



# Zambia: Stand-Alone Solar Businesses

## *Developer Guide*

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## A NOTE TO THE READER

*This Developer Guide is meant to be a 'reference document' to inform early market exploration. It is a relatively long document which summarises a wealth of details. It should best be read to obtain specific facts or information. The Guide is supplemented with Case Studies and Model Business Cases accessible at [www.get-invest.eu](http://www.get-invest.eu).*

### ABOUT GET.INVEST MARKET INSIGHTS

The first series of GET.invest Market Insights are published in early 2019 covering four renewable energy market segments in three countries, namely: renewable energy applications in the agricultural value-chain (Senegal), captive power (behind the meter) generation (Uganda), mini-grids (Zambia) and stand-alone solar systems (Zambia).

Each Market Insight package includes **a)** a 'how to' Developer Guide, **b)** Model Business Cases and **c)** Case Studies. The Developer Guide enables the reader to navigate the market and its actors, to understand the current regulatory framework and lays down the step-by-step process of starting a new project/business. The Model Business Case analyses project economics and presents hypothetical, yet realistic, investment scenarios. It hence indicates the criteria for a viable project/business to enable the reader to identify the most cost-effective project/business opportunities. The Case Study analyses the viability of operational or high-potential projects/businesses to highlight lessons learnt and industry trends.

GET.invest Market Insights therefore summarise a considerable amount of data that may inform early market exploration and pre-feasibility studies. It is recommended to cross-read all three products to gain a comprehensive overview. The products are accessible at [www.get-invest.eu](http://www.get-invest.eu).

### ABOUT GET.INVEST

GET.invest is a European programme which supports investment in decentralised renewable energy projects. The programme targets private sector business and project developers, financiers and regulators to build sustainable energy markets.

Services include project and business development support, information and matchmaking, and assistance in implementing regulatory processes. They are delivered globally and across different market segments.

GET.invest is supported by the European Union, Germany, Sweden, the Netherlands, and Austria, and works closely with initiatives and industry associations in the energy sector.

## FOREWORD

For meeting the challenges but also realising the opportunities of Sustainable Development Goals and climate change, a transformation of energy systems is paramount. As a key element, private sector needs to be mobilised, and scarce public resources need to be channelled into enabling and leveraging private sector investment. Through innovation, further reducing costs, a focus on low-carbon and resource-efficient solutions, the private sector will have a major role to play in the transformation towards an inclusive green economy and energy access for all.

One of the key barriers remains the access to capital, and how more projects and business ventures can successfully tap into the many existing financing options. Tackling this challenge has been the focus of the efforts of the European Union and its Member States.

In this context, the EU, Germany, the Netherlands, Sweden, and Austria jointly contribute to GET.invest, in a collaborative European effort to accelerate private investment in decentralised renewable energy projects.

Information about market opportunities as well as the country- and market-segment-specific “how to do business” is an important complementary tool to more tangible support provided by GET.invest to project and business development to access financing. We therefore expect that the Market Insights publication series will be useful to both national as well as international stakeholders in developing sustainable markets for decentralised renewable energy projects.

The Sustainable Development Goals show us what challenges still lie ahead. They also show us, however, that the current moment can be an opportunity. With everyone’s commitment, bringing both public and private actors to the table, we can make a difference towards the transformation to an inclusive green economy.

**Signed collectively,  
the supporters of GET.invest**



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## ABBREVIATIONS

<b>AEEP</b>	Africa-EU Energy Partnership	<b>GDP</b>	Gross Domestic Product
<b>AECF</b>	Africa Enterprise Challenge Fund	<b>GEF</b>	Global Environment Facility
<b>AfDB</b>	African Development Bank	<b>GIS</b>	Geographic Information System
<b>AGRA</b>	Alliance for a Green Revolution Africa	<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
<b>ARPU</b>	Average Revenue Per User	<b>GNI</b>	Gross National Income
<b>B2G</b>	Business-to-Government	<b>GOGLA</b>	Global Off-Grid Lighting Association
<b>BOP</b>	Balance of Payments	<b>GW</b>	Gigawatt
<b>CA</b>	Catchment Area	<b>GWh</b>	Gigawatt hour
<b>CEC</b>	Copperbelt Energy Corporation	<b>HDI</b>	Human Development Index
<b>CEEEZ</b>	Centre for Energy, Environment, and Engineering	<b>HFO</b>	Heavy Fuel Oil
<b>DBZ</b>	Development Bank of Zambia	<b>IAAZ</b>	Impact Assessment Association of Zambia
<b>DFID</b>	UK Department for International Development	<b>ICT</b>	Information and Communications Technology
<b>DoS</b>	Department of State	<b>IDC</b>	Industrial Development Corporation
<b>EEP S&amp;EA</b>	Energy and Environment Partnership Southern & Eastern Africa	<b>IEA</b>	International Energy Agency
<b>EERG</b>	Energy and Environmental Research Group	<b>IEC</b>	International Electrotechnical Commission
<b>ERB</b>	Energy Regulation Board	<b>IFC</b>	International Finance Corporation
<b>ESCO</b>	Energy Services Company	<b>IMF</b>	International Monetary Fund
<b>EIZ</b>	Engineering Institute of Zambia	<b>IPPs</b>	Independent Power Producers
<b>EU</b>	European Union	<b>JICA</b>	Japan International Cooperation Agency
<b>EU EI PDF</b>	European Union Energy Initiative Partnership Dialogue Facility	<b>KCM</b>	Konkola Copper Mines
<b>EUR</b>	Euro	<b>KNBE</b>	Kariba North Bank Extension
<b>FCO</b>	Foreign Commonwealth Office	<b>kV</b>	Kilovolt
<b>FDD</b>	Forum for Democracy and Development	<b>kWh</b>	Kilowatt hour
<b>FDI</b>	Foreign Direct Investment	<b>LED</b>	Light Emitting Diode
<b>FEWS</b>	Famine Early Warning Systems	<b>M2M</b>	Machine-to-Machine
<b>FiTs</b>	Feed-in Tariffs	<b>M4D</b>	Mobile for Development
<b>FQM</b>	First Quantum Minerals	<b>MMD</b>	Movement for Multi-Party Democracy
		<b>MW</b>	Megawatt

<b>MWh</b>	Megawatt hour	<b>SNV</b>	Netherlands Development Organization
<b>NAPSA</b>	National Pension Scheme Authority	<b>SPL</b>	Solar Portable Light
<b>NDP</b>	National Development Plan	<b>SPV</b>	Special Purpose Vehicle
<b>NPL</b>	Non-Performing Loans	<b>TI</b>	Transparency International
<b>OGS</b>	Off-Grid Solar	<b>TWh</b>	Terawatt hours
<b>OPEC</b>	Organization of the Petroleum Exporting Countries	<b>UK</b>	United Kingdom
<b>OPPI</b>	Office for Promoting Private Power Investment	<b>UNZA</b>	University of Zambia
<b>PACRA</b>	Patents and Companies Registration Agency	<b>UPND</b>	United Party for National Development
<b>PAYG/ PAYGO</b>	Pay-As-You-Go	<b>USAID</b>	United States Agency for International Development
<b>PAYE</b>	Pay as You Earn	<b>USD</b>	United States Dollar
<b>PF</b>	Patriotic Front	<b>UV</b>	Ultraviolet
<b>PMU</b>	Project Management Unit	<b>VAT</b>	Value Added Tax
<b>PPA</b>	Power Purchase Agreement	<b>VHF</b>	Very High Frequency
<b>PV</b>	Photovoltaic	<b>W</b>	Watt
<b>RE</b>	Renewable Energy	<b>WHO</b>	World Health Organization
<b>REA</b>	Rural Electrification Authority	<b>Wp</b>	Watt-peak
<b>REF</b>	Rural Electrification Fund	<b>ZABS</b>	Zambia Bureau of Standards
<b>REFIT</b>	Renewable Energy Feed-in Tariff	<b>ZAMSIF</b>	Zambia Social Investment Fund
<b>REMP</b>	Rural Electrification Master Plan	<b>ZANACO</b>	Zambia National Commercial Bank
<b>RGCs</b>	Rural Growth Centres	<b>ZARENA</b>	Zambian Renewable Energy Agency
<b>SADC</b>	Southern African Development Community	<b>ZDA</b>	Zambia Development Agency
<b>SAPP</b>	Southern African Power Pool	<b>ZEMA</b>	Zambia Environmental Management Authority
<b>SCADA</b>	Supervisory Control and Data Acquisition	<b>ZESCO</b>	Zambia Electricity Supply Corporation
<b>SHS</b>	Solar Home System	<b>ZMW</b>	Zambian Kwacha
<b>Sida</b>	Swedish International Development Cooperation Agency	<b>ZRA</b>	Zambia Revenue Authority

## EXECUTIVE SUMMARY

With a welcoming investment climate, a reputation for political stability, and a deepening national power crisis, Zambia is emerging as an attractive destination for entrepreneurs, venture developers, and investors seeking to launch commercially viable energy access businesses.

This GET.invest Renewable Energy Developer Guide describes the potential for developing an Off-Grid Solar (OGS) business in Zambia. The Guide describes the country and market context, the opportunity for off-grid solar home solutions, and reviews regulatory and operational considerations for developers and investors preparing an investment opportunity.

The key takeaways are as follows:

- Given a national electrification rate of 28% and more than 2 million off-grid households, there is a tremendous market opportunity for off-grid solar solutions. The market opportunity is estimated at more than **EUR 210 million per annum**.
- The commercialization of off-grid solar solutions follows **light-handed regulation**, as Solar Portable Lights (SPLs) and Solar Home Systems (SHSs) are treated as consumer goods.
- **Public finance is prioritizing growth in Zambia's Off-Grid Solar (OGS) sector**, catalysing the development of existing ventures and new market entrants.
- Incoming developers and investors should be prepared to adapt business models to accommodate **low population densities**, an **underdeveloped mobile money ecosystem**, a **developing regulatory regime**, and a **rapidly changing competitive landscape**.

## SECTION 1

# Introduction



Achieving universal access to electricity is critical to accelerating sustainable development worldwide. In Zambia, where electricity access is recorded at 28% (World Bank, 2017) and population densities are among the lowest on the continent (World Bank, 2017), the deployment of decentralised off-grid solar (OGS) solutions can substantially accelerate progress towards reducing the country's energy access deficit.

The global OGS industry has seen tremendous growth in recent years, particularly in India and East Africa, with over USD 220 million of private investment flowing into Pay-As-You-Go (PAYGO) OGS business models alone in 2016 (Bloomberg, 2017a). Since 2013, PAYGO OGS solutions have provided more than 1.1 million people in energy poor economies with access to electricity (Bloomberg, 2017b).

Zambia's experience with OGS solutions is nascent but fast emerging. While the country has a relatively developed history with stand-alone solar home systems (SHS), dating back to at least the 1990s (REMP, 2009), "new wave" OGS developments have only emerged in the country within the last two to three years. The domestic Zambian company VITALITE is leading the country's experience with mobile money-enabled PAYGO OGS solutions, while market leaders from the East African region, including Azuri Technologies, Fenix International, and others, are increasing their respective presences in the country.

This GET.invest Developer Guide comprises several considerations for entrepreneurs, venture developers, and investors exploring commercial opportunities in Zambia's burgeoning OGS sector. The Guide is meant to inform early stage market exploration activities, and provide a consolidated resource for developers crafting business plans or investment theses; however, the Guide is by no means intended to substitute for on-the-ground market research activities. Indicative data points are provided based on document reviews and interviews undertaken with market stakeholders in Zambia between January and April 2017. Due to the commercially sensitive nature of some data, as well as the sector's current pace of development in Zambia, developers are encouraged to consult relevant authorities, regulations, and their business network to confirm the latest market information in Zambia.

The Guide is structured as follows. [Section 2](#) presents a brief country overview of Zambia. [Section 3](#) profiles components of the Zambian electricity sector that are of relevance to OGS developers. [Section 4](#) provides an overview of the market

potential for OGS in Zambia. [Section 5](#) provides "how-to" guidance on developing an OGS business in Zambia, while [Section 6](#) reviews sector-specific financing options for OGS developer.

## SECTION 2

# Country Profile



The Republic of Zambia is landlocked in Southern Africa, east of Angola and south of the Democratic Republic of the Congo (Figure 1) (Nations Encyclopaedia, 2017). Zambia gained independence from the United Kingdom in 1964 (Nations Encyclopaedia, 2017).

## 2.1 GEOGRAPHY, TOPOGRAPHY AND CLIMATE

Zambia has a surface area of 752,618 km<sup>2</sup> with a perimeter of 6,043.15 km (Nations Encyclopaedia, 2017). The Zambezi River, the fourth longest river in Africa, forms a natural riverine boundary with Zimbabwe. Lake Kariba on the Zambia-Zimbabwe boundary

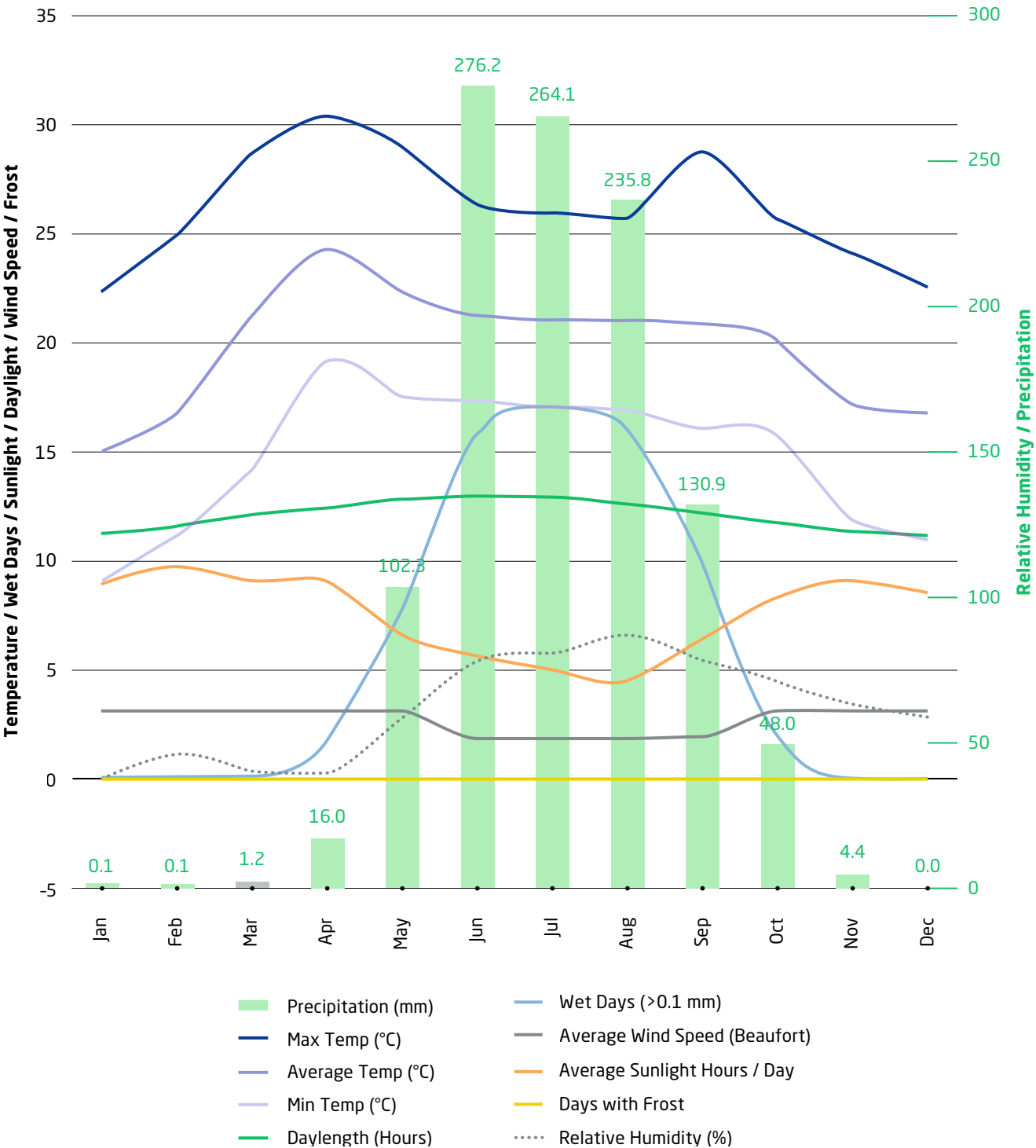
der forms the largest reservoir by volume in the world (Nations Encyclopaedia, 2017). Most of the landmass in the country consists of a wide and high plateau lying 910–1,370 meters above sea level (Nations Encyclopaedia, 2017). Elevations below 600 meters are encountered in the valleys of the major river systems (Nations Encyclopaedia, 2017). In the Northeast, the Muchinga Mountains exceed 1,800 meters (Nations Encyclopaedia, 2017). Plateaus in the north-eastern and eastern regions of the country are interrupted by the low-lying Luangwa River, and in the Western half by the Kafue River (Nations Encyclopaedia, 2017). Both rivers are tributaries of the upper Zambezi, the major waterway in the area (Nations Encyclopaedia, 2017).

