Innovative Heating Options for the Poor in Epworth

PERCY TORIRO[1]

Abstract

This article explores the cooking options being resorted to by poor Epworth residents. The urban settlement of Epworth is a typical 'arrival city' that started off as a mission farm. The missionary owners gave out land to needy people until the settlement grew beyond their management capabilities at which stage, they surrendered it to the government in 1986. Despite the Zimbabwe government's documented heavy-handedness towards unplanned settlements, Epworth became an exception as a decision was taken to upgrade it, rather than demolish existing structures. Epworth demonstrates typical global South urban challenges, such as poor infrastructure, high levels of poverty, informality and rapid population growth. The article uses secondary data sources but also gathered some primary data through interviews and observing residents during periods they cook. With firewood becoming expensive and cleaner options, such as liquified petroleum gas and solar already beyond their reach, it is not easy for the poor Epworth residents. They are caught between a rock and a hard place.

***Keywords**: energy, climate change, urban poor, alternative; energy sources*

INTRODUCTION

Access to electricity in Africa has been documented to be the lowest globally at 17% by the turn of the 20th century (Davidson and Mwakasonda, 2004). The rural access is even lower at 5% availability (Davidson and Sokona, 2002).

[1] Consultant at the African Centre for Cities, University of Cape Town

Some scholars have described the electricity shortages as an 'energy poverty' (Chipango, 2018). Zimbabwe's energy policies have changed over the years. At independence, and throughout the early eighties, the policy was dominated by a desire for energy self-sufficiency. In the nineties, pressure from the World Bank prompted a shift towards least-cost options which, at the time, were imports and hydropower (Soderholm, 1999). Changes in the global economy have, however, meant that hydropower and imports are no longer the least-cost options. With its abundant coal supplies, thermal power has been government's new preferred option as evidenced by the current expansion of Hwange Thermal Power Station (HTPS). The new realisation that fossil fuels are contributing to global warming and climate change means that the continued use of coal will receive increasing resistance. The investment costs for hydroelectric power stations are also beyond the reach of a country suffering economic difficulties and unable to attract significant external funding.

Zimbabwe is experiencing severe energy shortages. The country has a power generation capacity of about 2000 megawatts (MW) when operating at optimum capacity. The main supply source, the hydroelectric power station at Kariba Dam is designed for just over 1000MW, assuming there is sufficient water in the lake. HTPS is designed to supply about 900MW when all units are operational. The thermal power stations in Harare, Munyati and Bulawayo could add another 300MW to the national power grid. The figures are, however, only an indicator of the potential power generation capacity. As at the beginning of 2020, all the power stations were facing different constraints that reduced their actual output. The water levels at Kariba were so low that only 300MW of power was guaranteed daily. HTPS was undergoing upgrades and an average of 600MW was being produced. The smaller thermal power stations in Harare, Munyati and Bulawayo were old and could only supply much less and irregular supplies. The depressed local energy generation capacity has come at a time when the country is experiencing economic challenges. Zimbabwe cannot afford to pay for electricity imports to cover the gap between supply and demand of electricity. This has seen the country experiencing long hours of power-cuts. For poor urban dwellers, adaptation has been a huge challenge.

Under the circumstances, for the past decade Zimbabwe has been experiencing electricity deficits. Urban residents are going through many hours of power-cuts, sometimes, as long as 18hours, a day. This is happening within a context of a deteriorating economic environment. There is a huge gap between electricity energy supply and demand. For poor urban residents, this presents difficult choices for alternative energy sources. Whilst options may exist, they may not be affordable or available. The region has huge solar power opportunities. For the urban poor, however, the investment costs of installing solar are beyond the reach of many. Due to rising consciousness about global warming and climate change, environmental authorities are also putting a lid on some of the common options that they used in the past. The country is also facing severe oil shortages, due to foreign currency constraints. Some lighting and heating options, such as paraffin and liquid petroleum gas are in short supply.

Using data collected from Epworth, Zimbabwe, this article argues that the economic difficulties confronting the country leaves vulnerable residents in a dire situation. Clean energy sources are either unavailable or out of reach whilst traditional heating options are now equally unavailable or illegal. They are caught between the proverbial rock and a hard place.

LITERATURE REVIEW

The literature reviewed included the country's energy history, climate change and its effects and economic stress that the country has gone through. All these impact on the heating energy options available for Epworth residents.

