter. They managed to make copies of the keys to the protection boxes and to study the system’s weaknesses by making the circuit breaker inoperative. Also, they vandalized transformers in order to create overloads that cause damage to customer appliances, and the blame for such malfunctions is shifted on to the KPLC. Thus, the work of the protection teams now also involves checking meter tampering and informing KPLC of the hacking.

Informants report that cartels cut or vandalize KPLC’s electricity connections, threaten customers enticed away by KPLC and, above all, they threaten the local KPLC technicians in charge of removing parasite connections. In June 2016, violent struggles broke out between the protection teams and the inhabitants of certain areas. In October 2016, various cartels reached an agreement to join forces in collectively combating KPLC’s regularization efforts. As a result, many of the households equipped with new meters and physically connected to the formal grid have returned to Kibera PLC to subscribe to its flat rates and to escape from potential reprisals by the cartels.

6. Conclusion

This case study highlights the importance of understanding the political economy of a slum-upgrading project to apprehend its unexpected effects. While Kibera was shaped for a long time by the absence of connectivity to the legal electricity networks, a weak political representation of its slum dwellers and an overall absence of public service provision, Kenya’s recent slum electrification programs and power sector investment have opened possibilities for change. Learning from major experiences of KENSUP, electrification programs in Kenya and other countries in the global South, the KPLC, in collaboration with the national and urban government and international donors, has launched an ambitious initiative to extend and regularize power networks in marginalized settlements. This is done through a promising approach that combines adjusted payment modalities and technologies as well as the strategic involvement of local intermediaries. Such an extension of modern electricity networks might seem as “post-political”, since it aims at helping the (urban) poor in “climbing the energy ladder”, acknowledges their urban citizenship, provides them with economic opportunities and access to more ecologically sustainable and safe energy sources and in recovering the utility’s investment costs.

The field research included in this study, however, reveals a more complex picture of the underlying dynamics and politics of electrification in a particular territory. It shows that urban slums are neither chaotic sites without service provision, nor the underdeveloped spaces that are represented in development discourses (cf. [56: 241]). Rather, the organized socio-technical responses of slum dwellers that have established over many decades of state/KPLC absence represent a source

of resistance to recent attempts at integration into the modalities of formal networks. The attempts to control electricity supply, to regularize entrepreneurial and user activities and to extend territorial authority to slum areas in Kibera provoke tensions with the local cartels and resellers who have been providing electricity services in the absence of public utilities. The recruitment of local intermediaries and cartel members can limit local opposition to the extension of networks and metering technologies. However, the daily micro-resistance of slum dwellers and the increasingly organized opposition by cartels competing with KPLC for local customers, circumvents the formal structures in various ways—a circumvention that effectively challenges the ability of KPLC and the state to provide services that justify their formal monopoly and authority and to assert control over those territories.

The conclusion to be drawn can neither be a fall-back to the state's absence nor an unmodified continuation of the on-going electrification projects. Instead, KPLC's recent "pragmatic turn" in acknowledging the slum dwellers energy needs and practices, affordabilities and rights to the city and in collaborating with technicians, former cartel members, protection teams and members of youth groups from the slums needs to be further developed and strengthened. However, for an effective "community-based approach", these new workers' essential groundwork for KPLC needs to be acknowledged by providing them with realistic opportunities to transform their job into regular KPLC employments. Moreover, the tariff structures need to accommodate the energy users' basic rights to electricity and their abilities to pay more sincerely by reconsidering the level of the lifeline tariff. Finally, national slum electrification programs should no longer focus on the increase in (physical) connectivity rates of households as the key benchmark alone, but instead prioritize the socioeconomic accessibility of slum dwellers, i.e. their actual use of, and payment for, electricity as the main source of energy. Such reforms may help on-going slum upgrading projects to succeed and proliferate, and to lower important barriers to electricity access for the urban poor. In addition, it will help to overcome resentments of local residents resulting from the neglect by the state and KPLC for many decades. Though such an integration of poor city dwellers into formal electricity networks may partially redefine their urban way of living and the ways they are recognized by the state, but it can only contribute to some degree in reducing the prevailing socioeconomic and political inequalities in Kenya's capital city. KSEP accepts inequality without combating it, without giving a legal recognition through land titles and providing proper housing conditions, which leads to a strong differential provision of basic services between rich and poor users in the city and within the slum. Given the high level of these inequalities, future experimentations and restructuring of KPLC strategies seem inevitable and, *in fine*, necessary to ensure the continuity of a regularization process, which is locally opposed and contested by the ongoing practice of poaching.

