Metering and Payment Technologies for Mini-grids:

An Analysis of the Market in Zimbabwe

Practical Action Consulting
Southern Africa

Copyright

Contents

List of tables

List of figures

Copyright

Introduction

Zimbabwe has an abundance of natural resources, including renewable energy. Despite this, very little has been done with regard to exploiting energy forms such as solar to provide for the 8.2 million people who currently lack electricity access. This group of people, who represent more than half of the country's population, have neither a grid electricity supply to their homes nor are they yet benefitting from decentralised electricity sources. Most of these people are located in rural areas at some considerable distance from the national grid and would be most economically (and most rapidly) served by mini-grids.

Despite the existence of this large untapped market, there is a scarcity of mini-grid developers (private, public or NGO) able to increase the small number of schemes currently in operation. The lack of activity with respect to providing power to isolated communities may be attributed to economic and political uncertainty; historically, the government placed great emphasis on grid extension as the mechanism for rural electrification, and it is only recently that decentralised renewable energies are being seen as an equally valuable solution to ending energy poverty in rural areas.

In recent years, Zimbabwe has engaged with initiatives whose purpose is to advocate for the use of decentralised renewable energy technologies, for example the Sustainable Energy for All (SEforALL) and Power for All initiatives and campaigns.

Zimbabwe developed a National Energy Policy in 2012 which many considered to give insufficient coverage to renewable energy sources, which are very often the main source of power generation for decentralised mini-grids. The nation is currently in the process of developing renewable energy policy and later an energy efficiency policy which are expected to catalyse the mini-grid sector as well as other renewable energy initiatives.

This market assessment gives an overview of the state of the electricity sector in Zimbabwe, and describes the country's renewable energy potential and the degree to which it has been exploited. Assessments of the decentralised generation and mini-grid sectors follow, alongside an exploration of the monitoring and billing solutions which are currently applied in Zimbabwe as part of on- and off-grid systems.

Off-grid Energy Sector Overview

Globally, the International Energy Agency (IEA) estimates that mini-grids will be the best solution for 45% of the people currently lacking electricity access, and stand-alone systems for a further 25%. Grid extension is only the most economically viable option for 30% of the rural population[1] (IEA, 2011). Measured by numbers of connections or by millions of dollars, mini-grids are already a globally relevant technology, yet there remain a number of challenges which must be overcome before mini-grid coverage can expand by the degree required to deliver universal electricity access[2].

Zimbabwe currently has a national electrification rate of 41.5%. While electricity has reached 79% of the urban households, rural electrification is still below 19%[3].

[1] World Energy Outlook (2011): International Energy Agency.
[2] Practical Action Technical Brief (2016): Real-time Monitoring, Control and Payment Technologies for Mini-grids.
[3] Hivos Zimbabwe Energy Profile

Copyright

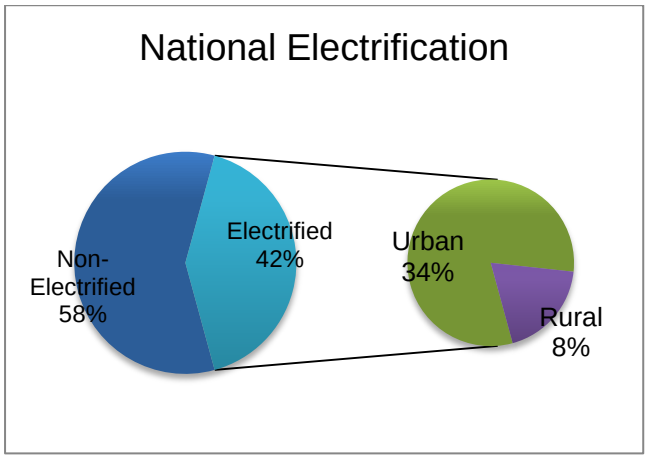


Figure 1: Electrification rate distribution

Typically, rural communities meet 80 – 90% of their energy requirements from traditional fuels (mainly wood fuel). Coal, charcoal and LPG are used by very few households (<1%)[4], although this figure may have changed over the past 4 years since the establishment of the National Energy Policy.

Zimbabwe is currently facing a shortage of electrical energy due to generation shortfalls and has to import more than 35% of its electricity requirements from neighbouring countries (Mozambique, South Africa and Zambia and, indirectly, the Democratic Republic of Congo). Power imports now constitute a significant foreign currency outflow and have put a strain on the foreign currency situation.

Relevant Policies

The Electricity Act of 2002, as amended in 2003 and 2007, and the Rural Electrification Fund (REF) Act of 2002 provided for the establishment of the Zimbabwe Electricity Regulatory Commission (ZERC) and the creation of a Rural Electrification Agency (REA), and restructured the Zimbabwe Electricity Supply Authority (ZESA) into a holding company with four subsidiary companies.

The Energy Regulatory Authority Act of 2011 established the Zimbabwe Energy Regulatory Authority as the successor to the Zimbabwe Electricity Regulatory Commission. This act provides for more efficient use of scarce human and financial resources for the regulation of the whole energy sector. It also provides for greater autonomy of the regulator.