Zimbabwe once had near-sufficient power supply with evidence that between 1994 and 1999, the number of urban domestic households using electricity increased leading to less firewood use in Zimbabwe's urban areas (Campbell *et al.*, 2003; Kagande *et al.*, 2013; Samu *et al.*, 2016). However, even at its peak supply capability, 20% of Zimbabwe's urban households were still not connected to electricity supplies (Dube, 2003). As at year end 2000, Harare had an electrification rate of just over 80%, whilst the second city Bulawayo fared better at just over 90% electrification (Mapako and Afrane-Okese, 2002). High-income residential areas within cities always had much higher percentage of access to electricity. The foregoing figures were mostly in the

low-income residential areas occupied by blacks, due to the pre-independence segregation policies that did not sufficiently prioritise African areas for development (Hosier, 1986).

Part of the reason for low access to electricity was because of low investments in energy over the years. As of the year 2000, the country had only 18% rural electrification penetration (Kayo, 2002). A former chief executive officer of the national power utility attributes low investments in energy to the electricity tariff which government has controlled in an effort to protect the poor (Mangwengwende, 2002). The slow growth of the electricity energy sector has also been attributed to the national power utility's monopoly and the absence of an independent energy regulator (Mbohwa, 2002). For several years now, Zimbabwe's power generation capacity has been too low to meet the country's energy demand (Batidzirayi *et al.*, 2009).

Zimbabwe is facing massive power-cuts and 'the country has an installed generation capacity of just over 2,000 megawatts (MW), but as at December 2019, the Kariba South Power Station, which generates more than 50% of the country's electricity, was producing a mere 238 MW, while the Hwange Thermal Power Station, the second-biggest power generator, was producing 374 MW' (Mukeredzi, 2019:1). Zimbabwe has had to import power from the South African power company Eskom. The supplies have, however, not been regular as the country periodically fails to pay for power imports and has had to either reduce the imports or suspend for certain periods when the country fails to raise the required foreign currency to pay for energy (*The Zimbabwe Independent*, 2019). Even the imports have not been enough as South Africa is also facing power deficits. The Minister of Power and Energy development in Zimbabwe is said to have been making numerous trips to South Africa and Mozambique in an effort to get additional power (Mukeredzi, 2019). As this is happening, there is evidence that areas near cities are facing deforestation as the urban poor cut trees for wood fuel. A study of the city of Masvingo showed massive deforestation near the low-income suburb of Rujeko Extension (Mapira and Munthali, 2011). The same could also be happening near other cities in the country, including Epworth.

According to the United Nations, 'climate change is one of the major challenges of our time and could undo decades of development effort' (UNEP, 2010:1). Literature now has abundant evidence that the global climate is changing and it is the world's poorest regions feeling the worst effects of the phenomenon (Frayne *et al.*, 2013). In Zimbabwe, there have been energy projects that respond to climate change, but these have targeted rural areas of the country. Like most countries, poverty was historically a rural issue and only started to receive prominence as an urban issue recently (Potts, 2008). So, energy projects that targeted the poor were implemented in rural areas. These included the Global Environment Fund (GEF) project that explored and funded solar alternatives for rural households (Marawanyika, 1997). More than 85,000 homes were installed with solar photovoltaic (PV) systems in the mid-1990s under the project (Mapako and Afrane-Okese, 2002). Sadly, the project collapsed soon after the GEF funding ended and many of the installed systems became dysfunctional. Some scholars investigated alternative energy sources for use by households in the era of climate change but, again, the focus was rural (Jingura and Matengaifa, 2009). Other climate change-related energy projects that were implemented in the country include the solar water-heating project as a way of alleviating the energy and economic problems facing the country and a strategy for climate change mitigation (Batidzirayi *et al.*, 2009).

The discontinuation of solar projects is regrettable because the country is located in a region that renders it suitable for clean energy investment, particularly solar power. A recent study on the country's potential and suitability to generate solar energy revealed that Zimbabwe has the potential to generate at least 71GW of solar power which the researchers estimated to 30 times the country's current energy demand (Ziuku *et al.*, 2014). With a current electricity energy mix of 43% hydroelectricity and 57% from coal, the country is not doing well in terms of clean energy generation and ultimately climate change mitigation (Makonese, 2016).

Seeking alternative energy options has been complicated by the economic position of the country. Since the year 2000, Zimbabwe's economy has been on a sustained decline. Scholars have attributed the economic decline to numerous factors, including poor government policies, corruption and

difficult international relations (Murangagwa, 2009). One study interestingly manages to link the country's economic decline to the declining electricity supply. It uses satellite imagery to trace how most Zimbabwean cities now have less lighting, at night. than in the past (Li, 2013). Epworth has equally been affected by the national economic distress, moreso, because its residents are largely low-income (Tawodzera, 2010; Tawodzera *et al.*, 2019). The economic decline has seen the country's urban areas change from very high standards of living and very strictly regulated cities to exhibiting typical global South urban challenges, such as high levels of informality (Mitullah, 2004; Chen, 2012; Njaya, 2014; Rogerson, 2016). As the economic stress has hit hard on everyone, land-use planners and other urban managers remain aloof to these challenges rather dreaming of beautiful 'world class cities', unattainable under the lived reality (Watson, 2003 and 2013; Kamete, 2012; Skinner and Watson, 2018). The economic stress has forced Harare and other cities to transform from typical colonial settler cities to ordinary global South cities (Rakodi, 1995).