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References

- [1] F.W. Geels, The multi-level perspective on sustainability transitions: responses to seven criticisms, *Environmental Innovation and Societal Transitions* 1 (2011) 24–40.
- [2] Susan Parnell, Edgar Pieterse, *Africa's Urban Revolution*, Zed Books, London and New York, NY, 2014.
- [3] UN-Habitat, *The State of African Cities, Re-imagining Sustainable Urban Transitions*, United Nations Human Settlements Programme, Nairobi, 2014 278 p.
- [4] IEA (International Energy Agency), *Africa Energy Outlook. A Focus on Energy Prospects in Sub-Saharan Africa*, International Energy Agency, Paris, 2014.
- [5] IEA (International Energy Agency), *World Energy Outlook 2016*, International Energy Agency, Paris, 2016.
- [6] S. Jaglin, Regulating service delivery in southern cities: rethinking urban heterogeneity, in: S. Parnell, S. Oldfield (Eds.), *The Routledge Handbook on Cities of the Global South*, Routledge, Abingdon and New York, 2014, pp. 434–447.
- [7] J. Monstadt, S. Schramm, Toward the networked city? Translating technological ideals and planning models in water and sanitation systems in Dar es Salaam, *International Journal of Urban and Regional Research* 41 (1) (2017) 104–125.
- [8] M. Kooy, K. Bakker, Splintered networks: the colonial and contemporary waters of Jakarta, *Geoforum* 39 (6) (2008) 1843–1858.
- [9] W. Anderson, Introduction: postcolonial technoscience, *Social Studies of Science* 32 (5–6) (2002) 643–658.
- [10] J. Robinson, *Global and World Cities: A View from off the Map*, *International Journal of Urban and Regional Research* 26 (3) (2002) 531–554.
- [11] C. Rakodi, Order and disorder in African cities: the social roots and contemporary outcomes of approaches to governance and land management, *UNU-WIDER Project Workshop Beyond the Tipping Point: Development in an Urban World*, 26–28 June, 2008, Cape Town, 2008.
- [12] V. Watson, Seeing from the south: refocusing urban planning on the globe's central urban issues, *Urban Studies* 46 (1) (2009) 2259–2275.
- [13] S. Jaglin, M.H. Zérah, Urban water in the South: rethinking changing services. Introduction, *Revue Tiers Monde* 2010 (3) (2010) 7–22.
- [14] E. Pieterse, Rethinking African urbanism from the slum, *Sustainable Urban Development* 32 (3) (2013) 14–18.
- [15] R.H. Ghanadan, *Public Service or Commodity Goods? Electricity Reforms, Access, and the Politics of Development in Tanzania*. Ph.D. Thesis, University of California, Santa Barbara, 2008.
- [16] M. Degani, Emergency power: time, ethics, and electricity in postsocialist Tanzania, in: S. Strauss, S. Rupp, T. Love (Eds.), *Cultures of Energy*, Left Coast Press, Walnut Creek, 2013, pp. 177–193.
- [17] Idalina Baptista, 'We live on estimates': everyday practices of prepaid electricity and the urban condition in Maputo, Mozambique, *International Journal of Urban and Regional Research* 39 (5) (2015) 1004–1019.
- [18] A. Luque-Ayala, J. Silver, Introduction, in: A. Luque-Ayala, J. Silver (Eds.), *Energy, Power and Protest on the Urban Grid: Geographies of the Electric City*, Routledge, 2016, pp. 8–32.