The latest policy document is the National Energy Policy (NEP) of 2012. The country is currently in the process of formulating a renewable energy policy, an energy efficiency policy and a biofuels policy. ZERA is presently (2016) drafting a net metering regulation that is intended to promote small scale renewable power generation by allowing feed in tariffs for small generators that wish to export power to the national grid. The regulation is also intended to increase the viability of mini-grids.

Zimbabwe is a land-locked country which is endowed with a lot of natural resources that could enable substantial growth of the energy sector given sufficient and appropriately-targeted investment. The main sources of energy used in Zimbabwe comprise of coal, fuel wood, electricity and petroleum fuels. According to the latest national energy balance, fuel wood provides the bulk (53%) of the total energy supply, followed by coal (20%), liquid fuels (14%) and electricity (13%).

Zimbabwe	
Population	14.15 million (2013)
Rural Population	8,751,031
GDP	13.3 USD Billion
GDP Growth rate	4.5% annual change (2013)
GDP per capita	475.26 USD

[4] National Energy Policy 2012

Copyright

The regulatory board ZERA awards licences for power producers who generate, transmit and distribute in excess of 100kW of power. All licences are valid for a period of up to a maximum of thirty (30) years subject to satisfying periodic audits conducted by ZERA. Though ZERA does not regulate generators under 100kW, if a mini-grid developer wants to feed in their Power back into the national grid they have to do so in consultation with the Zimbabwe Electricity Transmission and Distribution Company (ZETDC).

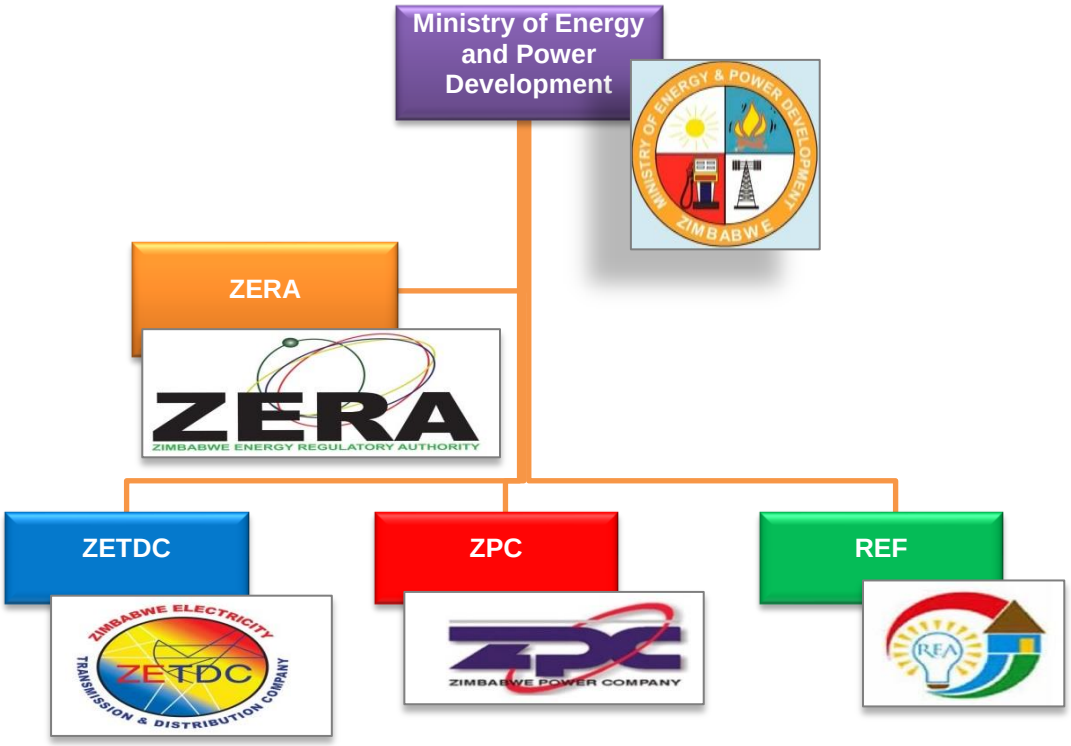


Figure 2: Zimbabwe Government Electricity Sector: Institutions and State-Owned Companies

Ministry of Energy and Power Development - the Ministry oversees the entire energy sector and has been operating under different acts of Parliament. The ministry's main function is to develop and establish an effective legislative and regulatory framework to facilitate orderly operations of the electricity industry. Other functions include: ensuring availability of adequate supplies of electricity to facilitate economic growth and sustainable development; facilitating infrastructure development in the power sector; accelerating the pace of rural electrification in Zimbabwe.
http://www.energy.gov.zw/