METHODOLOGY

The main data collection method used was field observations complimented by a detailed literature search helped understand the background to climate change, Zimbabwe's energy situation and the economic stress. A survey was conducted on 100 households to provide evidence of the energy options they were using for cooking. These were located in two distinct areas, reflecting the urban form of Epworth, some from the informal part and others from the planned part. The planned part has better access to infrastructure, including electricity connectivity, whilst the more informal part does not have easy access to electricity. The participating households in the selected areas were randomly selected until the sample size of 100 was reached. To verify the responses, visits were timed to coincide with cooking times so that observations of cooking energy options were actually seen on the ground.

RESULTS

This section outlines the general energy mix emerging from the household survey before sharing stories of two participants who volunteered to share more on how the stricter government response to deforestation was affecting them.

Epworth is a secondary urban settlement with interesting geographic and administrative characteristics. Administratively, it is inside the Harare Metropolitan Province, including Harare, Ruwa and Chitungwiza. It is also geographically within the Harare city boundaries. It is closer to Harare city centre than some parts of the city since it is only 15 kilometres from the Harare central business district (CBD). Epworth is an ideal study site for this inquiry. The settlement has development characteristics and challenges faced by many cities in the global South. It has high levels of informality having started off as a mission farm. It also has many urbanisation problems, such as high levels of unemployment, acute poverty, poor public infrastructure, including energy infrastructure. In fact, Epworth has a comparatively worse energy infrastructure when compared to other cities in Zimbabwe or other suburbs of Harare and nearby Chitungwiza. However, in spite of these constraints and as is typical of most secondary cities in the developing world, Epworth is growing rapidly, both geographically and in terms of population. The population was 20,000 in 1980 and rose to 114,067 in 2002. According to the last census in 2012, the population had grown to 167,462 (GoZ, 2002; 2012). This makes Epworth the fourth largest urban settlement in Zimbabwe by population.

Epworth started off in 1890 as a mission farm owned by the Methodist Church (Butcher, 1986; Rakodi, 1995). The missionaries settled numerous people on the farm over the years. Initially, they were in small numbers, but this became a flood in the 1970s as many rural residents took refuge in Epworth as they ran away from Zimbabwe's war of liberation that was largely waged in rural areas (Chatiza and Mlalazi, 2009). This background to how Epworth was settled helps in understanding its largely unplanned form. As a departure from its historical heavy-handedness, the government of Zimbabwe decided to upgrade Epworth, rather than demolish it (Chirisa, 2011). By 1986, the settlement had become too large and too complicated for the missionaries to manage, hence, they surrendered it to the government of Zimbabwe.

The intention of the government was to let Harare City Council run the settlement as one of its suburbs, but Harare refused. The city authorities asked government to first upgrade Epworth to the same standards as those

prevailing in its own residential areas at which stage, they would then take over management (Chatiza and Mlalazi, 2009). This forced government to appoint an independent board to run Epworth and designate it as the lowest status of an urban area according to Zimbabwe's laws (GoZ, 1996b). Epworth is now one of Zimbabwe's 31 urban local governments that form an association of urban councils known as the Urban Councils Association of Zimbabwe (UCAZ). The settlement grew in an *ad hoc* manner since it was determined by the allocations to needy people by missionaries who were not experts in land-use planning. As a result, the settlement is largely informal in form. An autonomous local board was then appointed to run the settlement after government takeover. Epworth then became one of the recognised 31 urban settlements in Zimbabwe in terms of the law run by a local board (GoZ, 1996b). Whilst the local board initially comprised hand-picked government appointees, since the year 2000, Epworth was divided into eight administrative wards that are now represented by democratically elected councillors. The council is known as the Epworth Local Board (Dialogue on Shelter, 2012).

As already intimated, there are many urbanisation challenges, including high levels of poverty, unemployment, poor infrastructure and informality in Epworth (Tawodzera, 2013; Chirisa, 2012). These characteristics make Epworth a suitable site for making an inquiry into its resilience capabilities in terms of options for cooking in the era of climate change. It helps understand how an urban area facing severe urbanisation challenges can respond to climate change by examining available options.