**FIGURE 1.** Political map of Zambia<sup>1</sup>



1) United Nations (2004) Map of Zambia, UN Department of Peacekeeping Operations, Cartographic Department.  
Link: <http://www.un.org/Depts/Cartographic/map/profile/zambia.pdf> – accessed April 2019

**FIGURE 2.** Climate chart for Lusaka at altitude: 1280 m<sup>12</sup>



2) ClimaTemps (2017)

Three large natural lakes exist: Bangweulu, Mweru and Tanganyika, all in the northern region of the country (Nations Encyclopaedia, 2017). Kariba, one of the world's largest manmade lakes, is on the southern border, and was formed during the construction of the Kariba Dam (Nations Encyclopaedia, 2017). Although Zambia lies in the tropics, it enjoys a pleasant climate due to its average altitude of 1,200 meters. As indicated in **Figure 2**, the country experiences three seasons, described as: **a)** cool and dry from May to August; **b)** hot and dry from September to November, and; **c)** warm and wet from December to April (Zambia Tourism, 2017). The valleys of the Zambezi and Luangwa exhibit the highest temperatures, particularly during October (Zambia Tourism, 2017).

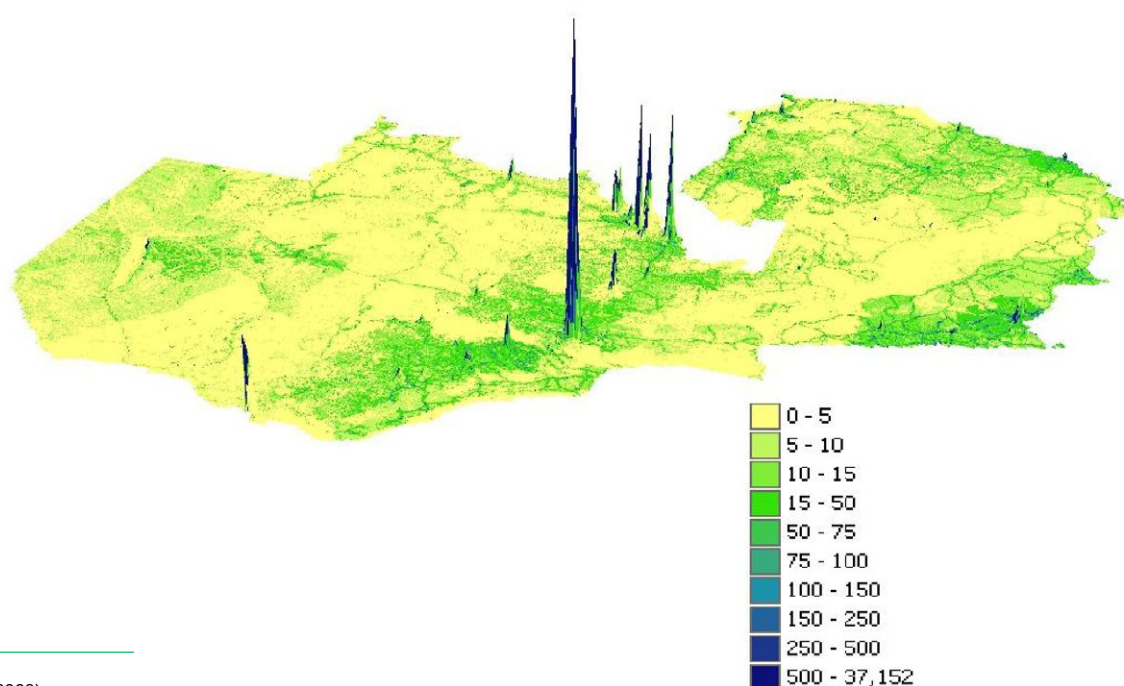
## 2.2 DEMOGRAPHICS, WEALTH AND POVERTY DISTRIBUTION

Zambia is home to over 18 different ethnic groups (CIA, 2017), with the largest groups by population including the Bemba (21%), Tonga (13.6%), Chewa (7.4%), Lozi (5.7%) and Nsenga (5.3%). There are over 70 languages and dialects, many of which are members of the Bantu family (CIA, 2017).

Zambia's population is estimated to be between 15.5 million (LCMS, 2015) and 16.21 million people (World Bank, 2017), and has been growing at approximately 3 percent per year since 2010 (World Bank, 2017). It is projected that the total population will reach 27 million people by 2035. Over half of the country's population is less than 19 years old (LCMS, 2015), and 42% of the Zambian population currently lives in urban areas (LCMS, 2015). The capital Lusaka is the most populated city, with more than 1.7 million residents, and is followed in population by Kitwe (0.50 million), Ndola (0.45 million) and Kabwe (0.20 million) (City Population, 2017). It is anticipated that approximately half of the population will be living in urban areas by 2035 (UNECA, 2015).

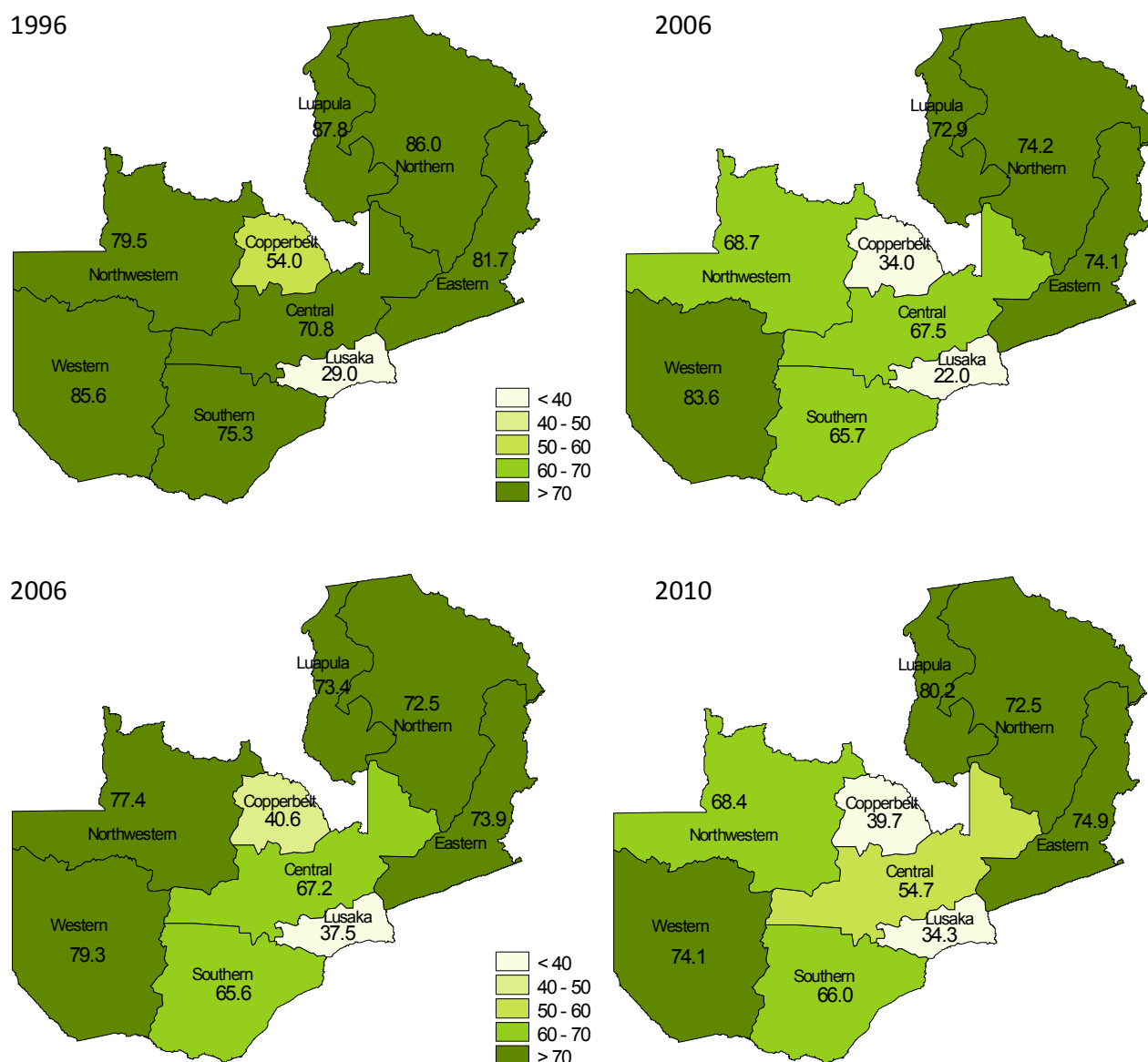
As compared to countries in East Africa that have seen substantial penetrations of OGS solutions, Zambia exhibits significantly lower population densities. In 2015, the average population density is 22 people per km<sup>2</sup>, as compared with an average of 80 people per km<sup>2</sup> in Kenya, 60 people per km<sup>2</sup> in Tanzania, 483 people per km<sup>2</sup> in Rwanda, and 207 people per km<sup>2</sup> in Uganda. (World Bank, 2017). However, as compared to a few of its larger, neighbouring Southern African countries — i.e. Mozambique, Angola, Namibia, and Zimbabwe — Zambia's average population density is congruent with countries in the

**FIGURE 3.** 2009 GIS map of population density, people per square kilometre<sup>3</sup>



3) MSU (2009)

**FIGURE 4.** Percentage of population living below the poverty line by province, 1996–2010 – lighter shades indicate lower percentage<sup>4</sup>



region. According to the 2010 Census of Population and Housing (CSO, 2011), population densities reach a high of 100 people per km<sup>2</sup> in Lusaka province, and a low of 5.6 people per km<sup>2</sup> in North-western Province. [Figure 3](#) indicates population densities as of 2009.

Extreme poverty continues to be a predominantly rural rather than urban occurrence (UNECA, 2015). Increases in income have been densely concentrated among a relatively small segment of the urban workforce (World Bank, 2012); however, high rates of urban unemployment preclude the rural workforce from participating in the country's more dynamic economic sectors (World Bank, 2012). [Figure 4](#) illustrates a time series depicting percentages of the population living below the poverty line, per province, over the years 1996 to 2010. Particularly notable are

4) World Bank (2012)

the implications that increased economic activities and urban development have had throughout the Copperbelt region and in Lusaka over the last 20 years. Whereas the percentage of population below the poverty line fell from 54% to 39.7% in the Copperbelt region over the period, this increased in Lusaka province from 29% to 34.4%.

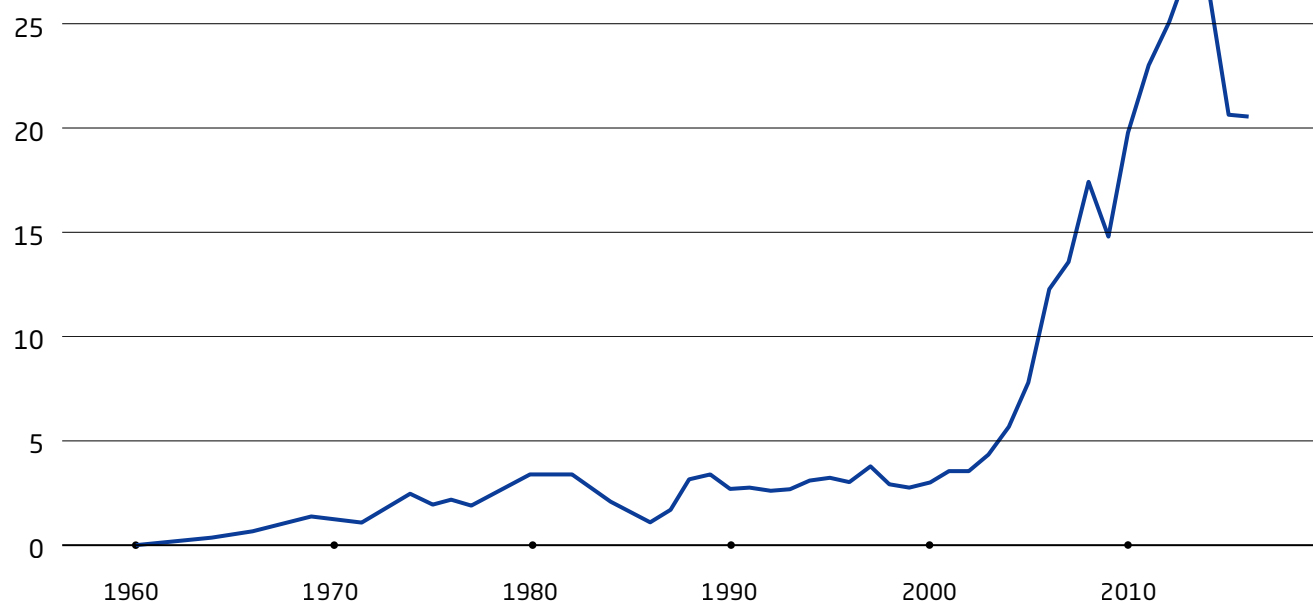
## 2.3 POLITICAL AND ECONOMIC SITUATION

Zambia consists of ten provinces<sup>5</sup> and is governed as a presidential republic (CIA, 2017). The main political parties are the Alliance for Democracy and Development (ADD), Forum for Democracy and Development (FDD), Movement for Multiparty Democracy (MMD), United Party for National Development (UPND) and the Patriotic Front (PF), the latter of which is headed by President Lungu (CIA, 2017). The government exercises executive power, while legislative power is vested in both the

government and parliament. Regionally, Zambia has a reputation for relative political stability (BBC, 2017). After former President Michael Sata's death in 2014, President Edgar Changwa Lungu won the subsequent election to become the sixth President, and was re-elected to a full five-year term in August 2016 (BBC, 2017). The legal system in Zambia is mixed, comprising English common law and customary law (CIA, 2017). All disputes having to do with commercial transactions are dealt with within the Commercial Court, a division of the High Court (US DoS, 2017).

Zambia has experienced rapid economic growth over the last few decades (Figure 5). Despite recent challenges for the economy, performance has been generally strong since 2010, with the World Bank recognizing Zambia as a middle-income country in 2011 (World Bank, 2012). GDP in 2015 was USD 21.15 billion (World Bank, 2016c), placing the country among the twenty major economies in Africa.<sup>7</sup> GDP had since declined from a high of USD 28 billion in 2013.

**FIGURE 5. GDP of Zambia in current USD, 1960-2015<sup>6</sup>**



5) A map showing administrative provinces is provided in [Annex A](#).