ZERA - the **Zimbabwe Energy Regulatory Authority** (ZERA) is a body corporate established under the terms of the Energy Regulatory Authority Act [Chapter 13:23] of 2011. It is mandated is to regulate the entire energy sector in Zimbabwe in a fair, transparent, efficient and cost effective manner for the benefit of consumers and energy suppliers. ZERA regulates any person or private company that operates an electricity undertaking which generates, transmit, distributes, or retails electricity for commercial purposes in excess of 100 kW.
http://www.zera.co.zw/

Copyright

ZPC - the **Zimbabwe Power Company** is a subsidiary of ZESA holdings responsible for the generation of power in Zimbabwe. The organisation has been authorised to construct, own, operate and maintain power generation stations for the supply of electricity. The company's mandate is to generate electricity for the domestic market. Each power station under ZPC holds a generation licence from the Zimbabwe Electricity Regulatory Authority (ZERA). Currently ZPC operates four coal-fired power stations (Hwange, Bulawayo, Munyati and Harare thermal stations), and one hydro power station, Kariba South Power Station. Together, the five have a total of 1960 MW installed capacity.
http://www.zpc.co.zw/

ZETDC - the **Zimbabwe Electricity Transmission and Distribution Company** is also a subsidiary of ZESA Holdings. ZETDC is responsible for the transmission of electricity from the power stations, the distribution of electricity as well as its retailing to end users. ZETDC's transmission responsibilities involve meeting the challenges of balancing supply and demand, managing the transmission of electricity from existing and new domestic generation plants and electricity trading (imports/exports) in the Southern African Power Pool to ensure continuity of supply. The distribution part of the company is responsible for distribution asset management (network planning, development, operation and maintenance) and marketing, which involves widening the scope and depth of the customer base, pricing and a provision of a safe and reliable service to the customers.
http://zetdc.co.zw/

REF - the **Rural Electrification Fund**, previously known as Rural Electrification Agency, was formed under the Rural Electrification Fund Act (13:20) and has the mandate for the total electrification of all rural areas, funded by electrification levies and government stipends. The main functions of the agency are the planning of projects, the raising and accounting of rural electrification funds, and the monitoring of project implementation. REF has so far seen the installation of more than 8,000 rural institution, farm or village systems, boreholes, dam points or irrigation schemes under the rural electrification programme.[5]
http://www.energy.gov.zw/index.php/power-development/rural-electrification-programme

Renewable Energy Potential

Solar Energy

Zimbabwe has been endowed with abundant solar energy. With an annual irradiation of between 1950 and 2200 kWh/m^2 and a relatively balanced monthly irradiation, Zimbabwe has a large technical potential for solar PV, including solar mini-grid installations. Solar energy traditionally been utilised for crop and meat drying. A variety of other applications have been deployed over the past few decades including:

- **Solar water heating**, primarily with locally-manufactured solar water heaters, for domestic and commercial purposes

[5] Daily News live 6/21/2016 (BUSINESS WRITER)

Copyright

- **Solar refrigeration** in isolated rural hospitals and clinics, largely funded by charitable organisations
- **Solar water pumping**, although to date this has only been deployed to a small extent since it is often not cost-competitive with the alternatives of hand pumping or petrol/diesel pumping
- **Solar home systems**, which are becoming more common in the country mainly for domestic use in rural and peri-urban settings. However, the quality of many products available on the market has historically been poor, an issue which has scarred the reputation of even legitimate high-quality products.

Though the government has exempted solar products from import duty a 15 % VAT still applies. Most stakeholders believe that it would help to boost the sector if the VAT was removed.[6]

Case Study: Mashaba Solar Mini-grid (Gwanda) 99kW

Practical Action has constructed a 99kW solar power power plant under the project Sustainable Energy for Rural Communities (SE4RC) funded by EC and GEF. The project was initiated with the aim of empowering communities to increase their productive use of energy. Project activities involve demonstrating new models of governance for community energy service companies, deploying innovative technical and social solutions such as “energy kiosks” and designing and installing mini grids that have service delivery as their driving aim.

Figure 3: Mashaba clinic and mini-grid battery bank
Source S. Masuka

The plant is constructed from 400 x 255W solar panels whose power output is transmitted at 33kV on a 3 phase line that spans 23 km and branches into four load centres. The system’s energy storage is comprised of 144 x 1000Ah lead crystal batteries (144kAh) which are used mainly for night lighting and light cooking in some instances. The system has 5 transformers, 1 step-up transformer converting 400V to 33kV at the power plant and 4 step-down transformers converting from 33kV to 400V at each load centre.

[6] Accelerating access to electricity in Africa with off-grid solar (2016): ODI, GOGLA, Solar Aid and Practical Action.