To understand the mix of energy types being used by the residents of Epworth, this section shares the outcome of a survey of 100 households randomly selected, as indicated in the methodology. Although Epworth has large unplanned areas, it also has some planned areas. The survey was, therefore, conducted in two wards of Epworth that reflect its planned and unplanned form.

Most of the people in Epworth use firewood for heating purposes. Out of a sample of 100 households surveyed, the majority (61), used firewood for cooking purposes. This is reflective of the low electricity connectivity in the

urban settlement. In much of the unplanned areas there is very low electricity connectivity. In some of the new planned areas, electricity availability is low, due to delays by the power utility to connect applicants. This forces most of the residents to use firewood as its cost is said to be increasing but is comparatively easily available when compared to the options. One resident remarked, "*Huni ndodzinowanikwa nyore, che dzaakudhura asi ukaenda kumusika unodziwana* (firewood is accessible, true, the costs are increasing, but if you go to the market, you will find it)."

This is unlike alternatives that may not be available on the market most of the times when residents look for them.

There were 10 households that reported using liquified petroleum gas as the main source for cooking and heating. This is a relatively clean energy source but there are problems of supply and cost. Most vendors were said to charge an average of US$3/ kilogramme of gas, a cost that was beyond the reach of many residents of this low-income settlement. Another reason for the low uptake of liquid petroleum gas was the erratic supply of the product. As indicated in the introduction, Zimbabwe is facing shortages of foreign currency to buy imports, such as liquified petroleum gas. The gas is, therefore, not readily available even if residents could afford it. Many residents, thus, do not always look for it as they know the challenges of its availability. "I used gas in the past, but now it's never available", one resident indicated. So, whilst gas could be a viable alternative for a largely off-grid settlement like Epworth, it is not readily available. Perhaps even the average cost reflects the premium for its scarcity.

There were only 12 households that use electricity mainly for heating and cooking in Epworth. These are all mostly in the planned areas where there is a good electricity network. In the planned area, almost all houses are connected to electricity and so use it for cooking. They, however, indicated frustration at the long hours of power-cuts. They also reported that recent price increases were forcing some of them to reconsider exclusive use and reliance on electricity. The long hours of unavailability have removed electricity as a reliable energy source because even for those connected, it is rarely available.

This is the reason why some of those connected to electricity also reported using firewood and gas.

A sizeable number of respondents reported that they use three different heating forms in almost equal proportions. Thirteen (13) respondents reported that they used firewood electricity and gas in almost equal proportions, depending on availability. This was a measure they had taken to guarantee regularity of energy. When there is no electricity, they use gas and when there is no gas, they use firewood. These appear to be the better-off residents that have the luxury of having options. Unfortunately, most residents of Epworth cannot afford to have all three energy types available and on standby. It is an option and a preserve of the few better-off residents.

Only four residents in the sample reported using paraffin, a liquid fossil fuel. This was a bit unexpected based on the historical high use of paraffin amongst the poor in Zimbabwe's urban areas. Historically, the government has always subsidised the cost of paraffin so that it is affordable to the majority low-income urban residents. Its low use is probably explained by the shortages of petroleum products in general and paraffin in particular. It would appear as government has struggled to provide diesel and petrol, the two main types of fuel driving vehicles in the country, the poor have been sacrificed. A follow-up survey of fuel stations found none of 10 on the way from Epworth to Harare CBD had paraffin although three had either petrol or diesel. So, whilst paraffin is not a clean source of energy, but one of the unintended outcomes of fuel shortages has been the sacrifice of the poor's subsidy on paraffin.

Table 1: Summary of the Epworth Energy Mix

Energy Type	Firewood	Gas	Paraffin	Electricity	Firewood, Gas and Electricity
Frequency	61	10	4	12	13
Total	**N=100**				

Firewood remains by far the most popular heating option for many residents of Epworth. This is because it is the most easily available option. Most houses are not on the national electricity grid. The electricity infrastructure does not cover many parts of the settlement. In some areas, the national grid

transmission lines only cover shopping centres without providing access to many houses. Whilst one sees several liquid petroleum gas kiosks, the supply of the gas is erratic. Wood, therefore, remains a popular option that is, however, increasingly being threatened by limited availability and increasing policing by the environmental authorities. Due to firewood's remaining popularity for Epworth residents and its link to deforestation and climate change, the study inquired on the sustainability of its supplies. Two stories volunteered by one middle-aged resident and a wood vendor who has been in the business for a long period are shared below to help understand the causes of the threats to firewood use for heating:

