

## Country briefing



## Accelerating access to electricity in Africa with off-grid solar

### Off-grid solar country briefing: Zambia

This country briefing is one of 13 prepared as part of a background study for the Energy Africa campaign launched by the Department for International Development (DFID) on 22 October 2015. The study was undertaken by the Overseas Development Institute (ODI), the Global Off-Grid Lighting Association (GOGLA) with SolarAid, and Practical Action.

The analysis and conclusions in this briefing, and other reports from study, are those of the authors and do not necessarily reflect the views of their organisations, ODI, GOGLA, Practical Action and SolarAid, nor those of DFID.

All project reports are available at: [www.odi.org/publications/10200-accelerating-access-electricity-off-grid-solar](http://www.odi.org/publications/10200-accelerating-access-electricity-off-grid-solar)



## Background

Zambia has a population of 16.2 million people, expected to grow to over 25 million by 2030.<sup>1</sup> In 2012, an estimated 26% of the population had access to electricity (45% in urban areas and 14% in rural regions),<sup>2</sup> leaving nearly 12 million people without electricity. The population density is low at only 20 people per square kilometre, almost one third the density in Tanzania and a quarter of that in Kenya.<sup>3</sup> This both limits the prospects for on-grid growth, making off-grid renewables a potentially critical energy access solution, and creates distribution challenges for those currently working in the off-grid sector. Off-grid solar was estimated to have a 5% market penetration by one interviewee, with sales predominantly through the distributor SunnyMoney. In the Climatescope assessment, Zambia ranks 30th out of 55 countries and 9<sup>th</sup> in the region.

A dry spell during the 2014/15 rainy season left the country grappling with huge electricity shortages, as hydropower from the country's three major dams, Victoria Falls, Kafue and Kariba, accounts for over 90% of the nation's grid supply. This affected domestic electricity supply and had an impact on energy exports and the nation's copper sector, the bedrock of the economy. In May 2015, the dry spell led the national power company, ZESCO, to start a programme of load-shedding to preserve dwindling water supplies until the rainy season in November. Since May 2015, much of the on-grid population and businesses have regularly suffered scheduled 'brownouts' and are often without electricity for up to eight hours at a time. The national power shortage is weakening the Zambian economy, with productivity in the agriculture and mining industries hit particularly hard, and the Kwacha – also hit by devaluation of the yuan and fears around the Chinese market – falling to record lows.

## Policy environment

The key national policies for renewable energy in Zambia are the National Energy Policy of 2008 (NEP2008), the Sixth National Development Plan (SNDP, 2011 - 2016) and VISION 2030. As regards the energy sector, the stated ambition is to have universal access to clean, reliable and affordable energy by 2030. The former Ministry of Mines, Energy and Water Development noted this as being "51% rural energy access and 90% urban access."<sup>4</sup> To outline the practical implementation of these objectives, a National Renewable Energy Strategy was created which includes targets to generate 100 MW from solar, 200 MW from small hydro and 100 MW from biomass by 2030. In addition, it is envisaged that 500,000 solar home systems will be disseminated and 350,000 solar water heaters installed.

To increase rural energy access to 51%, the Rural Electrification Master Plan (REMP), a blueprint for rural electrification, has been drawn up with help from the Japanese government and will be implemented by the Rural Electrification Authority (REA). This includes (i) extension of the national grid, (ii) construction of mini-hydro power stations, and (ii) installation of solar home systems.<sup>5</sup>

Interviewees suggested that there is still a lack of focus on the potential for off-grid solar but that this may change given the recent energy crisis. The government has supported the establishment of solar mini-grids in some locations, and solar powered hammer mills are to be set up in 10 provinces to address issues around the price of mealie meal.<sup>6</sup>

The French Government recently announced its support for small solar projects in the country to help address the power deficit, which is estimated

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[https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Zambia\\_EOI.pdf](https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Zambia_EOI.pdf)

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[https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Zambia\\_EOI.pdf](https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Zambia_EOI.pdf)

<sup>6</sup><https://www.lusakatimes.com/2015/08/04/government-buys-solar-powered-hammer-mills-to-be-set-up-in-the-10-provinces/> Details about whether these mills are to be connected to the grid or off-grid are unavailable.

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<sup>1</sup> United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision.

<sup>2</sup> IEA (2014) *Africa Energy Outlook 2014*, International Energy Agency.

<sup>3</sup> <http://data.worldbank.org/indicator/EN.POP.DNST/countries?display=default>

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to be 560 MW.<sup>7</sup> In August 2015, Ségolène Royal, France's Minister of Ecology, Sustainable Development and Energy, specifically highlighted that this support would focus on off-grid decentralised solutions, citing the way that these can be deployed rapidly at village level and highlighting concerns about the future impacts of climate change on Zambia's hydropower resources.