6) World Bank (2017)

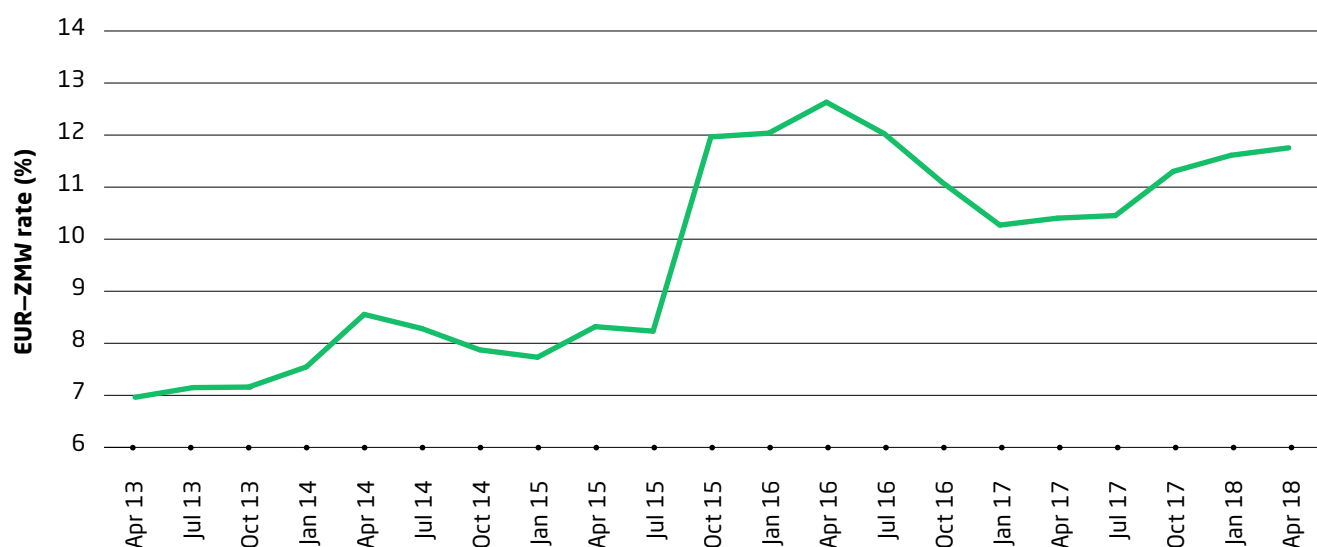
7) Main African economies per GDP in 2015 (World Bank, 2016): Nigeria USD 481.1 billion; Egypt USD 330.8 billion; South Africa USD 314.6 billion.

The Zambian Kwacha converted from the Old Zambian Kwacha (ZMK) to the currently used Zambian Kwacha (ZMW) on 1 January 2013.<sup>8</sup> The Zambian Kwacha reached an all-time high of USD 13.90 in November of 2015, and traded at USD 9.86 as of December 19, 2017 (Trading Economics, 2017). The ZMW is expected to trade at USD 9.39 at the end of Q1 2018, and at USD 9.2 by the end of Q3 2018. Inflation in Zambia is anticipated to decrease from 6.3% in Q3 2017 to approximately 4.1% in 2020 (Trading Economics, 2017). While the Kwacha nearly lost half of its value against the Euro in 2015 (Figure 6), it has somewhat stabilized through 2016 and 2017 at between 10 and 11 ZMW/EUR. According to the International Monetary Fund (IMF), volatility in the Zambian Kwacha was linked to reduced export earnings and government revenues during 2015 and 2016; although this has more or less subsided through recently tightened monetary

policy. Developers are encouraged to review the [Zambia Country page](#)<sup>9</sup> of the International Monetary Fund (IMF) for additional analyses of fiscal and monetary policy in Zambia, and implications for currency stability.

Zambia's GDP per capita is noted to be most similar to those of Ghana and Kenya (World Bank, 2017). FDI inflows have increased from approximately USD 300 million in 2005 (current USD) to approximately USD 1.5 billion in 2015, and have followed recent economic performance, falling from a high of USD 2.1 billion in 2013 (World Bank, 2017). The economy is strongly dependent on its most important sector — copper mining — which accounts for around 70% of export revenue (US DoS, 2017) and contributes approximately 10% of GDP, with remaining GDP accrued in non-mining industries and the services sector (World Bank, 2016c).

**FIGURE 6. EUR to ZMW 5-year exchange rate, 2013-2018<sup>10</sup>**

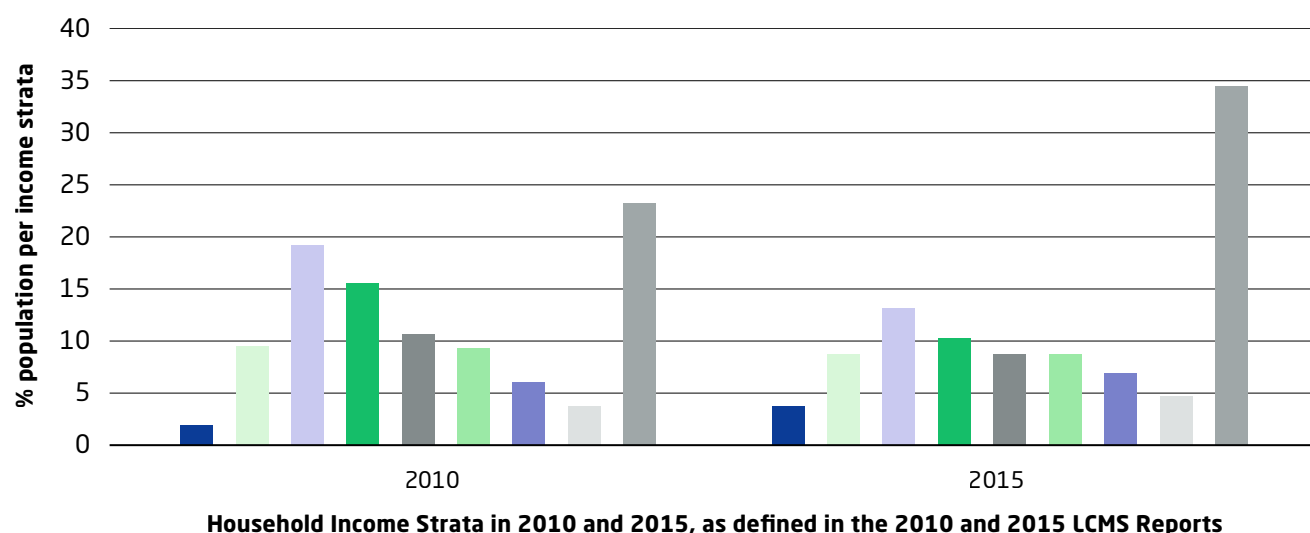


8) Changes to Zambia Currency – Standard Bank. Link: [https://www.businessonline.standardbank.com/bol\\_africa/changes\\_to\\_zambia\\_currency.jsp](https://www.businessonline.standardbank.com/bol_africa/changes_to_zambia_currency.jsp) – accessed March 2019

9) Link: <http://www.imf.org/en/Countries/ResRep/ZMB#country> – accessed March 2019

10) European Commission (2018) InforEuro monthly accounting rate of the euro, Zambian Kwacha, EC website. Link: [http://ec.europa.eu/budget/contracts\\_grants/info\\_contracts/inforeuro/index\\_en.cfm](http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/index_en.cfm) – accessed February 2019

**FIGURE 7.** Comparison of household income distributions in Zambia in 2010 and 2015<sup>11</sup>



As recently demonstrated, Zambia’s limited economic diversity leaves the country vulnerable to international dynamics. Per the African Economic Outlook (2017):

“In 2015, the Zambian economy faced economic headwinds initially due to fast rising expenditures and a fiscal deficit that more than doubled in 2013. Slowing demand from China had reduced copper prices to their lowest level in more than seven years. The situation was exacerbated by low agriculture output and a growing electricity crisis. Real economic growth fell to its lowest in 15 years, with gross domestic product (GDP) growth estimated to have slowed to 3.7% from 5.0% in 2014. Maize output declined by 22% due to poor rains. Copper prices declined by 28% while mining output remained roughly the same as in 2014.

Slow economic growth is projected for the medium term as the electricity-supply deficit continues and Zambia continues to import electricity from neighbouring countries.” According to the US Department of State (DoS, 2017): “... rampant government spending, widespread borrowing, corruption, and inconsistent economic policies left the economy especially vulnerable to external shocks such as instability in copper prices and poor electricity generation.”

At a household level, it can be said that the economic situation for a majority of Zambian citizens is improving. GNI per capita has approximately quadrupled over the past two decades, from a level of 330 (Current USD) in 2000 to 1,360 (Current USD) in 2016 (World Bank, 2017). **Figure 7** provides a comparison of national population distributions across nine household income strata, as defined in the Republic of Zambia’s Central Statistics Office Living Conditions and Monitoring Survey Reports (LCMS 2010, 2015), for the years 2010 and 2015.<sup>12</sup> While the proportions of population occupying both the lowest and highest income strata have increased over the period, there is also an indication of an expanding “middle class”. Whereas only 53.4% of all households occupied the top five income strata in 2010, corresponding to an average monthly household income of approximately EUR 38<sup>13</sup> or greater, this proportion of the population expanded to approximately 64.1% in 2015.

12) The 2010 LCMS Report defines the following nine strata of monthly household income (2010 ZMK): <50,000; 50,000-150,000; 150,001-300,000; 300,001-450,000; 450,001-600,000; 600,001-800,000; 800,001-1,200,000; >1,200,000. The 2015 LCMS Report defines the following nine strata of monthly household income (2015 ZMW): <50; 50-150; 150-300; 300-450; 450-600; 600-800; 800-1,000; 1,000-1,200; and >1,200. The discrepancy in the values defining the strata between 2010 and 2015 is due to the 2013 conversion of the Zambian-Kwacha; however, the strata are considered to be identical.

13) Using 1 ZMW = 0.086 EUR, as of 19 December 2017.

11) Author analysis based on 2010 LCMS and 2015 LCMS data

## 2.4 SAFETY AND SECURITY

Safety and security for foreigners in Zambia is generally not a concern during daylight hours. As in most countries, international travellers should exercise appropriate caution.

## 2.5 TELECOMMUNICATIONS AND MOBILE MONEY

There are approximately 12 million active mobile phone users, and approximately 6 million mobile broadband users (ZICTA, 2017). Average Revenue Per User (ARPU) is estimated at 400 ZMW per year.

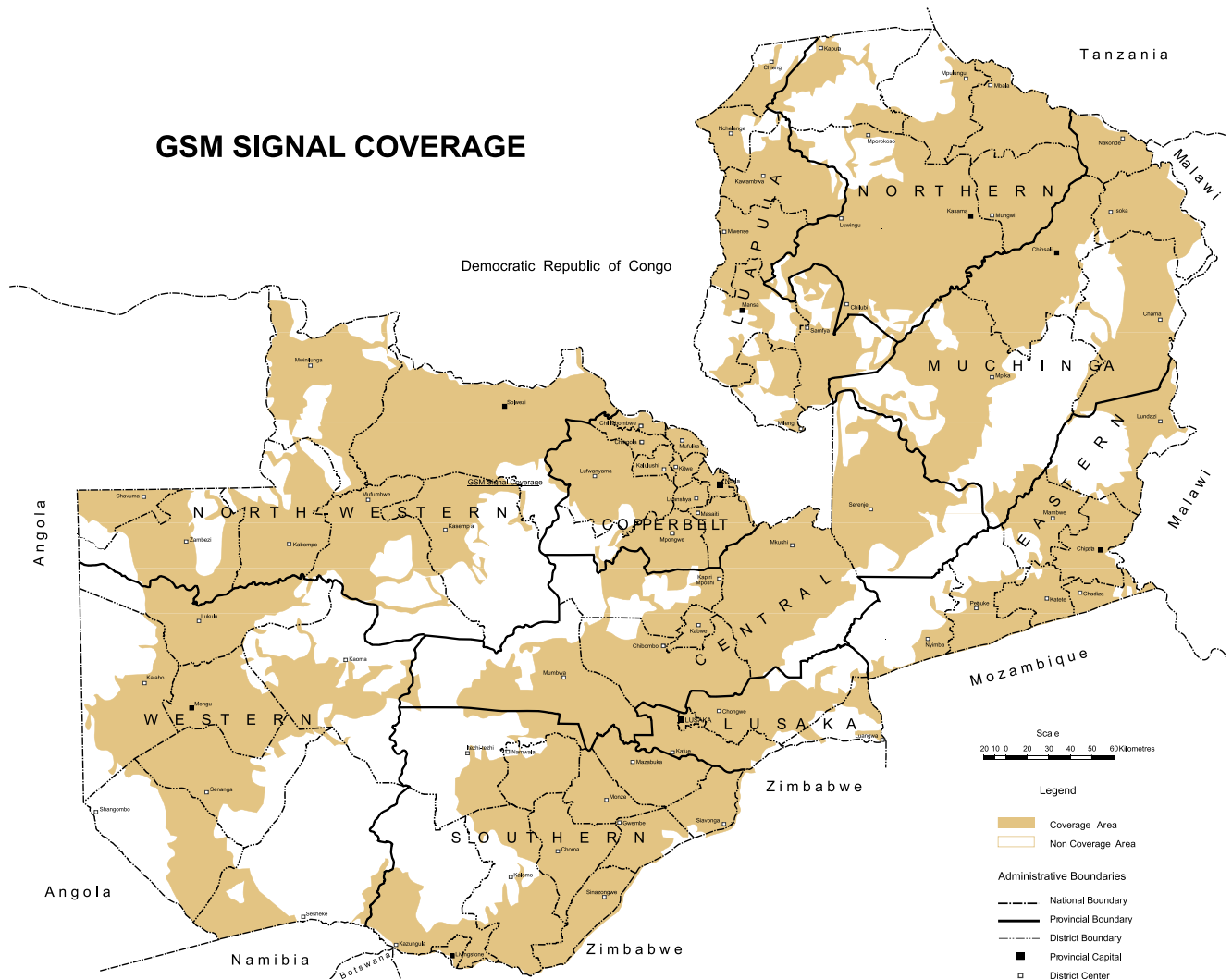
The key telecommunications actors in the country include Airtel, MTN, Zamtel, and Vodafone. At the time of writing, Vodafone's communications license is limited to the provision of data services. As of Q2 2017, MTN Zambia had the largest subscriber base with approximately 44% of subscribers, followed by Airtel with approximately 43% of subscribers (ZICTA, 2017). Airtel claims to have the largest 3.75G network in the country with more than 200 towers present in all administrative districts, however its coverage list suggests a focus of service in urban areas — including the cities of Lusaka, Ndola, Kitwe, and Chingola (Vodafone, 2017).

Relatively recent commentary on the state of the country's mobile network suggested a severe urban-rural disparity in geographical network coverage (allAfrica, 2015). According to the International Telecommunication Union (ITU, 2016), approximately 78% of the country's area was covered by GSM networks in 2016, and current statistics from the Zambia Information and Communications Technology Authority (ZICTA) suggest nearly 93% coverage by population. ZICTA's national ICT survey (2015) affirms greater coverage in urban than rural areas, as shown in [Figure 8](#). As of Q2 2017, ZICTA statistics (ZICTA, 2017) estimate 2,440 mobile communications towers in the country.

Mobile money usage in Zambia remains limited, despite a seemingly welcome environment. 86% of individuals aged above 10 years old do not have a bank account, yet are willing to learn new technologies, and 47% of Zambians do not like to carry cash (ZICTA, 2015; FinScope, 2015). There are a number of money transfer services and mobile money providers — including Airtel, MTN, Zoonza, Kazang, Shoprite and ZANACO — however approximately half of adults in Zambia are not aware of the existence of digital financial services (FinScope, 2015). Less than 20% of the population has ever used digital financial services (FinScope, 2015). For those that are aware of digital finance, there appears to be limited understanding of how various platforms work as well as a general scepticism towards the integrity of mobile to mobile transactions (UNCDF, 2016). According to the Helix Institute of Digital Finance (UNCDF, 2016), Zambia could become an “Over the Counterled” mobile money market, whereby agents support consumers in making transactions. This suggests a consumer preference for working with agents to process transactions, as opposed to the person-to-person (“wallet”-type) mobile banking that is prevalent throughout East Africa (UNCDF, 2016).