Mrs Mpahlo an Epworth resident, said,

> "For many years we have relied on firewood. When I was growing up in the early nineteen eighties, we used to go out to look for firewood in the many bushes and forests that existed around Epworth. Once a week we would go and cut trees and get firewood. As more people came to Epworth, demand for wood increased and we started to go further to the surrounding farms to get firewood. Around the year 2000, we were getting firewood from the council game park at Cleveland Dam. This changed when a private person took over the management of the game park and installed electric fences around it. Since then we started to buy firewood from wood vendors who were bringing in truckloads of firewood from new farms. That time it was affordable to buy firewood from the vendors. There have, however, been new problems since around 2010. The vendor prices have gone up considerably because they complain that EMA (the Environmental Management Agency) is now mounting roadblocks where all firewood is confiscated. They are also fined for illegally cutting trees. So, we still get firewood but now at a much higher price from these vendors."

Mrs Mpahlo's story is corroborated by a vendor who has been selling wood in Epworth since the year 2000.

Bla Jedza, an Epworth wood vendor, said,

> "I started this business of wood vending around the year 2000. In the first days it was good and easy business where we made good profits. We

> made much money during the land reform period because firewood was easily available as people cleared new fields and others just found it viable to sell firewood than farm. So, we would go out with lorries and buy firewood for resale back here. Things changed for the worse when the environment people came. They started to mount roadblocks together with the police during the day and, sometimes, even at night. If they found a truckload of wood, they would impound the lorry and arrest the owners. It meant one lost the money they would have paid for the firewood; the lorry hire fees and labour costs for loading the firewood. So, it is no longer viable these days. Meanwhile, the customers are complaining that our product is now expensive, but we are not making any money."

These two stories highlight the slow discontinuation of the use of wood fuel as measures are taken to fight deforestation and climate change.

With the increasing difficulties in accessing heating, this section looks at two popular innovations that were reported by most residents, buying pre-cooked beans and cooking at night for those with access to electricity.

Almost a third of the respondents reported buying pre-cooked beans. Beans are a popular protein used as a relish eaten together with sadza[2], the staple food in Zimbabwe. People like beans because they are affordable and cheaper than most protein options. Beans are easily available at most local markets in Epworth. They can be found as fresh green beans, but mostly as dried beans. As dried beans, they can last long so can be found in that form throughout the year. However, dried beans take very long to cook. They can be on the fire for an average of three hours[3]. This presents a challenge in light of new difficulties in accessing affordable heating and cooking for most residents. A new innovation reported in the study is the availability of pre-cooked beans on the market in a variety of sizes of packages. One can find small 50-gram packages for one person up to larger one-kilogramme packages. The pre-cooked beans have gained much popularity, due to the energy challenges. It has become an affordable innovation for most households as they buy the pre-cooked beans

[2] A thick porridge made out of maize meal
[3] Interview with Epworth residents

for direct consumption. Others reported that they make a tomato and onion soup which they can quickly prepare and add to the beans. This allows them to have a fresh meal in a few minutes that would, otherwise take them hours to prepare.

Another innovation that was prevalent amongst those with access to electricity was cooking at night. As the country is going through long hours of power-cuts, electricity is only guaranteed at night. Many areas, including Epworth, are going through long periods without power. So, when the power comes at night, one has to do"... whatever could not be done when there was no power. "This includes cooking food. Almost all the respondents that reported using electricity mainly for cooking are resorting to this new adaptation method. An Interview with a resident of Epworth revealed, thus,

> "When the power comes, we do all chores that require power, such as ironing clothes and cooking. Since power only comes at night, I prepare the food for the whole day, that is dinner and lunches. I then store the food in the freezer and avoid opening the freezer unnecessarily so that it maintains cold temperatures even when the power goes off. If you don't cook when the power is available at night, you limit your food options, so I make it a point I cook enough for 24 hours until power returns. When I have gas, I then use it to warm food before eating."

This is a new innovation to power-cuts in Zimbabwe. The long hours when service is not available have certainly forced residents to learn to adapt.

DISCUSSION

The energy options that came up in the Epworth survey are not the only energy or heating options available in the era of climate change. This section discusses other available options that can be used to provide energy. The options discussed are all off-grid options as they would best suit a settlement with limited connectivity, such as Epworth.

An option that has been used in some similar environments is wind energy by use of small-scale wind turbine technology. This is one low-cost technology that has worked in areas with good wind speed. A study of the feasibility of the option in Zimbabwe concluded that it is 'economically not feasible'

because of the poor wind speeds which may not be sufficient to drive the turbines (Mayr, 2017). Zimbabwe does not enjoy strong nor consistent winds to continuously turn the turbines. As a result, the option is not a possible nor viable consideration in Epworth.