Support for off-grid solutions at a local level through the Ministry of Education was highlighted by interviewees as strong in respect of both the distribution of solar energy and research. One interviewee noted that there appears to be increasing support for off-grid solar.

### Access to Finance for the Private Sector

A lack of financing remains a key issue for increasing the supply of off grid solar solutions. Zambia is a landlocked country 2,000 miles from the Tanzanian port of Dar Es Salaam. The long length of the supply chain and the time it takes to get goods to customers has significant impacts on capital requirements. Even after shipment, goods have to be imported into, and transported across, two countries, before even beginning the challenge of 'last mile' distribution. The length of the sales cycles is a severe constraint on companies' cash flow and increases the risk for businesses of currency fluctuation. Upstream financing is, therefore, key for unlocking the potential of the off-grid market.

Climatescope note that the Zambian power sector is more liberalised than that of many of its neighbours, and that \$ 215 million has been invested in renewable energy projects in recent years. All of this investment was directed to small hydro schemes through asset financing and corporate deals.<sup>8</sup>

Due to their ability to be more rapidly deployed, and to complement hydropower sources, the recent energy crisis has led to a stronger focus on solar solutions. Much of the activity appears to be focused on on-grid solutions, with the government recently announcing a plan to create 1.2 GW solar power capacity by August 2016, and the IFC pledging to provide debt financing for two solar

power projects with 50 MW capacity in line with their Scaling Solar initiative.<sup>9</sup> The Government has also reported that international investors have shown interest in bigger solar facilities.<sup>10</sup> A lack of low interest loans and investment incentives, as well as a lack of clarity around tariffs, were cited by interviewees as a critical impediment to the growth of the off-grid sector.<sup>11</sup>

### Ease of Doing Business:<sup>12</sup>

Zambia receives a very high Ease of Doing Business score of over 80 out of a hundred (with 100 being the highest score). Starting a business takes only six days, though construction and property purchases are more complex. Zambia recently eliminated the minimum capital requirement and raised the threshold of VAT to K800,000 (about \$ 70,000). Globally Zambia stands 23rd out of 189 countries on the ease of getting credit. However, the local interest rate is relatively high, with a base rate of 12.5% and bank lending rates of 22-24%. The country does not score well on the Ease of Doing business index for trading across borders. For example, due to the distance from ports as well as documentation, handling and clearance time, importing a container of goods from Durban, South Africa, takes around 53 days.

### Import of solar household related equipment and fiscal barriers

Solar panels and certain solar items enjoy import tariff exemptions, showing to some extent the commitment to improve the uptake of solar energy. However, the current regulations around what is, or is not, exempted from VAT and tariffs are not always explicit, meaning that in practice exemptions can be applied inconsistently (VAT is normally 16%).

As the market for off-grid solar products is extremely price sensitive, and more than 60% of the population live below the poverty line, a more comprehensive approach to VAT and tariff exemptions would be beneficial for market growth. The lack of clarity on charges can also further delay

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[http://www.climateactionprogramme.org/news/france\\_to\\_finance\\_solar\\_projects\\_in\\_zambia](http://www.climateactionprogramme.org/news/france_to_finance_solar_projects_in_zambia)

<sup>8</sup> <http://global-climatescope.org/en/country/zambia/#/details>

<sup>9</sup> <http://cleantechnica.com/2015/08/13/zambia-plans-add-1-2-gw-solar-power-capacity/>

<sup>10</sup> <http://in.reuters.com/article/2015/09/16/zambia-power-investment-idJINI5N1114V420150916>

<sup>11</sup> Interview Energy and Environmental Concerns for Zambia, and others  
<sup>12</sup> [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/11/10/000477144\\_20141110083005/Rendered/PDF/921630WP0Box38094580Zambia00Public0.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/11/10/000477144_20141110083005/Rendered/PDF/921630WP0Box38094580Zambia00Public0.pdf)

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the import of goods, again causing knock on impacts to solar distributors' cash flow.

### Consumer protection and quality assurance

The Energy Regulation Board (ERB) is a statutory agency established to regulate the energy sector in Zambia. Among other functions, the ERB issues licences, sets standards and investigates consumer energy complaints. It is responsible for ensuring that consumers are provided with quality solar energy products and services in line with ERB standards and regulations, and so get value for money.

The ERB's responsibilities, however, do not appear to include licenses for solar distributors and clear guidance on the quality of off-grid products.<sup>13</sup> Therefore, although customs do check products (a time consuming process), there is no effective quality control of small solar products at the border. This has led to an increase in poor quality products entering the market, especially in more rural areas and those near to the country's borders. In some regions the low quality and short life-span of these products is encouraging consumers to purchase quality products. For example, in the Southern Province, consumers are wary of products that do not come with a warranty, as a result of SunnyMoney's community education campaigns. Building trust and awareness in good quality products has taken the investment of both time and money, but interviewees noted this is helping to limit market spoilage.