As of December 2016, the existing base of users of digital finance services was approximately 7 million registered accounts, of which 1.3 million were considered active accounts. This represented an annual 24% increase in both the number of registered accounts and of active accounts. Over the same period, the number of active agents increased by 69%; from 7,304 active agents (83 active agents per 100,000 adults) to 12,376 active agents (136 active agents per 100,000 adults) (UNCDF, 2017).

**FIGURE 8. GSM coverage map of Zambia<sup>14</sup>**



14) ZICTA (2015)

## SECTION 3

# Electricity Sector Profile



Zambia's electricity sector is largely dependent on hydropower. As a result of erratic rains, declining water levels in Kariba Dam (IGC, 2016) and increased electricity demand, the country has experienced a severe electricity supply deficit since approximately June 2015. [Table 1](#) summarizes several high-level indicators of the country's electricity sector.

**TABLE 1. Key electricity sector indicators<sup>15</sup>**

INDICATOR	VALUE
Installed Generation Capacity (2016), MW	Approx. 2,500
Installed Fossil Fuel Capacity (2016), % of total installed capacity	4
Hydro Capacity (2016), % of total installed capacity	95
Other RE Capacity (2016), % of total installed capacity	<1
Renewable electricity output as % of total electricity output excl. hydro (2016)	<1
Avg. distribution and transmission losses as % of output (2013)	9
Net electricity imports (2014), kWh	13 million
Electrification rate, total (2016) %	28
Electrification rate, urban (2016) %	62
Electrification rate, rural (2016) %	5
Peak demand (2015), MW	Nearly 2,000
Per capita electricity consumption (2013), kWh	731

### 3.1 ELECTRICITY POLICIES AND REGULATIONS

The Zambian government views renewable energy as a critical element of the country's future energy mix. The country's Vision 2030 document and National Energy Policy 2004 each acknowledge a need to diversify generation in the sector and increase electricity access.

#### National Energy Policy (Revised 2008)

The National Energy Policy was a crucial step for the development of the energy sector in the last decade. It liberalized the electricity sector by opening all market segments to private operators and laid the foundations for the establishment of two new key institutions: The Energy Regulation Board of Zambia (ERB), established under the Energy Regulation Act, and the Office for Promoting Private Power Investments (OPPI), which was created to manage additional investment in the energy sector (MEWD, 2015). View the National Energy Policy [here](#)<sup>16</sup>.

#### Energy Regulation Act 1995 (amended 2003)

The act formally established the ERB and defined its functions and powers as regulating the energy sector in a fair, transparent, effective and efficient way to safeguard the interest of all stakeholders. The ERB is responsible for establishing fuel prices (including electricity tariffs), establishing and monitoring the application of the Zambia Grid Code, and designing standards in regards to the quality, safety and reliability of supply of energy in conjunction with the Zambia Bureau of Standards. View the Energy Regulation Act [here](#)<sup>17</sup>.

#### Rural Electrification Act of 2003

The act established the Rural Electrification Authority (REA) and equipped it with a Rural Electrification Fund. The REA is responsible for implementing the Rural Electrification Master Plan (REMP), by facilitating the creation and monitoring the operation of rural electrification organizations or companies. These organizations and companies (including entrepreneurs, community-based organization and others) are expected to fulfil their obligations and perform in accordance with standards and appropriate tariff structures (jointly set up with the ERB). View the Rural Electrification Act [here](#)<sup>18</sup>.

#### Zambia Grid Code of 2006

The Zambia Grid Code was approved by the Energy Regulation Board in 2007, and was gazetted in August 2013, with the objective of facilitating open and non-discriminatory access to the transmission system. Its aims are to enhance efficiency and

16) Link: <https://goo.gl/9Fu84T> – accessed March 2019

17) Link: <http://www.parliament.gov.zm/sites/default/files/documents/acts/Energy%20Regulation%20Act.pdf> – accessed March 2019

18) Link: <http://www.erb.org.zm/downloads/legislation/Rural%20Electrification%20Act.pdf> – last accessed March 2017, link no longer available

15) Sources provided in [Document References Table 12](#)

more rapid electrification, in line with the country's liberalization of the sector. View the Grid Code [here](#)<sup>19</sup>.

### Rural Electrification Master Plan (2008)

Together with the Japanese government, the REA developed the REMP (REMP, 2009) for the term 2008–2030. The plan clusters 1,217 un-electrified Rural Growth Centres (RGCs) into 180 project packages, estimating that over USD 1.1 billion (or USD 50 million per year) is required to electrify all packages by 2030 (REMP, 2009). The Plan indicates a target of achieving 51% rural electricity access by 2030 (REMP, 2009). View the REMP [here](#)<sup>20</sup>.

## 3.2 INSTITUTIONAL ARRANGEMENTS

### Ministry of Energy

The Ministry of Energy, which houses the Department of Energy, is responsible for the development and management of energy resources in a sustainable manner. The MoE is responsible for the formulation and implementation of the national energy policy, coordination of stakeholders in the sector, the development of a national energy strategy and plan, the monitoring and evaluation of current policies, and the development of new energy program. The acting Minister of Energy as of December 2017 is David Mabumba.

### Energy Regulation Board (ERB)

The Energy Regulatory Board was established under the Energy Regulation Act Chapter 436 of the Laws of Zambia and commenced its work in 1996. The ERB is responsible for the licensing of Independent Power Producers (IPPs), the definition of petrol prices and electricity tariffs, the development of technical standards (in collaboration with the Zambian Bureau of Standards), investigation of customer complaints, arbitration of conflicts among sector stakeholders, and the promotion of new grid connections with a focus on low-income households (ERB, 2017). As of January 1, 2017, the ERB began enforcing revised regulations related to the importation of solar components. The license required to import and install OGS systems is the

“License for the Manufacturing, Wholesale Importation, and Installation of Solar Energy Systems”, and is further addressed in [Section 5](#).

### Office for Promoting Private Power Investment (OPPPI)

The OPPPI was founded in 1999 as a part of the then Ministry of Mines, Energy and Water. Its mandate is the promotion of private investment in the generation and transmission of electricity, but works largely with ZESCO. The office generally works with projects that are sized at more than 10 MW, although some exceptions exist. OPPPI is not considered an institution that OGS or SHS developers will need to interact with when exploring or entering the Zambian market (OPPPI, 2017).

### Rural Electrification Authority (REA)

The REA was established by the Government of the Republic of Zambia through the enactment of the Rural Electrification Act No. 20 of 2003, initially as an institution to manage the Rural Electrification Fund (REA, 2017). REA carries out all public activities in connection with rural electrification, including management of the rural electrification fund; development, implementation and revision of the Rural Electrification Master Plan (REMP); promotion of the use of available energy sources in rural areas; management of tenders for rural electrification projects; development of models for the operation of rural grids, and the development of proposals to the government concerning rural electrification. Per the Rural Electrification Act, the REA is legislated to “design and offer, on a competitive basis, to developers or operators, smart subsidies for capital costs on projects that are designed to supply energy for development of rural areas” and “finance project preparation studies for rural electrification projects”. In practice, entrepreneurs interviewed for this report were largely unaware of how best to interact with REA during the early stages of business preparation and planning.

### Zambia Electricity Supply Corporation (ZESCO)

ZESCO was established in 1970 and is fully owned by the Industrial Development Corporation, a fully state-owned investment holding company owning all state-owned enterprises. The company operates the electricity grid and is responsible for much of the country's power generation. Though the sector was formally liberalized in 1995, ZESCO is viewed as a monopoly. ZESCO's performance has been considered as hampered by highly subsidized tariffs, which has limited its ability to support the development of the national grid, maintain its assets, and invest in new generation capacity.

19) Link: <http://www.erb.org.zm/downloads/gridcode/ZambiaDistributionGridCode.pdf> – accessed March 2019

20) Link: <http://www.rea.org.zm/about-us/remp.html> – accessed March 2019

### Zambia Environmental Management Agency (ZEMA)

The Zambia Environmental Management Agency advises on environmental policy formulation, makes recommendations for the sustainable management of the environment, ensures the integration of environmental concerns in overall national planning, reviews environmental impact assessment (EIA) and strategic environmental assessment (SEA) reports, and facilitates public access to environmental information in the country (ZEMA, 2017). At the time of writing, OGS developers do not need to engage ZEMA in the development of their businesses.

### Zambia Bureau of Standards (ZABS)

The Zambia Bureau of Standards (ZABS) is the national standards body for Zambia, responsible for standards formulation, quality control, quality assurance, import and export quality inspections, certification, and removal of technical barriers to trade (ZABS, 2017). As of 2017, importers of solar equipment must present ZABS with a certification of product quality. This may be provided by the manufacturer, and should specify that their product is certified by the standards bureau of the country of origin.

## 3.3 ELECTRICITY DEMAND AND ELECTRIFICATION RATES

According to the 2015 Living Conditions Monitoring Survey Report, approximately 30% of Zambian households are electrified, with 67.3% and 4.4% of households electrified in urban and rural areas, respectively. Approximately 420,000 urban households and 1.7 million rural households currently do not have access to electricity — based on an average household size of 5.1. The Government of Zambia maintains an official target of achieving 51% rural electricity access by 2030 (REMP, 2009). Despite an abundance of domestic energy sources, with technical potentials for hydropower and solar power being particularly strong, Zambia imported 13 million kWh in 2014 (CIA, 2017).

The economic progress over the past decades has increased national demand for electricity. Peak demand has been recorded

at 1,960 MW (Bloomberg, 2015), while annual growth in electricity demand has been estimated at approximately 3%, requiring between 150 MW and 200 MW of new capacity per year (Zambia Invest, 2017). As shown in [Table 2](#), the industrial sector is by far the biggest consumer of electricity, consuming more than twice the country's residential sector. Approximately 70% of the country's electricity demand is driven by its mining sector, which benefits from highly reduced, legacy tariffs (Climatescope, 2017).

**TABLE 2. Electricity consumption in 2014<sup>21</sup>**

ECONOMIC SECTOR	GWh
Industry	6,429
Transport	31
Residential	3,251
Commercial and Public Services	668
Agriculture / Forestry	241
Fishing	0
Other non-specified	99
Final Electricity Consumption	10,719

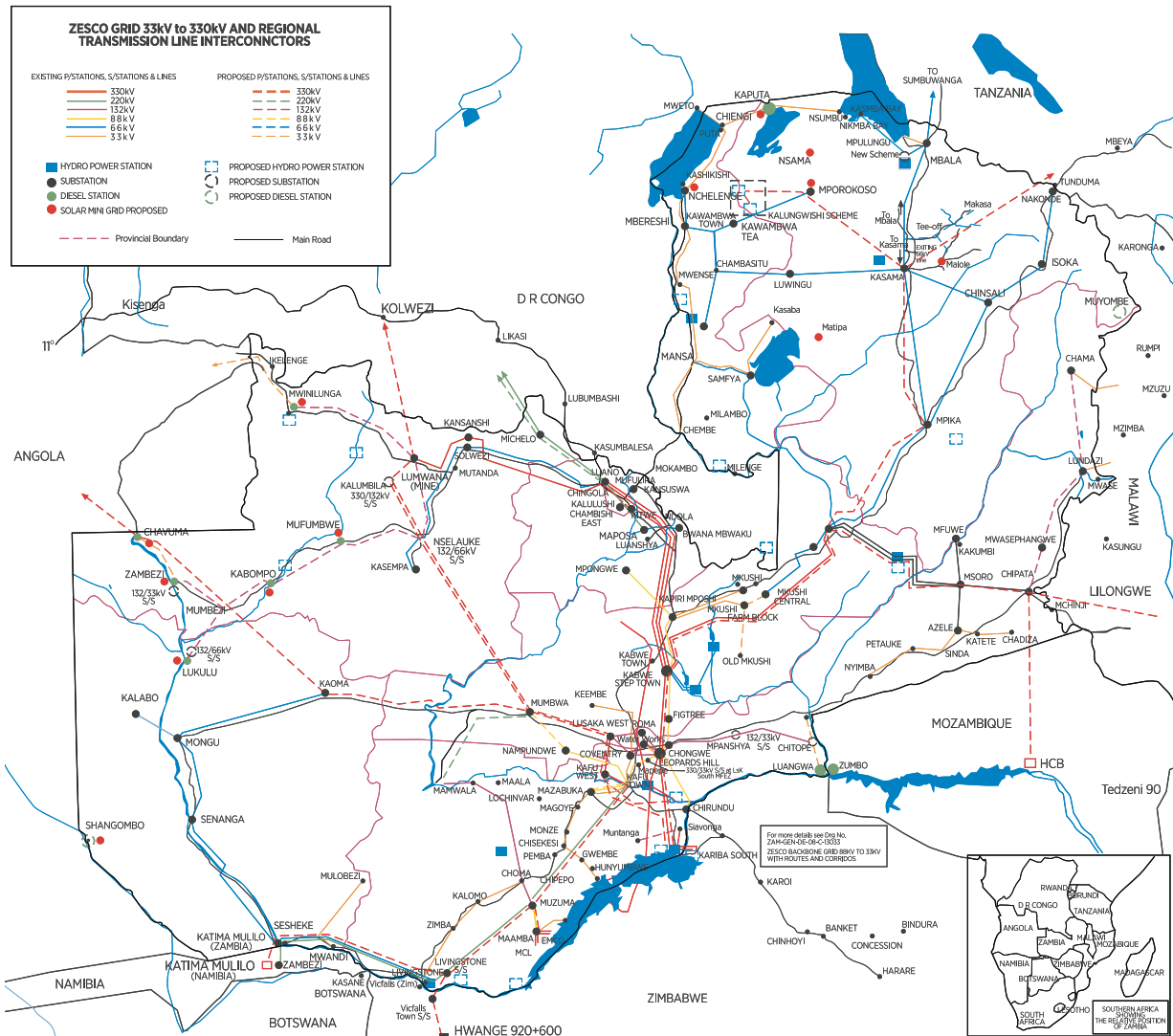
Transmission and distribution facilities in Zambia are mostly owned by the vertically integrated ZESCO, which operates and maintains a high and low voltage distribution system. As shown in [Figure 9](#), vast areas of the country remain off-grid. The grid operated by ZESCO is based on five voltage levels: 330 kV (2,241 km), 220 kV (571 km), 132 kV (202 km), 88 kV (734 km) and 66 kV (1,037 km) (ZESCO, 2017). Several initiatives meant to improve transmission and distribution in the country are currently underway, the details of which can be found on the [Transmission Projects<sup>22</sup>](#) and [Distribution Projects<sup>23</sup>](#) pages of ZESCO's website.

21) IEA (2014)

22) Link: <http://www.zesco.co.zm/projects/transmission> – accessed March 2019

23) Link: <http://www.zesco.co.zm/projects/distribution> – accessed March 2019

**FIGURE 9.** Transmission and distribution network in Zambia<sup>24</sup>



### 3.4 ELECTRICITY TARIFFS

Electricity tariffs in Zambia have historically been heavily subsidized, leading to a challenging commercial environment for private developers, as well as for ZESCO (Climatescope, 2017). For offgrid entrepreneurs and developers, the exceedingly low tariffs can provide customers with an expectation of modern electricity services at utility rates, which is often untenable on a per kWh basis for OGS solutions and mini-grids.

Efforts to raise tariffs to cost reflective levels are ongoing, in line with the objective of the SADC to achieve cost reflective electricity prices by 2019 (Climatescope, 2017). In 2015, the Energy Regulation Board (ERB) granted a tariff increase averaging a 187% increase for all customers except mining customers (Lusaka Times, 2017). While the tariff increase was approved, ZESCO suspended the implementation of the new tariff in order to ensure a less drastic transition to a new tariff regime (Lusaka Times, 2017). In March 2017, ZESCO applied to the ERB to increase tariffs by an average of 75% over two phases in

24) IRENA (2013)

2017 (Lusaka Times, 2017). In May 2017, the ERB announced the approval of the proposed ZESCO tariffs, with a 50% increase effected on May 15, 2017, and a 25% increase effected on September 1, 2017 (ERB, 2017b). Additionally, the Board of the ERB approved the revision of residential tariff bands, as well

as ordered the removal of the fixed charge component for residential consumers. However, as of the time of writing, a fixed monthly charge is still visible on the tariffs schedule of the ZESCO website, as shown in [Table 3](#).