Use of firewood is considered a biomass option but for purposes of this article, options being considered in this section are those that were not found in the study. In particular, this section looks at biogas and other large-scale technological solutions that could provide clean energy. Scholars estimate that, including ethanol production, biomass supplies approximately 66% of Zimbabwe's total energy consumption (Jingura *et al.*, 2013). Much of this consumption is, however, through the 'traditional' ways, such as firewood burning and the scholars recommend adopting 'modern biomass technologies' which could provide higher levels of efficiency (*ibid.*). According to Jingura and Matengaifa (2009), the biomass produced in Zimbabwe could produce up to 44% of the energy needs. This, however, must be balanced with other biomass needs, such as animal feeding. With the country's increasingly unpredictable rainfall patterns characterised by more frequent droughts, this option has limitations. Shonhiwa (2013) also assessed the volume of biomass available for energy generation from crops, forestry and municipal solid wastes and estimated that after providing for livestock, up to 48% of current production can be realised. A similar study explores the potential of growing sweet sorghum in Zimbabwe's lowveld and parts of Southern Africa for its ethanol and energy generation. The study concludes that this could produce 'significant' quantities of electricity, precisely 3% of the region's power and utilise 1% of the crop land. Due to growing levels of food insecurity, any option that introduces competition between energy generation and food consumption may not find many takers.

Maybe a viable option in Epworth could be small biogas plants that utilise solid urban wastes. As discussed, the settlement suffers poor service delivery and one area of weakness is solid waste management. Any strategy that views urban solid waste as a resource is likely to be socially acceptable and economically empowering. The potential for small-scale biogas plants is, therefore, a strong possibility.

CONCLUSION AND RECOMMENDATIONS

The study has provided evidence of the challenges residents of Zimbabwe's urban settlements are facing in the area of energy supply in a context of severe economic challenges. Climate change is a new reality that Zimbabweans are also facing. The recurrent droughts have caused lower than normal rains, thereby reducing the potential for power generation at Kariba Power Station. The energy shortages are manifesting in long hours of power blackouts, thereby limiting people's options for power for cooking and heating. The traditional alternative of firewood is threatened by climate change-induced tighter measures to stop deforestation. These are making firewood harvesting a criminal activity and the firewood option more expensive.

For low-income areas, such as Epworth, options for energy are getting more and more limited. This makes it imperative for urban managers and policy-makers to plan for alternative off-grid energy solutions in the absence of reliable electricity supplies. Residents are resorting to a cocktail of adaptation measures and two were found, particularly novel, the increasing popularity of pre-cooked beans and the night cooking for those with access to electricity. The study recommends that authorities engage donors to support clean off-grid energy solutions, such as solar energy and small biogas plants, to use up urban wastes. Otherwise, for the poor Epworth resident who can no longer access wood forests and find firewood unaffordable, they are caught between a rock and a hard place.

REFERENCES

Batidzirai, B, Lysen, E. H, Van Egmond, S and Van Sark, W. G. (2009). Potential for Solar Water Heating in Zimbabwe. *Renewable and Sustainable Energy Reviews*, 13(3), 567-582.

Bromley, R. (2000) Street Vending and Public Policy: A Global Review. *International Journal of Sociology and Social Policy*, 20(1/2), 1-28

Campbell, B. M, Vermeulen, S. J, Mangono, J. J and Mabugu, R. (2003). The Energy Transition in Action: Urban Domestic Fuel Choices in a Changing Zimbabwe. *Energy Policy*, 31(6), 553-562.

Chatiza, K and Mlalazi, A. (2009). Human Settlement Needs Assessment in Zimbabwe: Critical Review and Proposed Methodology. Harare. Government of Zimbabwe, UN-HABITAT.

Chen, M.A. (2012). *The Informal Economy: Definitions Theories and Policies*. WIEGO Working Paper No.1, August 2012, Cambridge: WIEGO.

Chipango, E. F. (2018). Reinterpreting Energy Poverty in Zimbabwe: A Scalar Perspective. *Journal of Political Ecology*, 25(1), 205-220.

Chirisa, I. (2008) Population Growth and Rapid Urbanisation in Africa: Implications for Sustainability. *Journal of Sustainable Development in Africa*, 10(2), 361-394.

Chirisa, I. (2011). Inclusive Cities and Housing: Analysis of Stewardship Instruments in Epworth, Zimbabwe. Paper Prepared for the FIG Working Week, 18-22 May 2011, Marrakech, Morocco.

Davidson, O and Mwakasonda, S. A. (2004). Electricity Access for the Poor: a Study of South Africa and Zimbabwe. *Energy for Sustainable Development*, 8(4), 26-40.