Copyright

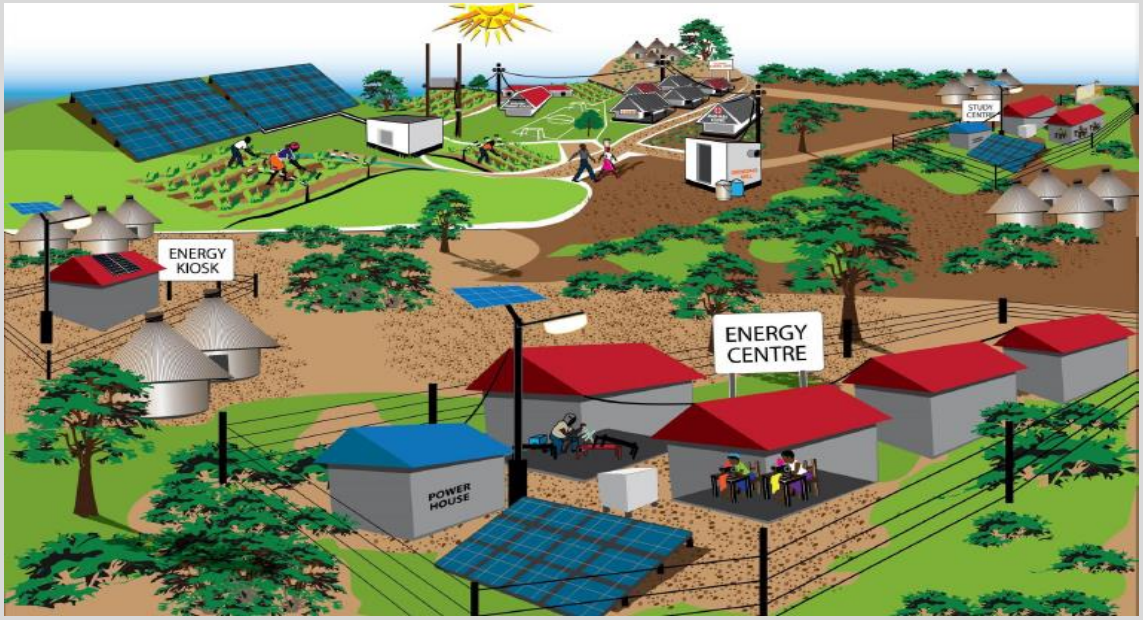
The power plant powers the 4 load centres as follows:

Rustlers Gorge irrigation scheme, which covers an area of 32 ha. The irrigation schemes makes use of four 5hp pumps.

Mankonkoni irrigation scheme, which has an area of 42Ha and currently has a pumping load of 25kVA, is on a separate transformer to Rustlers Gorge.

Mashaba primary school, which is on the same load centre as 3 shops including a butchery, bottle store and general dealer.

Mashaba clinic: the fourth load centre serves the local clinic, a business centre with 4 general dealer shops and an energy kiosk that offers electrical appliances to the community.



The energy kiosk helps to create demand for electricity services and directly increases household access to clean energy in the Mashaba community and beyond through the sale of pico-solar products.

Copyright

Hydroelectric Energy

The nation has an estimated hydroelectric potential of 17,500 GWh/year and of this only 19% has been exploited thus far. Though studies on the potential of the existing dams' capacity for generation have been conducted through SIRDC and the Ministry of Energy and Power Development[7], a lot more scoping has to be done for community-scale hydro projects. The productive potential for small hydro power of the areas that have so far been explored is some 120MW[8]. The following are some of the sites that were assessed:

Table 1: Small hydro sites being prioritised for development

District	Site	Capacity (MW)	Annual Energy Production (GWh)
Mwenzi	Manyuchi	1.4	5.5
Masvingo	Mutirikwi	5	40
Mutasa	Osborne	3	23.6
Bikita	Siya	0.9	5.6
Mutasa	Duru	2.3	6.0
Nyanga	Gairezi	30	70
Nyanga	Tsanga	3.3	8.8

Practical Action has constructed 6 micro hydro systems in the country with a combined capacity of 120 kW for the service of small decentralised communities. Most Independent Power Producers in the country use also hydro as their power source for example:

Table 2: Hydro mini-grid IPP's

Company	Capacity	Water source
Nyamingura Power Station (Pvt) Ltd	1.1 MW	Nyamingura and Madengwe rivers
Duru Power Station (Pvt) Ltd	2.2 MW	Duru River
Pungwe A Power Station (Pvt) Ltd	2.7 MW	Nyamombe tributary of the Pungwe River
Pungwe B Power Station (Pvt) Ltd	15 MW	Pungwe River

In recent years, Southern Africa has suffered from droughts that starve perennial rivers of their water and make micro-hydro systems less viable. Hybrid systems may be an option that could aid in making hydro power viable for communities adversely affected by climate change.

Case Study: Chipendeke Mini-Hydro (Mutare) 25kW

The result of a five-year European Union funded project which sought to improve energy access through community managed decentralised micro hydro systems in poor marginalised rural communities in Malawi, Mozambique and Zimbabwe, the Chipendeke mini-hydro scheme was commissioned in 2008. The power plant has brought electricity to 27 households, 6 shops, a school and a clinic.