- [19] B. Baruah, NGOs as intermediaries for slum electrification in urban India, in: M. Hodson, S. Marvin (Eds.), *Retrofitting Cities: Priorities, Governance and Experimentation*, Taylor & Francis, London, UK, 2016.
- [20] C. McFarlane, Infrastructure, interruption, and inequality: urban life in the global south, in: S. Graham (Ed.), *Disrupted Cities: When Infrastructure Fails*, Routledge, New York and London, 2010, pp. 131–144.
- [21] D.A. McDonald, Electric capitalism: conceptualizing electricity and capital accumulation in (South) Africa, in: D.A. McDonald (Ed.), *Electric Capitalism: Recolonizing Africa on the Power Grid*, Earthscan, London, 2009, pp. 1–49.
- [22] SEA, *State of Energy in South African Cities: Setting a Baseline*, Sustainable Energy Africa, Cape Town, 2006.
- [23] M. Welsch, M. Bazillian, M. Howells, et al., Smart and just grids for sub-Saharan Africa: exploring options, *Renewable and Sustainable Energy Reviews* 20 (2013) 336–352.
- [24] S. Jaglin, Differentiating networked services in Cape Town: echoes of splintering urbanism? *Geoforum* 39 (6) (2008) 1897–1906.
- [25] F. Pilo, Rio de Janeiro: regularising energy consumption in favelas through re-shaping consumers into customers, in: A. Luque-Ayala, J. Silver (Eds.), *Energy, Power and Protest on the Urban Grid. Geographies of the Electric City*, Routledge, 2016, pp. 67–85.
- [26] F. Pilo, A socio-technical perspective to the right to the city: regularizing electricity access in Rio de Janeiro's Favelas, *International Journal of Urban and Regional Research* (2017), <http://dx.doi.org/10.1111/1468-2427.12489> (online first).
- [27] L. Zaki, L'électrification temporaire des bidonvilles casablancais, *Politique africaine* 4 (2010) 45–66.
- [28] Laure Criqui, Delhi: questioning urban planning in the electrification of irregular settlements, *Energy, Power and Protest on the Urban Grid: Geographies of the Electric City*, (2016), pp. 86–111.
- [29] G. Ruiters, Developing or managing the poor: the complexities and contradictions of free basic electricity in South Africa (2000–2006) *Africa Development* 36 (1) (2011) 119–142.
- [30] A. von Schnitzler, Citizenship prepaid: water, calculability, and techno-politics in South Africa, *Journal of Southern African Studies* 34 (4) (2008) 899–917.
- [31] S. Jaglin, A. Dubresson, Urban Governance in Sub-Saharan Africa. For a geography of regulation Colloque Recompositions territoriales, confronter et innover, Territorial restructurings, comparaisons and innovations, Proceedings of the French-South African Meeting on Territorial Innovation, Jan, 2002.
- [32] D.A. McDonald, Conclusion: alternative electricity paths for southern Africa, in: D.A. McDonald (Ed.), *Electric Capitalism: Recolonizing Africa on the Power Grid*, Earthscan, London, 2009, pp. 437–453.
- [33] A. Joshi, M. Moore, Institutionalized co-production: unorthodox public service delivery in challenging environments, *Journal of Development Studies* 40 (4) (2004) 31–49.