Another key consumer protection issue can arise due to the scattered nature of distribution chains, which can weaken the link between the end user and manufacturers and make it hard for customers to claim warranties or get appropriate after-sales service. Some organisations, such as Village Power, combat this by using only their own distribution channels.

### Consumer awareness

An estimated 11% of the population either have, or know someone who has, a small solar product.<sup>14</sup> As well as the sale of solar products, universities and other institutions have undertaken initiatives to engage communities on using solar technology for lighting. In addition, the vast majority of the urban population is likely to have some awareness of solar

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<sup>13</sup> <http://www.erb.org.zm/downloads/notices/2014-LicensedSolarCompanies.pdf>

<sup>14</sup> SolarAid Research 2015

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energy and workers from urban areas visiting rural regions may bring with them knowledge of solar products, or the products themselves. Overall, awareness in the technology has been estimated at around 44% of the population.

The remote nature of many settlements and relatively weak distribution infrastructure means that awareness may be far lower in some regions than others. The ability to supply demand once it is created is even more of a challenge. Both high-level awareness raising campaigns and ‘below-the-line’ marketing, such as school campaigns and greater support for local vendors, complemented by availability, would improve the uptake of solar solutions.<sup>15</sup>

### Providing a level playing field

Zambia removed fuel subsidies in 2013. Since then, the fuel prices set by the ERB have been intended to work on the principle that all the costs in the supply chain are fully recovered at the pump price.<sup>16</sup>

In January 2015, the fall in world oil prices led the ERB to announce a 30% reduction in the price of kerosene, the main source of fuel for lighting. However, following an IFC visit to Zambia in March 2015, it was noted that pump prices were not covering costs and that the effective subsidies were putting pressure on the government budget. The 5% subsidy that had accrued due to the drop in prices early in the year, was removed in April. The cost of kerosene, petrol and diesel was increased again, to over \$ 1 per litre,<sup>17</sup> as the Kwacha has fallen against the dollar.

### Availability of consumer financing

In addition to distribution issues, a lack of access to consumer finance by low income households is a key impediment to the uptake of distributed energy sources. Although there are 12 microfinance institutions in Zambia and over 80,000 borrowers, MicroFinance Transparency notes that the sector is still “young, small in size and has a limited outreach.”<sup>18</sup> Strong links with the solar sector are not yet apparent, although a recent report on microfinance suggested that Vision Fund Zambia

was in discussions around creating loans for solar lights.<sup>19</sup>

A potential solution for consumer financing may lie in pay-as-you-go (PAYG) technologies. PAYG sales have not yet become predominant in Zambia, as there is not yet sufficient stock or enough country presence of PAYG companies to service potential customers. However, many look to PAYG as a way to increase the ability of low-income households to purchase solar technology.

One PAYG solution is to make payments via mobile money. Although the mobile money industry is far less advanced than that in Kenya, it is beginning to grow – 14% of adults currently use mobile money services.<sup>20</sup> Examples include MTN and Airtel, who work in partnerships with other companies, such as Cargill and Zoono, which operates across mobile networks and has over 700 agents.<sup>21</sup> Thought leaders from the sector suggest that the desire for solar energy by some, and mobile money by others, will help drive the uptake of both interlinked technologies.<sup>22</sup>

There are 11 million mobile phone connections in Zambia.<sup>23</sup> Some of the issues relating to a lack of network coverage in rural regions are being addressed by a recent Zambia Information and Communication Technology Authority (ZICTA) project to build 169 new mobile base stations in rural areas to boost connectivity. Local reports from earlier this year indicate that the roll out of cell towers is taking longer than anticipated and is subject to issues of quality and low network reach.<sup>24</sup> In addition, it is estimated that over 60% of the adult population have not heard of mobile money services, and where another 7% have heard of it, they do not know how they would access it.<sup>25</sup> This suggests a strong future potential for mobile PAYG solar energy systems but that a number of interconnected challenges will need to be addressed to support widespread implementation.