[7] http://www.zinwa.co.zw/catchments/runde-catchment/dams/
[8] http://www.energy.gov.zw/index.php/site-administrator

Copyright

Figure 4: Chipendeke mini-hydro power plant

The clinic has managed to buy a refrigerator for vaccines with an additional donation from UNICEF. The primary school students can now study in the evening using electric lighting. Businesses benefitted from electricity access, which allowed them to sell products they could not have sold previously and provide entertainment to attract customers.

The model that was adopted was a community-owned model whereby a committee was appointed to manage and collect revenue to sustain the ongoing operations of the plant. Though the con log system was capable of supporting different payment options, a fixed rate tariff was used. In practice the tariff selected was too low, meaning that the committee did not receive enough revenue to cover the cost of repairs. This necessitated a call for additional support after the project termination dates.

Biomass Energy

Biomass holds the largest share of utilised energy in Zimbabwe's energy mix, at 69 % in 2009[9]. However, biomass energy is mainly used for cooking and heating in rural communities, rather than for electricity generation.

Commercial companies who produce a lot of biomass waste from their saw mills or processing do use it as a fuel or feedstock for generating electricity, although the

[9] Zimbabwe Energy Profile (HIVOS)

Copyright

electricity generated by these organisations is mostly self-consumed. Some examples include:

Table 3: Biomass power generation plants

Name of Licensee	Plant Name	Fuel/Technology	Capacity
Tongaat Hullet (Pvt) Ltd	Triangle Sugar Mill	Bagasse	45 MW
Tongaat Hullet (Pvt) Ltd	Chiredzi Sugar Mill	Bagasse	33 MW
Green Fuel (Pvt) Ltd	Chisumbanje Ethanol Plant	Bagasse	18 MW
Border Timbers (Pvt) Ltd	Charter Sawmill	Wood waste	0.5 MW
ALLIED Timber Holdings	Zimbabwe Green Energy	Wood waste (gasification)	2 MW

Case Study: Charter Sawmill power plant (Chimanimani)

Charter Sawmill, Chimanimani, processes 200,000 m^3 of solid wood per year. The amount of residue left is considerable - 13,000 m^3 of bark, 80,000 m^3 of wet chips and sawdust, and 2,000 m^3 of dry chips. The thermal energetic value of the residue from this sawmill alone would be around 185 GWh per year. This would be enough to supply a 3 MW power plant running near-constantly, generating about 25 GWh of electricity annually[10].

Figure 5: Wood shaving waste heaps and steam generation plant
Source: T .Mudzingwa, ZERA

BTL 1 is a steam engine-driven combined heat and power plant at Charter Sawmill producing 0.5MW of electricity and 5MW of process heat. Waste wood and sawdust produced by the sawmill – both of which are renewable resources – fuel the boilers which, in turn, produce electricity-generating steam.[11]

Biomass mini-grids are most likely to be technically and economically viable in communities located near to industrial sites producing biomass waste. Industries that produce a sustained resource of biomass waste include forestry and sugar industries. Where these industries are currently generating power from waste, they most often

[10] Renewable Energy for Development 1996, Vol. 9, No. 3/4 - *Fredrik Mellqvist*, SEI and *Leif Palm*, SwedSteam.
[11] Rift Valley Sustainability Report 2014.

Copyright

feed surplus power back into the national grid rather than supplying neighbouring communities: at present, this option is more profitable for them, and furthermore it is simpler to manage since power generation is not their primary business.

Wind Power

Zimbabwe has relatively good history of exploiting its wind resources. Wind was traditionally used for water pumping in the 1930s but was largely substituted by cheaper petrol generators in the 1950s .In the late 1990s and early 2000s there was a renewed interest on the part of government, schools, hospitals, NGOs and others in wind pumping and light electricity generation for off-grid areas[12].