**TABLE 3.** Current ZESCO tariff schedule<sup>25</sup>

CUSTOMER CATEGORY	TYPE OF CHARGE	TARIFF AS OF 15 MAY 2017 (ZMW)	TARIFF AS OF 1 SEP 2017 (ZMW)	TARIFF AS OF 15 MAY 2017 (EUR*)	TARIFF AS OF 1 SEP 2017 (EUR*)
<b>1. Metered Residential Tariffs (Prepaid, Capacity 15kVA)</b>					
R1 — Consumption up to 200 kWh in a month	Energy Charge/ kWh	0.15	0.15	0.0145	0.0145
R2 — Consumption above 200 kWh in a month	Energy Charge/ kWh	0.77	0.89	0.0746	0.0862
—	Fixed Monthly Charge	18.23	18.23	1.7665	1.7665
<b>2. Commercial Tariffs (Capacity 15 kVA)</b>					
Commercial	Energy Charge/ kWh	0.47	0.54	0.0455	0.0523
—	Fixed Monthly Charge	82.64	96.41	8.0078	9.3421
<b>3. Social Services Tariffs</b>					
Schools, Hospitals, Orphanages, Churches, Water pumping, Street Lighting	Energy Charge/ kWh	0.42	0.49	0.0407	0.0475
—	Fixed Monthly Charge	71.87	83.84	6.9641	8.1240
<b>4. Maximum Demand Tariffs</b>					

Note: see Maximum Demand Tariffs Schedule on ZESCO website.

Note: Above tariffs are exclusive of 3% excise duty and 16% VAT.  
\* ZMW/EUR as of July 24, 2017.

25) ZESCO (2017)

**TABLE 4.** Electricity access by province<sup>26</sup>

PROVINCE	TOTAL NUMBER OF HOUSEHOLDS	ELECTRICITY ACCESS RATE (% HOUSEHOLDS, 2015)	TOTAL NUMBER OF OFF-GRID HOUSEHOLDS
Central	292,049	19.60%	234,807
Copperbelt	450,843	58.00%	189,354
Eastern	342,161	7.80%	315,472
Luapula	207,612	6.50%	194,117
Lusaka	592,073	70.60%	174,06q9
Muchinga	174,832	17.10%	144,936
Northern	253,779	8.90%	231,193
North-western	164,141	13.90%	141,325
Southern	338,259	24.70%	254,709
Western	199,215	6.00%	187,262

**TABLE 5.** Percent of main sources of lighting by province<sup>27</sup>

		KER	ELEC*	SOLAR PV	CANDLE	DIESEL	OPEN FIRE	TORCH	NONE	OTHER
Setting	Rural	1.6	3.7	7.4	6.2	0.3	4.3	70.6	2.4	3.4
	Urban	0.8	67.6	0.8	16.3	0.1	0.2	12.8	0.4	0.9
Province	Central	2.5	18.4	6.2	8.4	1.0	1.9	58.9	1.1	1.7
	Copperbelt	0.8	58.1	1.0	18.8	0.1	0.2	19.5	0.4	1.1
	Eastern	0.6	6.9	9.6	3.8	0.0	2.7	73.1	2.8	0.5
	Luapula	3.3	6.3	4.2	9.4	0.0	2.8	61.8	1.9	10.3
	Lusaka	1.1	70.9	1.2	14.7	0.2	0.0	10.5	0.6	0.8
	Muchinga	0.4	16.4	7.9	8.2	0.2	2.9	60.2	0.6	3.2
	Northern	3.9	8.3	5.5	8.5	0.2	2.6	68.3	0.4	2.2
	North-western	0.4	14.4	4.1	7.3	0.2	6.7	53.6	4.4	9.1
	Southern	0.1	24.6	5.9	6.9	0.2	1.6	59.3	0.8	0.5
	Western	0.5	6.0	6.2	9.3	0.0	13.0	56.3	6.5	2.1
<b>Zambia</b>	<b>—</b>	<b>1.3</b>	<b>31.2</b>	<b>4.6</b>	<b>10.6</b>	<b>0.2</b>	<b>2.5</b>	<b>45.7</b>	<b>1.6</b>	<b>2.3</b>

Note: Ker = kerosene/paraffin, Elec = electricity

26) LCMS (2015)

27) LCMS (2015)

### 3.5 RURAL ELECTRIFICATION

As noted by the limited access to electricity in rural areas, rural and off-grid capacity in Zambia is minimal, however rural electrification initiatives are beginning to emerge. In 2015, nearly 5% of households in the country reported Solar PV as a main source of energy for lighting, up from 3% in 2010 (LCMS, 2015), with rural electrification increasing from 3.1% to 3.8% over the same period (World Bank, 2017).

#### Electricity Access and Lighting Sources by Province

The most recent sub-national data on electricity access is provided by the 2015 Living Conditions Monitoring Survey Report<sup>28</sup> (LCMS, 2015). Provincial electricity access rates are shown in **Table 4**, and **Table 5** presents the main sources of lighting used by households for lighting per province.

According to the LCMS 2015, flashlights remain the main source of lighting for nearly half of all Zambian households. Interestingly, kerosene is not favoured as an off-grid lighting energy carrier, with only 1.6% of rural households citing it as a main source of lighting. Notably, just under 5% of Zambian households use solar PV as a main source of lighting, with the greatest adoption currently observed in Eastern Province.

#### Stand-Alone Off-Grid Solutions

As mentioned above, off-grid and stand-alone renewable capacity contributes minimally to generation in Zambia. Approximately 400 55 Wp SHSs were installed in Eastern province in the late 1990s, through a Sida supported ESCO programme (REMP, 2009). The Zambia Social Investment Fund (ZAMSIF) installed approximately 750 75 Wp SHSs at schools and clinics in Northern Province in the early 2000s (REMP, 2009). By June 2007, total ZAMSIF-supported installations comprised of nearly 300 kW of SHS capacity (REMP, 2009). In 2005, the Government of Zambia installed 200 80 Wp SHS in approximately 40 schools and 160 residences (REMP, 2009). Recent years have seen a proliferation of solar portable lighting products and, as noted above, an emerging pico-SHS sector, with system sizes largely below 10 W. There is at least one operational provider of mobile money-enabled Pay-As-You-Go (PAYGO) solutions, with several new market entrants launching operations in 2016 and 2017. Solar lanterns are widely available throughout the country.

Recent market sales figures compiled by the Global Off-Grid Lighting Association (GOGLA, 2017) estimate that approximately 16,500 solar home system kits and solar lanterns were sold in Zambia between January and June 2017, representing approximately USD 700,000 in cash sales revenues.

#### Mini-Grid Solutions

ZESCO operates several diesel-based mini-grids (REMP, 2009), with emerging public (e.g. through the Rural Electrification Authority — REA) and private activity in solar PV- and hydro-based mini-grids.<sup>29</sup> The Zengamina Hydropower Plant is a 750 kW plant operating in North-western province since 2007 (REMP, 2009). The plant serves a hospital, clinics, small businesses, and over 1,000 households. There are additionally a number of micro-hydro power plants (REMP, 2009) including Nyangombe (73 kW), Sachibundu (15 kW), Mutanda (2.5 kW), Mporokoso (5 kW), and Luena (24 kW). Muhanya Solar is an established provider of solar solutions in Zambia (including solar portable lighting and home solar solutions), that has installed a 30 kW solar PV-based mini-grid in Sinda District of Eastern Province, officially launched in April 2017<sup>30</sup>. Standard Microgrid is an early stage micro-grids venture that has installed at least three containerized solar PV and battery units in the country — including at Mugurameno (10 kW), Conservation Lower Zambezi (10 kW), and Sioma High School (24 kW) — financed and implemented in partnership with the Zambia-based NGO Empowered by Light.<sup>31</sup> Kafita Cooperative Society operates a 60 kW solar PV mini-grid in Mpanta village, that was initially supported by UNIDO and REA<sup>32</sup>. REA is currently developing two solar PV mini-grids in Chunga and Lunga, sized at 200 kW and 300 kW respectively.

28) The 2015 LCMS provides a wealth of country data with provincial granularity, and is a recommended resource for entrepreneurs.

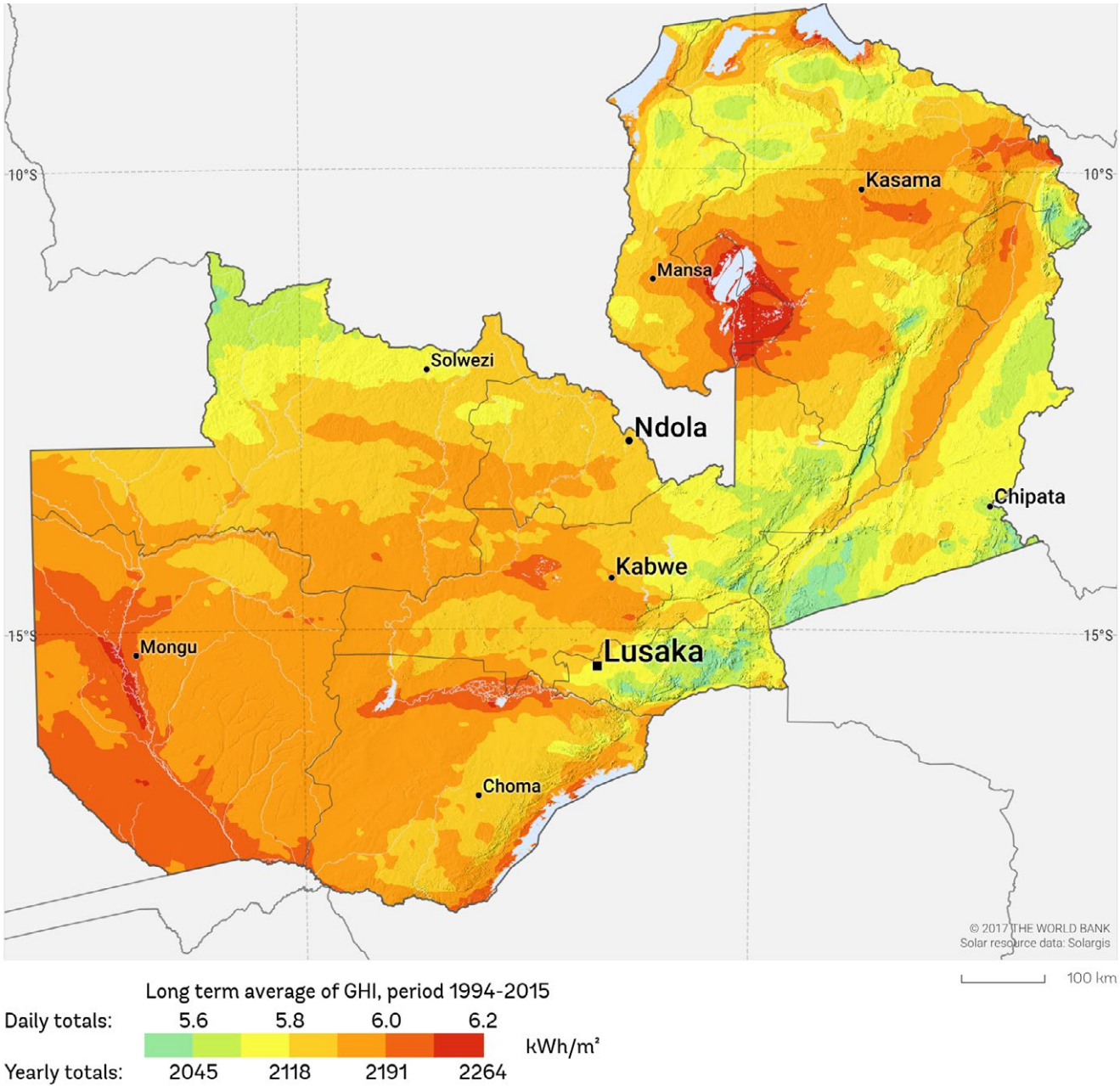
29) Personal communication with solar entrepreneur in Zambia.

30) Link: <http://www.usadf.gov/pressreleases/2017/4/11/zambias-first-public-private-solar-mini-grid?platform=hootsuite> – accessed March 2019

31) See additional project details at [www.standardmicrogrid.com](http://www.standardmicrogrid.com)

32) Personal Communication, Paul Nkumbula, February 2017

**FIGURE 10.** Solar irradiation in Zambia, kWh/m<sup>2</sup> <sup>(33)</sup>



33) Solargis (2017)

### 3.6 RENEWABLE ENERGY RESOURCES

High solar irradiation values provide strong potential for the development of solar PV-based generation. Zambia enjoys an average of 2,000 to 3,000 hours of sunshine per year. Average irradiation is 5.5 kWh/m<sup>2</sup>/day, with southern areas recording the highest global solar irradiation, of 2,300 kWh/m<sup>2</sup>/year, as shown in **Figure 10**. Such characteristics provide strong potential for photovoltaic applications.

ESMAP is undertaking a 5-year renewable energy resource mapping project in Zambia. Solar radiation measurement data, maps, and a modelling report are available via the ESMAP project team [here](#)<sup>34</sup>.

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34) Link: <http://www.esmap.org/node/3300> – accessed March 2019

## SECTION 4

# Scoping the Market Potential for Off-Grid Solar Home Solutions in Zambia



Given Zambia’s electricity access gap and an increasingly welcoming environment for private companies in the energy sector, the market seems well suited for the development of OGS businesses. The following sections review a few considerations for developers aiming to enter the Zambian market.

## 4.1 OVERVIEW OF OFF-GRID SOLAR HOME SOLUTIONS

Off-grid solar home solutions span several levels of value and service delivery to end customers. For the purposes of this document, we consider:

- **Solar Portable Lights (SPLs)** as including a solar photovoltaic (PV) panel (< 3 W), internal battery, and a single lantern form factor;
- **Pico- and Small-Solar Home Systems (SHS)**, as including a PV panel rated at less than 30 W, an internal battery, and associated plug and play accessories (e.g. LED lights, radio, mobile phone chargers);
- **Medium (30–200 W), and large (> 200 W) SHSs** including one or multiple PV panel(s), an external battery, charge controller, associated appliances, and in some cases inverters.

SPLs (as shown in [Figure 11](#)) typically retail between approximately EUR 5 and EUR 50 and increasingly include mobile phone charging capabilities. Given their affordability, these account for the majority of OGS home solution unit sales globally and in Zambia. As off-grid rural households without solar equipment may spend up to EUR 7–10 per month on lighting and mobile phone charging, the simple payback period for an SPL is a matter of months and nearly always below one year. These economics present limited risks for both consumers and distributors of SPL products. SPLs are considered a first and important step for off-grid households to transition away from stopgap lighting energy solutions, and potentially save for the financing of larger energy solutions.

**FIGURE 11.** Greenlight Planet’s SunKing Pro 2 Lantern (3.3 W)



**FIGURE 12.** M-KOPA IVSolar Home System (8 W)



Pico- and Small-SHS solutions, as shown in [Figure 12](#), comprise perhaps the fastest growing product categories in the OGS landscape. These solutions enable multiple points of lighting, mobile charging, and some systems can power small, energy efficient appliances (e.g. radios and fans). Pico-SHS solutions are typically retailed as a consumer electronics product in portable packages (e.g. VITALITE fosera product line, M-KOPA IV system, Azuri Quad), and are designed to be “plug and play”, allowing customers to connect and operate the system without specialized knowledge or tools. Customers can benefit from a range of electricity services, and systems can be swapped or upgraded as demand grows over time.

**FIGURE 13.** Mobisol Family SHS with 19" TV (80 W)



Medium- and Large-SHS (Figure 13) vary in size and technical configuration, however are generally considered as being able to provide the widest range of energy services, including the powering of productive appliances and household appliances simultaneously. For the purposes of this Guide, we distinguish medium-and large-SHS solutions as those including external batteries, which are typically sealed lead acid. While some medium-sized SHS systems may be sold in a retail fashion similar to pico- and small solutions, medium and large systems likely require professional installation and routine battery servicing. In addition to serving more financially secure households, these systems can also be configured as solutions for rural schools, clinics, and administrative buildings.