Davidson, O and Y. Sokona, (2002). 'A New Sustainable Energy Path for African Development: Think Bigger, Act Faster', Energy and Development Research Centre, University of Cape Town, Cape Town

De Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York, Basic Books.

Dialogue on Shelter (2012). Epworth Profile Report. Available online: http://dialogueonshelter.co.zw/downloads.html/:epworth-profile-report-feb2012. Accessed on 7 March 2020)

Dube, I. (2003). Impact of Energy Subsidies on Energy Consumption and Supply in Zimbabwe. Do the Urban Poor Really Benefit? *Energy Policy*, 31(15), 1635-1645.

Frayne, B, Moser, C and Ziervogel, G. (Eds.). (2013). *Climate Change, Assets and Food Security in Southern African Cities*. London: Routledge.

Government of Zimbabwe (1996a). Regional, Town and Country Planning Act [Chapter 29:12]. Harare: Government Printers.

Government of Zimbabwe (1996b). The Urban Councils Act [Chapter 29:15]. Harare: Government Printers.

Government of Zimbabwe. (1996c). Public Health Act [Chapter 15:09]. Harare: Government Printers.

Government of Zimbabwe (2002). Population Census Report. Harare: Government Printers

Government of Zimbabwe (2012). Population Census Report. Harare: Government Printers.

Hosier, R. (1986). Zimbabwe: Energy Planning for National Development (No. 9). Upsala: Nordic Africa Institute.

Jingura, R. M and Matengaifa, R. (2009). Rural Energy Resources and Agriculture's Potential as an Energy Producer in Zimbabwe. *Energy Sources, Part B*, 4(1), 68-76.

Jingura, R. M, Musademba, D and Kamusoko, R. (2013). A review of the State of Biomass Energy Technologies in Zimbabwe. *Renewable and Sustainable Energy Reviews*, 26, 652-659.

Kagande[1], L, Madanhire, I and Matsungo, C. (2013). Assessment of the Economic Impact of Full Scale Use of Domestic Solar Water Heaters in Zimbabwe in Comparison with Other Electrical Management Options.

Kamete, A.Y. (2012). Interrogating Planning's Power in an African City: Time for Reorientation? *Planning Theory*, 11(1),66-88.

Kayo, D. (2002). Power Sector Reforms in Zimbabwe: Will Reforms Increase Electrification and Strengthen Local Participation? *Energy Policy*, 30(11-12), 959-965.

Li, X, Ge, L and Chen, X. (2013). Detecting Zimbabwe's Decadal Economic Decline Using Nighttime Light Imagery. *Remote Sensing*, 5(9), 4551-4570.

Makonese, T. (2016). Renewable Energy in Zimbabwe. 2016 International Conference on the Domestic Use of Energy (DUE), Cape Town, 2016, 1-9.

Mangwengwende, S.E. (2002). Tariffs and Subsidies in Zimbabwe's Reforming Electricity Industry: Steering a Utility Through Turbulent Times. *Energy Policy*, 30(11-12), 947-958.

Mapako, M. C and Afrane-Okese, Y. (2002, April). Experiences and Lessons in the Implementation of Solar Home Systems from Zimbabwe. *Conference Proceedings, DUEE*, Cape Technicon, Cape Town, South Africa.

Mapira, J and Munthali, A. (2011). Household Energy Demand: Wood Fuel Consumption and Peri-Urban Deforestation in the City of Masvingo (Zimbabwe). *Journal of Sustainable Development in Africa, 13*(5), 269-279.

Marawanyika, G. (1997). The Zimbabwe UNDP-GEF Solar Project for Rural Household and Community Use in Zimbabwe. *Renewable Energy*, 10(2-3), 157-162.

Mayr, M. (2017). Feasibility Analysis of Power Supply by Small-Scale Wind Turbines in Urban, Semi-Urban and Rural Districts of Zimbabwe. Available online: https://mediatum.ub.tum.de/doc/1368133/1368133.pdf. Accessed on May 21, 2019.

Mbohwa, C. (2002). Zimbabwe: An Assessment of the Electricity Industry and What Needs to be Done. *The Electricity Journal*, 15(7), 82-91.

Mitullah, W. (2004). A Review of Street Trade in Africa. Chen M.A. (ed.) *The Informal Economy: Definitions Theories and Policies*. WIEGO Working Paper No.1, August 2012, Cambridge: WIEGO.

Mukeredzi, T. (2019). Power-cuts Are Plaguing Southern Africa. The Region Needs Renewable Energy. Available online: https://foreignpolicy.com/2019/12/24. Accessed on 7 March 2020

Munangagwa, C.L. (2009). The Economic Decline of Zimbabwe. *Gettysburg Economic Review*, 3(1), 9-15.