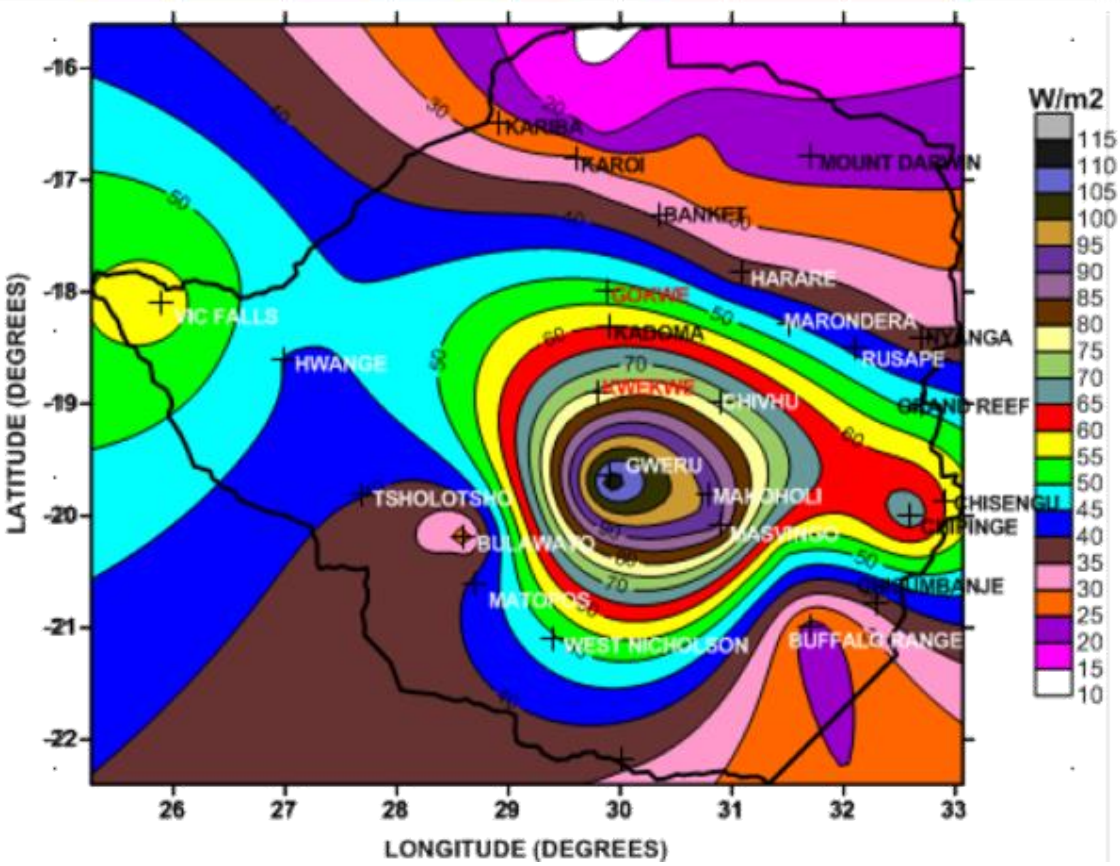


Figure 6: Average wind power densities, Zimbabwe
Source: T. Hove and L. Madiya (Developed using Surfer)

The wind power density for Zimbabwe is seen to be highest in the central region, the Midlands province. Across the country, the power density at 50 m hub height varies between about 10W/m^2 to 120W/m^2. These power density levels are on the low side for large-scale power production, but some selected sites in the Midlands area maybe suitable for small-scale wind energy projects[13].

[12] Zimbabwe Rural Electrification Study 2000, ESMAP.
[13] Wind resource mapping for Zimbabwe 2013, T. Hove & L. Madiya (Presentation University of Zimbabwe)

Copyright

Case Study: Temaruru Business Centre Pilot Wind Project (Makoni)

The pilot was one of the mini-grids developed under the “Power from Wind" Project implemented by the Zimbabwe Environmental Research Organization (ZERO). The initiative has also resulted in the ongoing production of 1kW and 4kW wind turbines by Power Vision, a local manufacturer. Four turbines with a combined capacity of 4kW were installed at the Temaruru Business Centre in Dumbamwe near the town of Rusape. The initiative also saw the establishment of community trusts to take charge of the project, and the creation of a successful partnership between the government, ZERO and the privately-owned Power-Vision Ltd.

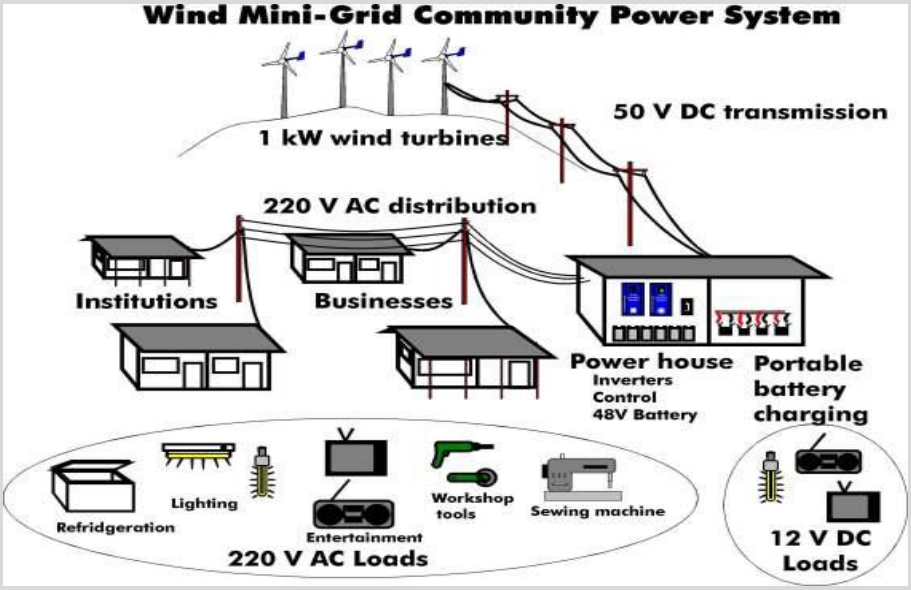


Figure 7: Temaruru model wind mini-grid system

Participation of the wider local community was an integral component of this project. The establishment of the Dumbamwe Trust fund enabled the community to have a sense of ownership of the project. In addition a project management committee comprising community representatives is responsible for maintenance of the turbines, monitoring the operation of the battery recharging system and the collection of payment for the electricity utilised by businesses.