## 4.2 BUSINESS MODEL OPTIONS

There are four predominant business model options for providers of off-grid solar home solutions. These include **a)** Cash-and-Carry; **b)** Prepaid/Pay-As-You-Go (PAYG); **c)** Lease to Own, and; **d)** Perpetual Lease/Energy as a Service models.<sup>35</sup>

The Cash and Carry model is the most straightforward, in that customers purchase the solution at a retail outlet as an electronic consumer good and assume ownership immediately. This is most commonly used for the SPL product category. The remaining product categories, and some SPL solutions, are most often sold through PAYGO, Lease-to-Own, and “Energy as a Service” models. Given the limited income of rural Zambian households, the Cash and Carry model will likely only be relevant

35) For additional information, see Kumar and Winiacki (2014), Bloomberg (2016), GOGLA ([www.gogla.org](http://www.gogla.org)), Benu Solar ([www.benu-solar.com](http://www.benu-solar.com)), and Sun Connect News ([www.sun-connect-news.org](http://www.sun-connect-news.org)).

for SPL solutions, and for SHS solutions targeting wealthier households.

PAYGO (or PAYG) companies often use mobile money-based payment platforms and “locking” mechanisms to receive periodic customer payments for use of the solution, enabling a system to be paid off over several months or a few years. Once a payment is transacted, the device is unlocked for a period of time, or to allow a given quantity of energy consumption. Customers then make payments per an agreed payment plan, until the system is fully paid off. PAYGO business models are most popular for Pico- and Small-SHS solutions, however are also being used to retail medium- and large-SHS solutions. PAYGO models can operate independently of mobile money platforms, instead using payment solutions such as scratch cards or text messages distributed by local agents. PAYGO solution providers are increasingly using solar assets as collateral to retail additional products, such as cookstoves, smartphones, and other household appliances, to PAYGO consumers. Given the affordability that is enabled by PAYGO models, these are likely well suited for the Zambian market. However, as the country has a comparatively limited penetration of mobile money usage, OGS solution providers will have to invest in increasing consumer awareness of digital finance, explore non-mobile money enabled PAYGO models, or consider a dual strategy.

Lease-to-Own models were popular in the early 2000s, prior to the ubiquity of mobile phone users, mobile money platforms, machine-to-machine (M2M) technologies, and cloud-based monitoring platforms. Leasing models for SHS solutions were typically implemented in collaboration with micro-financial institutions (MFIs); sometimes with MFIs acting as product distribution partners active in marketing, sales, installation, and postsales servicing in addition to being a key source of end-user finance. These models are generally similar to PAYGO models; however, are notably different in that consumer payments are usually arranged as a flat rate and decoupled from usage of the system. Arrangements that do not integrate PAYGO technologies may thus present greater potential for a higher incidence of non-performing loans (NPL) — whether through customer default or theft — as customers may continue to use the system whether a payment had been made or not.

Perpetual Lease/Energy as a Service models aim to sell energy as a service only, whereby customers never assume ownership of the solar asset. As customer demand grows, the service provider incrementally expands capacity. This approach is useful for consumers that may be cautious about entering into multi-year financial obligations, or could benefit from continuous maintenance. While this model is considered similar to PAYGO approaches, at the time of writing, there was some ambiguity as to whether these models may eventually be regulated differently than lease-to-own models. Developers are encouraged to confirm the latest regulatory information regarding perpetual leases for OGS solutions.

In considering an OGS opportunity, new enterprises and developers entering the sector may wish to partner with established organizations. A range of development pathways exist; companies can simply purchase stock from established technology providers through a hands-off customer-supplier relationship, and receive on-call technical support as required. Other suppliers may include a team member in-country, for a period of time, to help kickstart country operations. Others might provide ongoing back office support as a feature of using their systems. Finally, certain leading OGS companies may consider the development of exclusive franchises per country or region, through joint venture development opportunities with established operating entities.

### 4.3 MARKET SEGMENTATION AND CUSTOMER PROFILING

Off-grid households in Zambia have been estimated to spend approximately EUR 102/year on lighting alone (BNEF, 2016). With a population of 16.2 million, an average household size of 5.2, and urban and rural electrification rates of 62% and 5% respectively, a simple market sizing exercise<sup>36</sup> estimates the annual potential of the offgrid residential lighting services market to be in excess of 2.1 million units or approximately EUR 214 million per annum. However, as there has not been a major public program to increase consumer awareness of issues related to energy poverty and OGS solutions, developers should prepare for concerted efforts in customer acquisition.

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36) See [Annex B](#).

**TABLE 6.** Proposed multi-tier measurement of electricity supply in primary and secondary health facilities<sup>37</sup>

	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
	No Access	Minimal Access	Basic Access	Intermediate Access	Full access	Peak power capacity
Peak power capacity Watts (W)	< 5	5–69	70–199	200–1,999	2,000–9,999	> 10,000
Daily energy capacity Watt hours (Wh) per day	–	20–279 Wh per day	280–1,599 Wh per day	1,200–31,999 Wh per day	32–220 kWh per day	>220 kWh per day
Duration of supply Hours per day	–	> 4	> 4	> 8	> 16	> 23
Evening peak hours supply Hours per day	–	–	> 2	> 2	4	4
Cost-effectiveness (affordability) Lifetime costs per kilowatt hour	–	< 5 times benchmark	< 3 times benchmark	< 2 times benchmark	< 1.5 times benchmark	< 1 times benchmark
Quality No/poor/unstable voltage	–	–	–	Adequate	Adequate	Adequate
Reliability No outages of more than 2 hours in the past week	–	–	–	–	Adequate	Adequate
Operational sustainability Adequate operation and maintenance budget	–	–	–	Adequate	Adequate	Adequate
Environmental sustainability and health (gCO <sub>2</sub> eq/kWh)	–	< 2,400	< 1,400	< 1,000	< 850	< 500

37) WHO (2015)

The value of the market opportunity is likely to be substantially larger than the estimated EUR 214 million per annum, in consideration of the potential to serve higher income households, schools, clinics, and micro-enterprises with systems that deliver access to services beyond basic lighting and phone charging. Data on Willingness and Ability to Pay for rural energy services may be found in the REMP, and earlier studies (from the early 2000s) supported by analysis of the Zambia PV-ESCO project<sup>38</sup>. National statistics on household income distributions, household energy expenditures, and other highly useful demographic data may be found in the 2015 Living Conditions Monitoring Survey (LCMS, 2015), as referenced above.

### Rural Households

With nearly 1.8 million rural households off-grid, we estimate the value of the rural household opportunity for off-grid solar home solutions at approximately EUR 172 million per annum. This market sizes estimates the number of rural, offgrid households that may potentially be served with OGS solutions to meet basic needs of lighting and phone charging. A more detailed market sizing analysis would necessarily include considerations for affordability (i.e. not all rural, off-grid households will be able to afford an OGS solution), as well as a variety in service delivery (i.e. a few customer segments may be able to afford solutions that provide levels of service delivery above basic access). The 2015 LCMS report includes comprehensive data covering demographic, economic, household income, and household expenditure considerations broken out by province.

### Urban Households

With an urban population representing over 40% of the total population (World Bank, 2017) and an urban electricity access rate of approximately 62% (World Bank, 2017), Zambia shows strong urban residential market potential. While urban consumers are more likely to be grid-connected — both now and in the future — urban households remain underserved through poor grid quality and daily load-shedding. With an existing power deficit, growth of electricity demand outstripping increases in generation, and higher purchasing power, the urban residential market opportunity is likely to expand during the time it takes the national grid to strengthen. Moreover, as Zambia's national grid is susceptible to long term climate impacts and continued

stresses on hydroelectricity generation (International Rivers, 2012), it is likely that there is considerable durability in the urban solar PV and storage opportunity.

We estimate the value of the urban household opportunity for off-grid solar home solutions at approximately EUR 42 million per annum. This simple market sizing estimation comprises offgrid urban households only, and excludes underserved, grid connected consumers. Moreover, as above, considerations for affordability were not included.

### Schools

According to the 2015 Education Statistics Bulletin, there are approximately 9,636 schools offering grades 1–12. Of these, 8,800 schools are primary schools, while 830 are secondary schools (MoE, 2015). Approximately 70% of primary and 18% of secondary schools lack access to electricity (Knoema, 2015). This suggests nearly 7,000 schools that may be electrified through off-grid solar solutions. The REMP notes average monthly energy consumption for primary schools at 331 kWh/month, and that for secondary schools at 54 kWh/month. The disparity in average demand between primary and secondary schools is unknown, and may be attributed to sampling considerations. This suggests a potential unmet primary school electricity services demand of over 2 million kWh per month, and a conservative 8,000 kWh/month of unmet secondary school demand for electricity services.

### Health Clinics

According to the 2012 “List of Health Facilities in Zambia”, there are approximately 2,000 health facilities in the country (MoH, 2012). 1,100 health facilities are described as “Rural Health Facilities”, which serve catchment areas of up to 10,000 residents. 307 health facilities are described as “Health Posts”, which serve remote areas of up to 3,500 residents, providing only the most basic first aid services (MoH, 2012). Approximately 40% of all health facilities rely on hydro-based generation as a main source of electricity, 10% rely on diesel-based generation, 37% rely on solar PV, and approximately 13% are off-grid. However, a 2009 USAID study (USAID, 2009) of electrification opportunities for health facilities in Zambia suggests that as much as 66% of health centres and rural health posts are off-grid, or underserved — i.e. do not have access to electricity services beyond basic lighting and communications.

38) See “Rural People Pay for Solar” (Ellegard, et. al., 2004), and, “The impact of solar home systems on rural livelihoods. Experiences from the Nyimba Energy Services Company in Zambia” (Gustavsson and Ellegard, 2004).

Per a recent WHO (2015) study on electrifying rural health clinics, Health Posts and Rural Health Clinics in Zambia may be approximated to facilities requiring basic and intermediate access to electricity services, respectively, as follows:

- **Tier 2 (basic access):** The health facility can access at least 70 W of peak available capacity for at least four hours per day, including at least two hours after nightfall if required. The supply is capable of meeting additional applications beyond lighting such as blood analyser, UV water purifier, jaundice light, VHF receiver, LED microscope, air circulation, printing, ultrasound and vacuum aspirator. The facility may experience reliability issues and/or voltage problems, as well as difficulties with operational and environmental sustainability.
- **Tier 3 (intermediate access):** The health facility can access an electricity supply of least 200 W of peak available capacity for at least eight hours during the day, of which at least two hours are in the evening. In addition to applications mentioned in Tier 2, the health clinic is able to use most medium-capacity equipment, such as suction apparatus, vortex mixer, CD4 counter and centrifuge. While the facility does not face issues of supply quality or reliability, it may face environmental and operational sustainability problems.

The REMP similarly notes average monthly energy consumption for a rural health clinic at 337 kWh per month, which falls within Tier 3 service delivery, as shown in [Table 6](#). Given this market context, there appears to be a sizable opportunity to provide clinics with basic to intermediate access to affordable and reliable power through off-grid solar systems sized between 200 W and 2 kW. We conservatively estimate a rural health clinic and health post electricity services market at approximately 250,000 kWh/month.

The viability of serving this segment through purely commercial, or PAYGO-enabled approaches may be limited, and OGS-based electrification in this sector will mostly likely require some level of Business-to-Government (B2G) collaboration. OGS companies considering opportunities within the health sector are encouraged to review materials available through UNDP's ongoing Solar 4 Health project.

## 4.4 LANDSCAPE

The off-grid solar landscape in Zambia is nascent but rapidly evolving. The Zambian government has been supportive of the solar sector, specifically by exempting duty and VAT on some components of off-grid solar solutions, as discussed in [Section 6](#). There are 29 solar companies currently licensed with the Energy Regulation Board (ERB). The list of companies can be found on the ERB website<sup>39</sup>.

Zambia's OGS sector has primarily been served by SPLs and pico- and small-SHS products on a cash and carry basis, led by established market players including but not limited to SolarAid/ SunnyMoney, Total Awang, VITALITE Zambia, and Kazang Solar. As there has been limited consumer financing, SPLs have seen significant sales, with SHS distribution first picking up in 2017. Fenix International entered Zambia in 2017, and d. light design is developing its presence in the country. Emerging Cooking Solutions is creating an OGS business line to complement its existing clean cooking solutions business.

The major products that can be found in-country include those designed by Greenlight Planet, d. light design, Fosera (distributed by VITALITE), Fenix, and Azuri Technologies (distributed by Kazang Solar). Products are sold through dedicated agent networks as well as through product agnostic cash & carry retailers.

In March 2017, a group of licensed solar companies decided to establish an association to promote solar energy and advocate for a conducive enabling environment. All ERB licensed solar companies in Zambia are eligible to join. The association is in the process of being set up. VITALITE has been leading this process to date and intends to have a formal association established by the end of 2017. In addition, the Zambia Renewable Energy Agency (ZARENA), will be forming an Association to lobby for and support all renewable energy enterprises.

39) The most recent list (2017) can be found at: <http://www.erb.org.zm/downloads/notices/solarDealers2017.pdf> – last accessed March 2017, link no longer available

## 4.5 OUTLOOK ON MARKET DEVELOPMENT

With recent public financings and the announcement of additional market development interventions meant to catalyse the growth of Zambia's off-grid sector, it is likely that unit sales of OGS solutions will grow considerably over the next two years. Sida's Beyond the Grid Fund began distributing disbursements to its awardees in 2017, with a second Call for Proposals for the Fund tentatively planned for mid-2018. In addition, at the time of writing, Sida is working with partners to build a market platform intended to convene government, donors, entrepreneurs, academia, financial institutions and investors to create a deeper understanding of the off-grid market. The African Energy Challenge Fund's REACT window selected Zambia as one of four countries included in its 2017 Household Solar challenge fund competition. REACT has been one of the most active funders of off-grid energy access companies in Eastern and Southern Africa, making grants and repayable loans of up to USD 1.5 million available for awardees. As of the time of writing, the UK's Department for International Development (DFID) is exploring the design of an Energy Africa Compact Agreement with the Government of Zambia. DFID's Energy Africa program is focused on enabling the growth of household solar sectors in partner countries, through enabling environment interventions including (but not limited to) regulatory strengthening, the provision of innovative finance, and awareness raising.<sup>40</sup> Considering these developments, it is likely that new ventures will be able to benefit from an increased availability of concessional capital and an increasingly strengthened regulatory environment.

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40) Personal communication, Energy Africa Compact consultant.

## SECTION 5

# Developing an Off-Grid Solar Solution Business in Zambia — Essential “How-To” Guidance



## 5.1 INVESTOR PROTECTIONS AND PROCEDURES

The *Zambian Development Agency Act (2006)* articulates several investment promotion measures and protections afforded to investors in Zambia. The Act stipulates that an investor's property shall not be compulsorily acquired except for public purposes under an Act of Parliament. Investors will be compensated for any such acquisitions, however how this is defined is not clear. The Act also enables foreign investors to transfer funds out of Zambia, in foreign currency, after the payment of relevant taxes. These funds may be in the form of dividends or after-tax income; the principal and interest of any foreign loan; management fees, royalties, and other charges in respect of any agreements; or the net proceeds of the sale or liquidation of a business enterprise. The Act may be viewed [here](#)<sup>41</sup>.

## 5.2 BUSINESS LICENSING AND REGISTRATION

All potential companies in Zambia are required to be registered with the *Patents and Companies Registration Agency*<sup>42</sup> (PACRA). PACRA administers and attends to matters incidental to the *Companies Act Cap. 388*. The *Companies Act* provides for the incorporation, management, administration and winding up of companies. The Act also provides for the registration of foreign companies doing business in Zambia. Currently there are no local ownership requirements for registering a business in Zambia.