Njaya, T. (2014). Operations of Street Food Vendors and their Impact on Sustainable Urban Life in High-density Suburbs of Harare, Zimbabwe. *Asian Journal of Economic Modelling*, 2(1), 18-31.

Pieterse, E and Parnell, S, (2014). Africa's Urban Revolution in Context. *Africa's Urban Revolution*, London: Zed Books Ltd.

Potts, D. (2008). The Urban Informal Sector in sub-Saharan Africa: from Bad to Good (and Back Again?). *Development Southern Africa*, 25(2), 151-167.

Rakodi, C. (1995). *Harare: Inheriting a Settler-Colonial City: Change or Continuity?* London: John Wiley.

Rogerson, C.M, (2016). Responding to Informality in Urban Africa: Street Trading in Harare, Zimbabwe. *Urban Forum*, 27(2), 229-251.

Roy, A. (2005). Urban Informality: Toward an Epistemology of Planning, *Journal of the American Planning Association*, 71(2), 147-158.

Samu, R. Fahrioglu, M and Taylan, O. (2016). Feasibility Study of a Grid Connected Hybrid PV-Wind Power Plant in Gwanda, Zimbabwe. *HONET-ICT, Nicosia*, 2016, 122-126.

Shonhiwa, C. (2013). An Assessment of Biomass Residue Sustainably Available for Thermochemical Conversion to Energy in Zimbabwe. *Biomass and Bioenergy*, 52, 131-138.

Skinner, C and Watson, V. (2018). The Informal Economy in the Global South, in Bhan, G, Srinivas, S and Watson, V. (eds) *The Routledge Companion to Planning in the Global South*, London: Routledge.

Söderholm, P. (1999). The Political Economy of Power Generation in Zimbabwe Since 1980. *Natural Resources Forum. 23*(4), 335-346.

Tawodzera, G. (2013). Rural Urban Transfers and Household Food Security in Harare's Crisis Context. *Journal of Food and Nutrition Disorder*, 2(5), 1-10.

Tawodzera, G. (2010). Vulnerability and Resilience in Crisis: Urban Household Food Insecurity in Harare, Zimbabwe. Unpublished PhD Thesis, Cape Town: University of Cape Town.

Tawodzera G, Chigumira E, Mbengo I, Kusangaya S, Manjengwa O and Chidembo D. (2019). Characteristics of the Urban Food System in Epworth, Zimbabwe. Consuming Urban Poverty Working Paper No.9, Cape Town: African Centre for Cities, University of Cape Town.

The Zimbabwe Independent. (2019). Revisiting the Power Situation. *The Zimbabwe Independent* Newspaper. Accessed on 23 August 2019.

Toriro, P. (2018). Food Production Processing and Retailing through the Lens of Spatial Planning Legislation and Regulations in Zimbabwe. Unpublished PhD Thesis, Cape Town: University of Cape Town.

UNEP, (2010). Six Priority Areas Factsheets on Climate Change, Available online: http:/www.unep.org/pdf/Overview_folder.pdf. Accessed on 8 March 2020.

UNFPA, U and UN-HABITAT, I.O.M. (2013) Population Dynamics in the Post-2015 Development Agenda: Report of the Global Thematic Consultation on Population Dynamics. United Nations. Available online: http://www. worldwewant2015. org/file/313464/download/340868>. Accessed on 8 March 2020.

United Nations, Department of Economic and Social Affairs, Population Division. (2014). *World Urbanisation Prospects: The 2014 Revision, Highlights*. New York: United Nations.

Watson, V. (2003). Conflicting Rationalities: Implications for Planning Theory and Ethics. *Planning Theory and Practice*, 4, 395-408.

Watson, V. (2014). African Urban Fantasies: Dreams or Nightmares? *Environment and Urbanisation*, 26(1), 215-231.

Wikipedia Encyclopedia. (2020). Zimbabwe Electricity Supply Authority. <https:/www.wikipedia.org/ZESA>. Accessed 7 March 2020.

World Health Organization. (2018). Cholera in Zimbabwe. Available online: https://www.who.int/csr/don/05-october-2018-cholera-zimbabwe/en/>. Accessed on 8 March 2020.

Yiftachel, O. (2009). Theoretical Notes on Gray Cities': The Coming of Urban Apartheid? *Planning Theory*, 8(1), 88-100.

Ziuku, S, Seyitini, L, Mapurisa, B, Chikodzi, D and van Kuijk, K. (2014). Potential of Concentrated Solar Power (CSP) in Zimbabwe. *Energy for Sustainable Development*, 23, 220-227.