The living standards of people were increased, especially those operating shops in the Business Centre whose sales went up by an average of about 200%. The rise in sales was attributed to better lighting in the evening due to the presence of electricity. A new barber shop, hair salon and an electronics workshop were established. The women, men, and youth at Temaruru who used to travel long distances to Rusape for battery charging were for a time able to do it at their local centre instead. However, since then the mini-grid is has not been functional due to issues of ownership and responsibility and economic sustainability.

Copyright

Diesel/Petrol Off-grid Generation

Diesel generators have become essential as back-up systems for enterprises and institutions in every district in Zimbabwe. Many gensets serve as essential back-up systems for health, industrial and tourism applications, providing electricity in the event of disruptions from the grid. A number of diesel generators charge batteries for households and commercial establishments in rural Zimbabwe, where the installation of distribution networks is not viable or has not yet taken place. Some areas are far from where the diesel or petrol is distributed making it even more challenging to use these fuels as a source of electricity. Diesel is not considered a ready solution for the most isolated rural mini-grids because of the necessary reliance on road networks and the high cost of diesel in remote places. However, in these cases diesel is still a very useful back up other energy sources in a mini-grid.

Decentralised Generation and Mini-grids in Zimbabwe

Most large scale power producers feed into the grid and some produce power for their own use. Off-grid power generation is not as attractive to power producers despite the fact that in Africa for about 60% of the population, mini-grids and stand-alone systems would be the least cost means to provide access to electricity[14]. As of 2015, 18 IPPs were licensed by Government, and only five of these were believed to be operational[15]. On the other hand, licenced IPPs are not the only stakeholders in the decentralised generation space as developers of power plants and mini-grids less than 100kW do not require licences to operate. Table 4 lists the small number of visible decentralised generation schemes in Zimbabwe additional to those presented in previous sections.

Some of the IPPs that have been licenced by ZERA but are not yet in operation include the following solar installations: GeoBase Klean Energy Africa (Pvt) Ltd; Gwanda Solar Power (150MW); De Green Rhino Rufaroof Longlands Farm (50MW); and Oursun Energy Utopia farm (5MW). Hydro installations include NuPlanet Pvt Ltd (5MW), Kupinga Renewable Energy (1.5MW) and Manako Power (2.5 MW).

What becomes clear from an assessment of the decentralised generation sector is that, while the sector itself is reasonably small, the number of decentralised generators that are operational and supplying electricity to communities through mini-grids is much smaller.

[14] Scott, A., 2015. Building electricity supplies in Africa for growth and universal access. Background paper for Power, People, Planet: Seizing Africa's energy and climate opportunities. New Climate Economy, London and Washington, D.C

[15] BH24 Reporter- 05 Feb 2015

Copyright

Table 4: Decentralised Generation Schemes

Developer	Production description	Energy source	Customers	Type of organisation
Nyangani Renewable Energy Company	Nyangani Renewable Energy Company has constructed four hydro- plants with an installed capacity of up to 21 MW including Duri, Nyamingura ,Pungwe A and Pungwe B . These are all located in the Eastern Highlands of the country. Nyangani has a power purchase agreement with ZESA to feed into the grid but do not supply the local community directly nor subsidise the cost of electricity for local use.	Hydro power	ZETDC Supply national grid	Private sector
Rusitu Power Company	The Rusitu mini-hydro power plant has an installed capacity of 0.75 MW, but is currently out of action due to flooding.	Hydro power	ZETDC Supply national grid	Private sector
Green Fuel	Chisumbanje ethanol plant has the capacity to generate 18MW of power[16] but is operating at 8 MW of which 4 MW are committed to the plants operation and the other 4MW are fed back into the grid directly to the national grid.[17]	Bagasse (sugar cane)	Self - sustenance and ZETDC	Private sector

Metering Technologies

Though a lot of development is being made on many real-time monitoring and billing devices throughout the world, the technologies being utilised in Zimbabwe are not so sophisticated. This could be due to several reasons including affordability, knowledge on options and impacts of these technologies.

Most households connected to the national grid were using analogue meters until ZETDC conducted the national smart meter project which set out to achieve a target of 800,000 prepaid meters and 140,000 meters by 2018. The current achievement is 568,554 prepaid meters and 38,550 smart meters[18]. The prepayment system was introduced to cap losses through revenue collection by ZESA, and overall the meter replacement project is expected to deliver a saving to the utility once the costs of meters are factored in.