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[http://agriprofocus.com/upload/FINAL\\_REPORT\\_MF\\_Study\\_CMED1425\\_011540.pdf](http://agriprofocus.com/upload/FINAL_REPORT_MF_Study_CMED1425_011540.pdf)

<sup>20</sup> [FinScope Zambia 2015](http://www.finscope.org/finScope_Zambia_2015)

<sup>21</sup> <http://technologysalon.org/solar-lighting-payg-systems-are-illuminating-southern-africa-opportunities/>

<sup>22</sup> <http://technologysalon.org/solar-lighting-payg-systems-are-illuminating-southern-africa-opportunities/>

<sup>23</sup> <https://gsmaintelligence.com/markets/3798/dashboard/>

<sup>24</sup> <https://www.lusakatimes.com/2015/01/01/communication-towers-rural-areas-standards-cuts/>

<sup>25</sup> [FinScope Zambia 2015](http://www.finscope.org/finScope_Zambia_2015)

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<sup>15</sup> Interview SunnyMoney

<sup>16</sup> <http://www.times.co.zm/?p=63179>

<sup>17</sup> Climatescope, 2015.

<sup>18</sup> <http://www.mftransparency.org/microfinance-pricing/zambia/>

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## Level of local skills

Interviewees indicated that there is a good level of local skills and that with proper training companies can offer appropriate after-sales services and build in-country capacity for maintenance and assembly.<sup>26</sup>

Pulmani Renewable Energy Centre in Kafue provides a centre for education and training on renewable energy and how to install, maintain and troubleshoot solar systems.<sup>27</sup> The University of Zambia announced plans last year to establish solar applied energy laboratories.<sup>28</sup>

## Summary and recommendations

Although the low population density and large distances create problems for solar energy suppliers and distributors, the recent energy crisis may help drive support for off-grid energy access through household systems. Greater education of decision-makers, as well as the public, on the potential for off-grid solar to help address the energy crisis may help to accelerate market growth.

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<sup>26</sup> Interview Village Power, supported by comments from SunnyMoney

<sup>27</sup> <http://thebestofzambia.com/orgs/pumulani-renewable/>

<sup>28</sup> <http://www.africanreview.com/energy-a-power/renewables/university-of-zambia-to-establish-solar-laboratories>

Area	Situation	Opportunities
Policy framework	The government has voiced a clear agenda for increasing energy access and has focused recently on diversifying the energy mix due to the energy crisis. Solar is seen as a rapid way to increase energy for both domestic and productive purposes but the current focus seems more directed to on-grid solar and there is no clear direction of tariff structures.	<ul style="list-style-type: none"> <li>- Support awareness and policy targets for off-grid solar.</li> <li>- Strengthen policy and support for related sectors, such as telecoms and mobile finance.</li> </ul>
Access to finance	Access to finance is critical but limited. Currency fluctuations, a lack of track record in respect of PAYG and the length of the sales cycle create investor risk.	<ul style="list-style-type: none"> <li>- Undertake a wider assessment of donors involved in the local solar market.</li> </ul>
Fiscal barriers	A lack of clarity around VAT and tariffs creates confusion around imports and can lengthen the sales cycle.	<ul style="list-style-type: none"> <li>- Encourage the adoption of clearer exemptions for solar household systems.</li> </ul>
Consumer protection and quality assurance	Standards to serve as a benchmark for pico-solar products are absent. The potential for large numbers of low quality products to come from more established neighbouring markets presents a risk.	<ul style="list-style-type: none"> <li>- Support the official adoption of standards by the ERB, linked to tax exemptions.</li> <li>- Increase education and capacity within the ERB and amongst custom officials, to enable better regulation of quality and consumer protection.</li> </ul>
Consumer awareness	Awareness for solar portable lighting products and home systems varies across the country. Some areas have been reached by schools campaigns, but the large distances to be covered across the country mean that in others there is a low awareness of solar.	<ul style="list-style-type: none"> <li>- The recent energy crisis presents an opportunity to run an education and awareness campaign on the potential of off-grid solar energy.</li> </ul>
Level playing field	Fuel subsidies were removed in 2013. Changes in fuel prices led to some unintentional subsidisation during 2015. Kerosene is relatively expensive.	<ul style="list-style-type: none"> <li>- Greater education around the comparative costs of solar (including pico-solar) may help level the playing field as consumers will be able calculate the benefits.</li> </ul>
Consumer financing	The relatively strong prevalence of mobile phone use and the growing uptake of mobile money suggest that these might help support consumer financing. This is at an early stage, however.	<ul style="list-style-type: none"> <li>- Support greater engagement with MFIs and the piloting of solar specific consumer finance products.</li> <li>- Support and promote the linkage between off-grid solar and mobile money.</li> </ul>
Level of local skills	The general level of skills is considered good. Companies are able to provide core training to employees and there are a few institutions which focus on delivering training in renewable technologies.	<ul style="list-style-type: none"> <li>- Assist vocational training and support entrepreneurial opportunities in rural areas, to increase the regional spread of solar.</li> </ul>







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ISSN: 2052-7209

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This material has been funded by UK aid from the UK Government, however the views expressed do not necessarily reflect the UK Government's official policies.