PACRA also administers the following Acts that have relevance to operating a business in Zambia:

- The *Registration of Business Names Act No 16 of 2011* which provides for the registration of business names which may be a firm or a sole proprietor;
- The *Patents Act Cap. 400* which establishes and confers powers on the Patents Office, provides procedures and requirements for patenting an invention, rights accruing from patentability and how to protect such rights;

- The *Trade Marks Act Cap. 401* which provides procedures and requirements for registration, assignment and transfer of trademarks, rights accruing from registration and their protection;
- The *Registered Designs Act Cap. 402* which establishes and confers powers on the Designs Office, provides procedures and requirements for registration of industrial designs, rights arising from registration and the assignment and transfer of such rights and their protection;
- The *Movable Property (Security Interest) Act, 2016* of the Laws of Zambia, which provides for the creation of security interests in movable property.

Full information on registering a business and complying with annual filing requirements with PACRA can be found on the [PACRA website](#)<sup>43</sup>. In addition to being registered with PACRA, all companies, local or foreign, must register with Zambia Revenue Authority (ZRA) for Pay as You Earn (PAYE), Income Tax and possibly Value Added Tax (VAT), depending on the scope and scale of the business.

PAYE is calculated by deducting tax from employees' emoluments in proportion to what they earn. The term “emoluments” means total earnings of an employee from employment. These include wages, salaries, overtime, leave pay, commissions, fees, bonuses, gratuities and any other payments from employment or office. Current rates, per month, are set at the following:

- First ZMW 3,000 (EUR 300) at 0%;
- Next ZMW 800.00 (EUR 80) at 25%;
- Next ZMW 2,100 (EUR 210) at 30%;
- Balance at 35%.

An example of the PAYE tax calculation can be found on the ZRA website [here](#)<sup>44</sup>.

41) Link: [http://ilo.org/dyn/natlex/natlex4.detail?p\\_lang=en&p\\_isn=90114&p\\_country=ZMB&p\\_count=182](http://ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=90114&p_country=ZMB&p_count=182) – accessed March 2019

42) Link: <http://www.mcti.gov.zm/index.php/about-mcti/statutorybodies/patents-and-companies-registration-agency> – last accessed March 2017, link no longer available

43) Link: <https://www.pacra.org.zm/> – accessed March 2019

44) Link: <https://www.zra.org.zm/commonHomePage.htm?viewName=PAYE> – accessed March 2019

### 5.3 BUSINESS INCENTIVES AND TAX EXEMPTIONS

The Income Tax Act requires Limited Companies, Partnerships, and Self-Employed individuals to pay a tax on profits made. Information on the taxation of business profits, tax computation, provisional tax, declaration reporting requirements and taxpayer rights can be found via the [ZRA website](#)<sup>45</sup>. Value Added Tax (VAT) is a consumption-based tax that is currently set at 16% for standard rated supplies. It is levied in the supply chain at each point where value is added to a good or service. When importing products that are not zero rated or exempted from VAT, it is paid at the point of entry. Further information regarding VAT in Zambia is found via the [ZRA website](#)<sup>46</sup>.

Monthly filings to ZRA are required. Full information can be found at the [ZRA website](#)<sup>47</sup>. In addition, any company employing staff must register and file monthly with the National Pension Scheme Authority (NAPSA), which is currently set at 5% contribution of gross salary by both the employee and the employer, remitted monthly by the employer. Full information can be found at the [NAPSA website](#)<sup>48</sup>.

At the time of writing, Zambia has signed tax treaties with Botswana, Mauritius, the United Kingdom, Ireland, Seychelles, France, India, Uganda, Tanzania, Sweden, South Africa, Norway, Kenya, Japan, Italy, Germany, Finland, Denmark, and Canada. Further information can be found at the [ZRA website](#)<sup>49</sup>. In 2000, Zambia became a beneficiary of the African Growth and Opportunity Act (AGOA).

Tax regulation is subject to change, so it is necessary to consult ZRA, NAPSA and a professional tax consultant to ensure full compliance.

#### Customs Duty and Import VAT

A majority of imports are delivered through the port at Dar es Salaam, however ports at Beira and Durban are also used. From time to reaching port, it can take 15 days to assign a truck, while crossing the port of entry can take up to 10 days.

Customs duty and import VAT are collected by ZRA customs officers at Zambian points of entry. Solar consignments being imported are evaluated at point of entry to determine if the supply is eligible for zero rating on VAT and duty exemptions.

Since 2008, certain aspects of solar products have been duty and VAT exempt. Per the Customs and Excise (Suspension) (Electrical Machinery and Equipment) Regulations of 2008, specifically Statutory Instrument No. 32 of 2008 mandated by the Ministry of Finance and National Planning, the effective rate of duty is free for energy efficient lighting lamps, discharge lamps, other than ultra violet lamps (Heading Ex 85.39), solar batteries (Heading Ex 85.07) and inverters for solar power (Heading Ex 85.04).

Further, the Value-Added Tax (Zero Rating) (Amendment) (No.2) Order, 2008 to the Value-Added Tax (Zero Rating) Order 1996, by the Ministry of Finance and National Planning, stipulates zero rating for the following solar products:

#### “8. Energy Saving Appliances, Machinery and Equipment

- a) Discharge lamps, other than ultra violet lamps (Energy efficient lighting lamps) —
  - Florescent lamps (tubs and bulbs).
- b) Storage water heaters, non-electric (Solar geysers);
- c) Solar panels;
- d) Solar batteries —
  - lead acid, of kind used for starting piston engines;
  - other lead acid accumulators;
  - nickel cadmium;
  - nickel iron;
  - other accumulators.
- e) Static converters (inverters for solar power);
- f) Electric Generating sets —
  - Generators with compression ignition internal combustion piston engine (Diesel or semi diesel generators);
  - Generators with spark ignition internal combustion piston engines (Petrol Generators).”

45) Link: <https://www.zra.org.zm/commonHomePage.htm?viewName=ValueAddedTax> — accessed March 2019

46) Link: <https://www.zra.org.zm/commonHomePage.htm?viewName=ValueAddedTax> — accessed March 2019

47) Link: <https://www.zra.org.zm/> — accessed March 2019

48) Link: <http://www.napsa.co.zm/> — accessed March 2019

49) Link: <https://www.zra.org.zm/> — accessed March 2019

In reality, companies have experienced difficulties in the application of VAT and Import Duty regulations.

This is largely due to the unclear language in the SI code above; as an example, the SI code above does not specifically mention LI-ion batteries, which are now integral to many SPL and SHS kits. Developers that have been wrongfully charged are able to appeal with the Zambian Revenue Authority, however may incur demurrage for each day that a container is delayed at the port of entry. Developers should confirm the most up to date processes for zero rating and VAT exemptions with ZDA, which offers to facilitate communications with ZRA on this issue as a service to foreign investors. Once organized, Solar Association aims to lobby for improved enforcement of import regulations with national authorities.

### Retail Operations

Companies opening sales outlets within the jurisdictions of any municipality in Zambia (e.g. Lusaka, Kitwe, Chipata, etc.), are required to be registered with Council Permits for the intended areas of operation.<sup>50</sup> Additionally, as much of the rural areas are administered under customary law and are overseen by the Chiefs, it is advisable to consult with all local authorities prior to beginning commercial activities.

### Investor Incentives

Companies considering setting up in Zambia should consult the ZDA first, which offers both fiscal and non-fiscal investment incentives, in addition to providing investors with a range of coordination services. In the energy sector, the ZDA can help developers liaise with institutions including ERB, OPPPI, ZRA, and ZEMA for the necessary permits and licenses required to being business.<sup>51</sup> Investors that invest more than \$500,000 in a multi-facility economic zone, an industrial park or a priority sector (the latter including energy), or invest in a rural enterprise as defined under the ZDA Act can receive favourable tax and import duty incentives. Per the Zambia Development Act: “‘rural business enterprise’ means a business enterprise located in a rural area”. Per the 2015 LCMS, the Central Statistical Office defines an urban area as one having a minimum population size of 5,000 people, a main economic activity that is non-agricultural, and basic modern facilities such as piped water, tarred roads, post office, police post/station, and health centre. Developers may be entitled to zero percent tax rate on dividends

for five years from the first declaration of dividends; zero percent tax on profits for five years from the first year of operation; zero percent import duty on capital goods, machinery, and specialized motor vehicles for five years. Projects may receive non-fiscal incentives, including investment guarantees and protections against nationalization. Projects meeting the criteria but requiring between USD 250,000 and USD 500,000 of investment may receive the non-fiscal incentives. Micro- and Small Enterprises in urban areas may be exempt from income tax for the first three years of operation, while those in rural areas may be exempt for the first five years.

The complete list of incentives offered from ZDA is listed and updated on the [incentives page](#)<sup>52</sup> of the ZDA website. The ZDA has created a 2016 [investor guide](#)<sup>53</sup>, and full information about the services offered via ZDA can be found at the [ZDA website](#)<sup>54</sup>.

## 5.4 ENERGY SECTOR LICENSING AND REGULATION

### License for the Manufacturing, Wholesale Importation, and Installation of Solar Energy Systems

Licensing as a solar company for the purposes of retailing SPLs or SHS systems in Zambia is straightforward. There is a license to Manufacture, Supply, Install, and Maintain Renewable/ Solar Energy Systems. Additionally, as of 1 January 2017, ERB revised the administrative process for solar licensing, and has instituted a more rigorous regulation of the sector, specifically related to the importation of products. All companies planning to import solar products are now required to first apply for a solar importers license from the ERB. [Annex D](#) outlines the steps required to apply for a license. This new solar importer license is not required to distribute solar, and is only meant for companies that will be engaging in the importation of the solar products.<sup>55</sup> The manufacture, supply, installation, and maintenance of solar energy systems may still be licensed under the previous, existing solar company licensing framework.

To apply for a license, solar companies should consult the relevant ERB checklist ([Checklist — Licence to Manufacture](#),

50) Personal communication, solar entrepreneur in Zambia.

51) Personal communication, ZDA representative.

52) Link: <http://www.zda.org.zm/?q=content/investment-incentives> – last accessed March 2017, link no longer available

53) Link: <http://www.zda.org.zm/?q=download/file/fid/Z05> – last accessed March 2017, link no longer available

54) Link: <http://www.zda.org.zm/> – last accessed March 2019

55) Personal communication, ERB representative.

Wholesale Importation and Installation of Solar Energy Systems<sup>56</sup>) as well as the Licensing Procedure for Solar Importers Dealers<sup>57</sup> document — both of which can be found on the ERB website. Application forms should be filled in triplicate, with the following supporting documents:

- 5 years (for first time applicants) or 3 years (for renewals) business plan<sup>58</sup>;
- Latest signed audited financial statements by an audit firm registered with the Zambia Institute of Chartered Accountants (for not more than the previous two years);
- Certificate of Incorporation or Certificate of Registration of the applicant issued by the relevant agencies within Zambia;
- Proof of Funds (six months' bank statement for business already in existence for more than six months) or commitment letter from sponsor (on the same terms as the applicant);
- Current list of shareholders and directors issued by the relevant registration agencies in Zambia;
- Latest annual returns from the relevant registration agency in Zambia;
- Latest and valid Tax Clearance Certificate from ZRA, which is issued biannually as of January 1, 2017 upon request from ZRA.<sup>59</sup> Once the application is submitted, ERB will review the investment capital requirements of the applicant company and assess the 0.1% application fee. Once the fee has been paid, a technical assessment of the premises of the applicant will be carried out. The following features are required to qualify for a license:
- An adequate storage or warehouse facility;

- Work bench or work shop for testing and preparing equipment to dispatch;
- Trained engineer/technician/technologist or craft certificate holder registered with the Engineering Institute of Zambia (EIZ). Proof of Engineering Registration Board and valid Practicing certificate issued by EIZ. In absence of a valid 2017 practicing certificate, a copy of Engineering Registration Board card and copy of renewal receipt for 2017 Practicing license will be accepted. Not applicable for imports of solar lanterns and solar equipment of 10 W and below.
- Solar demonstration unit of equipment supplied by dealer. Not applicable for licensees that do not supply directly to the public or are only involved in contracting for large scale installations.

ERB notes that the expedience with which the license will be processed depends on the completeness of information provided. Anecdotally, the granting of the solar importing license takes an estimated three to 12 months to obtain.<sup>60</sup> License applications will not be rushed for extenuating circumstances, such as a shipment being held at the border and accruing storage fees. For one unlicensed entrepreneur, storage fees at one border entry ran to EUR 375 per day (per 20' container).

Once the license is obtained, it is required to be shown for all shipments of solar into Zambia. All solar import shipments are also required to be accompanied by a quality certificate from the country of origin.<sup>61</sup> This is the first step to regulate the importation and thus the quality of solar products in Zambia by the ERB, Zambian standards for solar products may replace this requirement in the future. Additionally, the administrative process mandates a 0.5% licence fee on annual turnover from the sale of solar PV panels, inverters, solar batteries (deep cycle batteries) and charge controllers only.<sup>62</sup> Dealers in solar lamps, solar lanterns, compact solar appliances with a built in solar panel of below 10 W or appliances designed to work with a solar PV panel of up to 10 W packaged together with the appliance will not be required to pay the 0.5% licence fee despite having an import license. These fees can be paid on a quarterly or annual basis.

56) Link: <http://www.erb.org.zm/downloads/licensing/checklists/checklistSolarDealer.pdf> — last accessed March 2017, link no longer available

57) Link: <http://www.erb.org.zm/downloads/licensingProcedureForSolarImportersDealers.pdf> — last accessed March 2017, link no longer available

58) Note, the ERB has a Business Plan template that can be found here: Outline of Business Plan (<http://www.erb.org.zm/downloads/licensing/OutlineofBusinessPlan.pdf> — last accessed March 2017, link no longer available).

59) The length of time required for issuance of the Tax Clearance Certificate is highly variable.

60) Personal communication, solar entrepreneur in Zambia.

61) Personal communication, solar entrepreneur in Zambia

62) Personal communication, solar entrepreneur in Zambia.

The licence application form is available on the ERB website — [License Application Form](#)<sup>63</sup> — or can be obtained from the Licensing Office within ERB’s Legal Department.

### Relevant Technical Standards

Developers are encouraged to confirm the latest status of applicable technical standards with the ERB. At the time of writing, the following (draft) technical standards are available for reference on the ERB website:

- **DVS 397:** Electricity Supply Quality of Consumer Service — Specification
- **DZS 403:** Batteries for Use in Photovoltaic Systems — Specification
- **DZS 404:** Charge Controllers for Photovoltaic Systems Using Lead-Acid Batteries — Specification
- **DZS 405:** Photovoltaic Systems Design and Installation — Code of Practice
- **DZS 407:** Lighting Devices for Use in Photovoltaic Systems — Specification

With respect to operational implications, ERB has communicated that, “the importer must obtain a quality certification from the country of origin with each shipment. This can be provided by the manufacturing company stating that their product is certified by that country’s standards bureau. Zambian standards are based on international IEC standards which are based on and are applicable internationally. The quality certification will be checked by Zambia Bureau of Standards (ZABS) at the point of entry. This license requirement is in addition to the already existing license to manufacture, install and distribute solar equipment.”<sup>64</sup>

## 5.5 IMMIGRATION AND WORK PERMITS

An employment permit is required for foreign nationals intending to take up employment in Zambia. Employment Permits are managed by the Department of Immigration. There are two types of work permit in Zambia: a short-term, temporary employment permit and an employment (long-term) permit.

The Temporary Employment permit is typically issued for business visitors in Zambia for longer than 30 days. The applicant can arrive in Zambia on a business visa and apply for a temporary employment permit in country, depending on their country of origin. The estimated processing time for the Temporary Employment permit is approximately one to two weeks. The permit is granted for a period that cannot exceed six months in any 12-month period. As of the time of writing, costs for issuance, renewal, duplication, and validation are EUR 440, EUR 510, EUR 510, and EUR 510 respectively. The process for obtaining a Temporary Employment permit can be found on the [Zambian Department of Immigration website](#)<sup>65</sup>.