Consumers connected to the national grid are supplied with meters according to ZETDC specifications. Since the number and customer base of truly off-grid mini-grids

[16] New Ziana (2015, October 14): Green fuels invest $300 into Chisumbanje ethanol plant. *The Herald*. Retrieved from http://www.herald.co.zw/

[17] LloydGumbo & Freeman Razemba (2015, October 10): Green Fuels increases production. *The Herald.* Retrieved from http://www.herald.co.zw/

[18] Livingstone Marufu, "ZETDC beats prepaid meter target". *Sunday Mail.* Retrieved 17th July 2016 from http://www.sundaymail.co.zw/

Copyright

is so low, there few examples of other metering systems deployed in Zimbabwe. There is need for more information on the kinds of monitoring and billing technologies applicable for mini-grids in Zimbabwe, and how they can benefit utilities and end users alike.

The following are some of the metering products used in Zimbabwe for on- and off-grid electricity consumption. There are no in-country manufacturers of sophisticated monitoring and billing technologies.

Residential Communication Split Keypad Meter

Type: Multifunctional prepayment/credit meter

Use: ZETDC, supplied to on grid consumers

Description and features

Multi-functional single phase smart meter with embedded communication module. The meter is used to measure electrical energy accurately for commercial and residential customers. This meter can be utilized for prepayment and post payment applications.

Users purchase recharge tokens from authorised retailers and the code is entered into the unit to recharge. When the units purchased run out the unit will disconnect the user until the next recharge. It is capable of showing daily usage and the LCD display window can display all meter information through the operating key.

Type: Standard prepayment/credit meter

Use: ZETDC, supplied to on grid consumers

Description and features

Using supplier-specific 20-digit STS prepayment tokens which are unique to each meter, the Cashpower Power-Rail PLC prepayment meter can be converted into a standard credit meter while retaining some of the useful features of a prepayment meter. It automatically disconnects users when credit runs out. The user interface includes graphic and numeric LCD display, audio feedback and LED indicators on rate of consumption.

Copyright

Type: Standard prepayment meter

Use: ZETDC to users on the national grid.

Description and features

Another variation of prepayment meters used by ZETDC, this product is capable of energy consumption and credit balance monitoring, credit limitation alarming and credit charging. Users purchase recharge tokens from authorised retailers and the code is entered into the unit to recharge.

Though the cost of new units is not clear, replacing a unit costs approximately US$ 60.

Con log system Chipendeke min-hydro

Type: Standard prepayment meter

Use: Practical Action installations in rural communities.

Description and features

The prepayment meter allows local communities to purchase their electricity in advance from a central location. It records usage patterns and displays the balance of units remaining. The central system includes a computer, printout machine, and software and communication devices to the units. The system can show electricity use patterns for grid monitoring purposes.

The central system including the software costs approximately US$20,000 with the units costing US$100 each.

Copyright

Conclusion

There is still a lot of room for growth in the mini-grids sector in Zimbabwe. There is a deficit in the power generated by conventional power plants compared to the nation's electricity demand. Most of the population of Zimbabwe is located in rural areas without access to the national grid. For many of the people and communities living in isolated areas of the country, mini-grids represent the most cost-effective way to provide clean reliable energy for basic household, institutional and productive uses. Though natural energy resources differ between each region of the country, solar is relatively abundant throughout.

Big questions remain around how mini-grids can be made more economically viable, and technically sustainable, in these poor communities. Solutions to this problem present themselves from several angles: increasing demand beyond just low-power lighting and appliances; improving ownership models; developing technical and human resources to install, operate and repair mini-grid equipment; and many more.

Monitoring and billing devices can play an integral part in a technically and economically sustainable mini-grid. Many mini-grid developers in other parts of the world have improved the profitability of their systems through investment in advanced monitoring, billing and load management systems that offer various functions like remote monitoring, time-of-day billing and time-controlled power allocation. These capabilities allow mini-grid operators to mould their business models more effectively. Currently very little recognition is given in Zimbabwe to the potential advantages that advanced monitoring and billing devices can bring to increasing the viability of mini-grids. Mini-grid operators should take time to find and incorporate the monitoring and billing device that best suits their specific situation in order to get the best return and impact from their mini-grids.

Copyright

This document is an output from a project co funded by UK aid from the Department for International Development (DfID), the Engineering & Physical Science Research Group (EPSRC) and the former Department for Energy & Climate Change (DECC) for the benefit of developing countries. The views expressed are not necessarily those of DFID, EPSRC or DECC.

This market analysis was produced as part of the ESCoBox research project. The authors would like to acknowledge the lead research partner De Montfort University, and partner organisations for valuable contributions of thought leadership, insightful studies and collaborative working.

Take Practical Action. Work with us.

This market analysis was written by Zibusiso Ncube of Practical Action Consulting Southern Africa with support from Drew Corbyn and Louise Waters of Practical Action Consulting UK.

Drawing on over 40 years of international expertise, Practical Action Consulting (PAC) provides independent and professional consulting services in the use of technology for poverty reduction to governments, NGOs, donors and the private sector.

To find out how we can work together contact us: consulting@practicalaction.org.uk

Website: http://practicalaction.org/consulting

Offices in Peru, Bolivia, Zimbabwe, Malawi, Kenya, Rwanda, Nepal, Bangladesh, India, Senegal, UK.

Copyright