- [34] N. Brenner, Global cities, glocal states: global city formation and state territorial restructuring in contemporary Europe, *Review of International Political Economy* 5 (1) (1998) 1–37.
- [35] N. Brenner, *New State Spaces: Urban Governance and the Rescaling of Statehood*, Oxford University Press, Oxford, New York, 2004.
- [36] E. Swyngedouw, Neither global nor local: 'glocalization' and the politics of scale, in: K.R. Cox (Ed.), *Spaces of Globalization: Reasserting the Power of the Local*, vol. 137, 1997, pp. 140–142.
- [37] B. Bon, L. Kennedy, Scalar politics in the construction of metropolitan Delhi. Shifting patterns of public and private engagement in mass transport and economic development, Conference Paper, City Futures, Special Session 21, Paris 18–20 June 2014, 2014.
- [38] Leela Gandhi, *Postcolonial Theory: A Critical Introduction*, Columbia University Press, New York, 1998 et Delhi, Oxford University Press.
- [39] R.D. Sack, *Human Territoriality. Its Theory and History*, Cambridge University Press, Cambridge, MA, 1986.
- [40] G. Myers, A world-class city-region? Envisioning the Nairobi of 2030, *Am. Behav. Sci.* 59 (3) (2015) 328–346.
- [41] E. Mutisya, M. Yarime, Understanding the grassroots dynamics of slums in Nairobi: the dilemma of Kibera informal settlements, *Int. Trans. J. Eng. Manag. Appl. Sci. Technol.* 2 (2) (2011) 197–213.
- [42] M. Huchzermeyer, Slum upgrading in Nairobi within the housing and basic services market: a housing rights concern, *Journal of Asian and African Studies* 43 (1) (2008) 19–39.
- [43] UN-Habitat, UN-Habitat and the Kenya Slum Upgrading Programme: Strategy Document, United Nations Human Settlements Programme, Nairobi, 2007.
- [44] S. Schramm, People's room for manoeuvre in a fragmented city: state housing in Kibera, Nairobi, *Transformation: Critical Perspectives on Southern Africa* vol. 93, (2017), pp. 116–141.
- [45] T. Meredith, M. MacDonald, Community-supported slum-upgrading: innovations from Kibera, Nairobi, Kenya, *Habitat International* 60 (2017) 1–9.
- [46] Government of Kenya, *Laws of Kenya. The Constitution of Kenya Constitution*, (2010) Published by the National Council for Law Reporting with the Authority of the Attorney-General www.kenyalaw.org.
- [47] Government of Kenya, *Kenya Vision 2030: A Globally Competitive and Prosperous Kenya: First Medium-term Plan (2008–2012)*, Office of the Prime Minister, Nairobi, 2007.
- [48] Government of Kenya, *Nairobi Metro 2030: A World Class African Metropolis*, Ministry of Nairobi Metropolitan Development, Nairobi, 2008.
- [49] KNBS (Kenya National Bureau of Statistics), *Kenya Demographic and Health Survey 2015*, Kenya National Bureau of Statistics, Nairobi, 2015.
- [50] M.N. Cheseto, *Challenges in Planning for Electricity Infrastructure in Informal Settlements. Case of Kosovo Village, Mathare Valley – Nairobi*, Department of Urban and Regional Planning, University of Nairobi, 2013 available at: <http://erepository.uonbi.ac.ke/handle/11295/56433> . (Accessed 29 March 2016).
- [51] L.E. Majoro, *An Assessment of Informal Power Distributors in Low Income Urban Areas: The Case of Kibera, Nairobi*. Master Thesis Submitted to the Chandaria School of Business, available at: <http://erepo.usiu.ac.ke/handle/11732/64> . (Accessed 23 July 2017) United States International University, Nairobi, 2014.
- [52] S. Karekezi, J. Kimani, O. Onguru, Energy access among the urban poor in Kenya, *Energy for Sustainable Development* 12 (4) (2008) 38–48.
- [53] GPOBA, *Output-based Aid for Energy Access*, (2016) June 2016 Note Number 52 https://www.gpoba.org/sites/gpoba/files/OBA52_OBA_%26_Energy_Access.pdf.
- [54] M.-H. Zérah, V. Dupont, S. Tawa Lama-Rewal, *Urban policies and the right to the city, India: Rights, Responsibilities and Citizenship*, UNESCO, New Delhi, 2011.
- [55] O. Coutard, J. Rutherford (Eds.), *Beyond the Networked City: Infrastructure Reconfigurations and Urban Change in the North and South*, Routledge, London, 2016.
- [56] E. Graesholm, *Making slums governable: integration and resistance in a Nairobi Slum*, Columbia University Academic Commons (2012), <http://dx.doi.org/10.7916/D8PC30C3>.