Employment Permits are issued to foreigners who enter the country to take up employment for longer than six months. They can be extended for up to ten years. The processing time for an Employment Permit is approximately four to six weeks, with costs for issuance, renewal, duplication, and variation at EUR 583, EUR 680, EUR 583, and EUR 100 to 300, respectively. A foreign national must be a holder of either an Employment or Investor’s Permit for over 10 and 3 years respectively, to apply for a residency permit. In March 2017, the fees for applying for work permits were revised<sup>66</sup>. Foreign nationals can access full information regarding work permits at the [Zambia Department of Immigration](#)<sup>67</sup>. Professional immigration consultants recognised by the Department of Immigration can be contacted for assistance with applying for work permits.

At the time of writing, the work permit situation for expatriate professionals was in flux, with a suspension on the renewal of work permits for expatriate workers announced in February 2017<sup>68</sup>. Developers are encouraged to seek advice from their professional networks on the latest status of work permitting. On-arrival visas are eligible for select nationalities, with additional information available [here](#)<sup>69</sup>.

63) Link: <http://www.erb.org.zm/downloads/legal/erbLicenceAppForm.pdf> — last accessed March 2017, link no longer available

64) Licensing Procedure for Solar Importers Dealers (ERB, 2016).

65) Link: <https://www.zambiaimmigration.gov.zm/> — accessed March 2019

66) Link: [https://www.zambiaimmigration.gov.zm/index.php?option=com\\_content&view=article&id=99:new-fees&catid=34:latest-news&Itemid=75](https://www.zambiaimmigration.gov.zm/index.php?option=com_content&view=article&id=99:new-fees&catid=34:latest-news&Itemid=75) — accessed March 2019

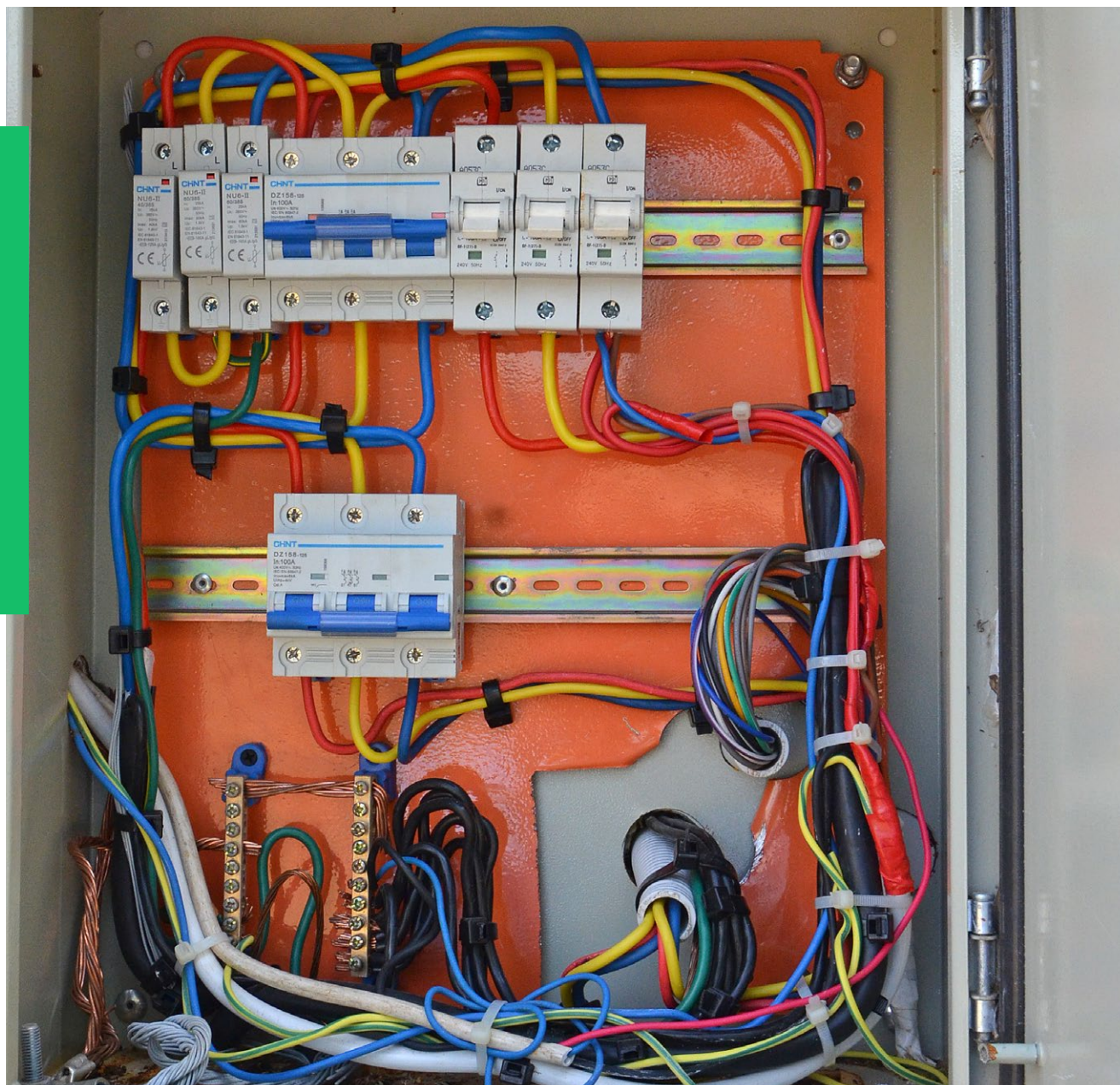
67) Link: <https://www.zambiaimmigration.gov.zm/> — accessed March 2019

68) Link: <http://lusakavoice.com/2017/02/03/renewal-of-workpermits-for-expatriate-workers-suspended-kampyongo/> — last accessed March 2017, link no longer available

69) Link: [https://www.zambiaimmigration.gov.zm/index.php?option=com\\_content&view=article&id=59&Itemid=67](https://www.zambiaimmigration.gov.zm/index.php?option=com_content&view=article&id=59&Itemid=67) — last accessed March 2017, link no longer available

## SECTION 6

# Financing an Off-Grid Solar Business in Zambia



With tremendous growth in the OGS industry over the past years, particularly in East Africa, new market actors in Zambia have the benefit of several transaction precedents to inform their planning.

## 6.1 TYPICAL FINANCING MODALITIES

OGS businesses are typically financed with a mix of grants, equity, and debt over a several year development cycle (Aidun and Muench, 2015). In the initial 2 to 3 years, activities may predominantly be financed through founder investments and grants. Once the business has demonstrated market and operational traction, it may raise an equity round, typically on the order of EUR 1–5 million. This round allows the business to grow its team and put the appropriate systems in place for scalable operations. Once the business is ready to scale, it will likely access larger equity rounds as well as debt, the latter for both working capital and the consumer financing of products (inPAYGO models).

Foreign exchange exposure is a critical business risk for PAYGO SHS providers who typically accumulate substantial assets in hard currency (due to international equity and debt finance that is typically USD- or EUR-denominated) and receivables in local currency (Muench, 2015). This risk is magnified for providers of larger systems that may require 24- or 36-month financing terms. As such, OGS developers are increasingly seeking debt facilities denominated in local currencies. At the time of writing, no country-specific facility existed for OGS developers in Zambia.

Developers are encouraged to explore currency hedging options, such as those provided by [TCX](https://www.tcxfund.com/)<sup>70</sup> and [MFX Solutions](http://mfxsolutions.com/)<sup>71</sup>, or secure local currency-denominated debt where possible. In April 2017, [SunFunder](http://sunfunder.com/)<sup>72</sup> announced a partnership with MFX Solutions enabling the provision of local currency-denominated debt for the sector.

## 6.2 DOMESTIC FINANCING OPPORTUNITIES

The opportunity for domestic financing in OGS is limited. The market, technology, and business model of OGS companies are rather unknown to local commercial banks, who may also consider other, more conventional investment opportunities as demonstrating both higher return and lower risk profiles.<sup>73</sup> While the OGS industry has grown considerably, there has only been a handful of domestic financings transacted by in-country commercial banks in the sector. These include the Commercial Bank of Africa's financing of M-KOPA in Kenya, and BPR's financing of BBOX in Rwanda.<sup>74</sup> These transactions occurred after each of these companies, and the OGS sector, had demonstrated several years of track record in a given market. As such, while domestic financing is technically an opportunity for OGS developers, this capital source may only open after the first 2–3 years of sector track record in Zambia.

## 6.3 NATIONAL SUPPORT MECHANISMS

The only national support mechanism that may be available for OGS entrepreneurs in Zambia is that of the Rural Electrification Fund. However, as mentioned above, little is known about the Fund by entrepreneurs on the ground, and REA was not available to clarify the operations of the Fund further.

## 6.4 INTERNATIONAL FINANCING OPPORTUNITIES

OGS companies are typically financed through a range of grant, equity, and debt financings. Developers are encouraged to research precedent transactions to the landscape of investors engaged in the OGS industry. This may be done through a review of recent press releases, industry reports, and the use of platforms such as [Owler](https://www.owler.com/)<sup>75</sup> and [Crunchbase](https://www.crunchbase.com/)<sup>76</sup>.

70) Link: <https://www.tcxfund.com/> – accessed March 2019

71) Link: <http://mfxsolutions.com/> – accessed March 2019

72) Link: <http://sunfunder.com/> – accessed March 2019

73) Personal communication, solar entrepreneur in Zambia.

74) See <http://www.m-kopa.com/m-kopa-solar-closes-fourthfunding-round/> for an announcement of the M-KOPA transaction and <http://www.bbox.co.uk/bbox-secures-unique-financing-facility-with-bpr-to-support-the-governments-off-grid-electrifications-goals/> for an announcement of the BBOX transaction – both last accessed March 2017, link no longer available

75) Link: <https://www.owler.com/> – accessed March 2019

76) Link: <https://www.crunchbase.com/> – accessed March 2019

As data detailing specific investment structures, valuation precedents, and terms are typically not available in public fora, developers are encouraged to seek advice from peers, potential investors, or advisory services providers. The [GET.invest Finance Catalyst](#)<sup>77</sup> service and the [Global Off-Grid Lighting Association \(GOGLA\)](#)<sup>78</sup> are two additional resources that developers are encouraged to consider during the preparation of fundraising campaigns.

In addition to international private finance, there are a range of public financing opportunities available for OGS developers. Grants may be used during the earliest stages of a business, to prove out a technology, concept, or team. During later stages, grants can be used to guarantee debt, or leverage additional private investment. Developers are encouraged to review the [GET.invest Funding Database](#)<sup>79</sup> for an overview of generally applicable financing opportunities for the OGS industry. A selection of sector-specific funding opportunities in Zambia is provided below.

#### **REACT Window of the Africa Enterprise Challenge Fund (AECF)**

The AECF is an Africa-based challenge fund that supports businesses in agriculture, agribusiness, rural financial services and communications systems, renewable energy and climate resilience (AECF, 2017). The AECF provides catalytic funding in the form of repayable and non-repayable grants to businesses that would otherwise not be able to secure early stage and growth financing (AECF, 2017). The AECF is part of the Alliance for Green Revolution in Africa (AGRA) family and has been supported by governments (Australia, Canada, Denmark, The Netherlands, Sweden and United Kingdom), as well as international financial institutions (Consultative Group to Assist the Poor and IFAD).

The AECF has previously provided financing to three projects in Zambia within the agribusiness sector (AECF, 2017). In 2017, AECF REACT announced a Household Solar challenge fund window focused on off-grid electrification solutions in Zambia, Zimbabwe, Malawi and Sierra Leone. The application period is now closed, however more information on future REACT windows can be found [here](#)<sup>80</sup>.

#### **Beyond the Grid Fund**

The Beyond the Grid Fund is a Sida funded EUR 20 million, four-year project aiming to help electrify 1,000,000 Zambians. The first round has awarded five companies with co-financed grants, including two companies already active in Zambia, and three new market entrants. A second round is under consideration, with a call for proposals expected to be released in 2018. The previous call for proposals included detailed application instructions; companies are encouraged to follow the Fund's progress [here](#)<sup>81</sup>.

#### **Energy and Environment Partnership Southern and East Africa (EEP S&EA)**

The Energy and Environment Partnership (EEP) is a programme that promotes renewable energy, energy efficiency, and clean technology investments. EEP implementation in Southern and East Africa (EEP S&EA) started in March 2010, and is jointly funded by the Ministry of Foreign Affairs of Finland, the Austrian Development Agency, and the UK's Department for International Development (DFID). As a challenge fund, the EEP S&EA supports projects at pilot and scale-up phases (EEP Africa, 2017). Total funding for the first phase (2010–2013) was EUR 25 million and approximately EUR 35 million for the second phase (2013–2017). The third phase of the program is currently under design, however indications for its future eligibility criteria have yet to be made available; developers are encouraged to follow its progress [here](#)<sup>82</sup>.

#### **ElectriFi**

ElectriFi is a specialist debt and equity financing partner for small-scale private companies focusing on new or improved electricity connections as well as on generation capacity from sustainable energy sources in emerging countries. ElectriFi is a 215-million-euro impact investment facility for renewable energy companies active on- and off-grid in emerging markets. Partnering with the European Development Finance institutions, the European Commission launched ElectriFi in December 2015 during the COP21 in Paris. ElectriFi is also funded by contributions from the US Power Africa and Sweden.<sup>83</sup>

77) Link: <https://www.get-invest.eu/finance-catalyst/> – accessed March 2019

78) Link: <https://www.gogla.org/> – accessed March 2019

79) Link: <https://www.get-invest.eu/funding-database/> – accessed March 2019

80) Link: <https://www.aecfafrica.org/portfolio/competitions> – accessed March 2019

81) Link: <https://www.reeep.org/bgfz> – accessed March 2019

82) Link: <http://eepafrica.org/> – accessed March 2019

83) Link: <http://electrifi.org/> – accessed March 2019

**11th European Development Fund, National indicative Programme (2014–2020)**

As a part of ongoing support from the European Union to the energy sector in Zambia, the Delegation of the European Union to Zambia and COMESA will be providing support to both public and private sector organizations active in Zambia's rural electrification sector. With regards to funding available for OGS entrepreneurs and developers, the Delegation will be preparing and awarding a call for proposals for demonstration projects in rural electrification. It is anticipated that 3–4 grants will be awarded to support the development or enhancement of privately operated off-grid electrification activities.

## ANNEX A

# Map of Administrative Provinces in Zambia

**FIGURE 14.** Map of administrative provinces in Zambia<sup>84</sup>



84) Vidiani (2017)

## ANNEX B

# Market Sizing Calculations

**TABLE 7.** Market sizing calculations

INDICATOR	VALUE
<b>Population</b>	<b>15,473,905</b>
Of which rural	58.2%
Of which urban	42%
<b>Average household size</b>	<b>5.1</b>
<b>Number of households</b>	<b>3,034,099.02</b>
Of which rural	1,765,846
Of which urban	1,268,253
<b>Electricity access</b>	<b>—</b>
Electrification rate, rural	4.40%
Electrification rate, urban	67.30%
<b>Number of off-grid households</b>	<b>2,102,867.28</b>
Of which rural	1,688,148.42
Of which urban	414,718.86
<b>Average annual lighting expenditure per off-grid household (EUR/year)</b>	<b>102</b>
<b>Annual lighting expenditures by off-grid households (EUR)</b>	<b>214,492,462.59</b>
Of which rural	172,191,139.02
Of which urban	42,301,323.58

## ANNEX C

# Relevant Stakeholders

This Annex compiles a non-exhaustive list of stakeholders selected according to their relevance to the subject of this guide.

### Development Partners Active in Renewable Energy African Development Bank (AfDB)

The African Development Bank has two ongoing projects in Zambia's energy sector, including support for the development, construction, operation and maintenance of a 120 MW base load hydro power plant at the site of the Itzhi-Tezhi dam on the Kafue River in Zambia, and the construction of associated transmission and distribution infrastructure (AfDB, 2017).

### Department for International Development (DFID)

In February 2017, the UK's Department for International Development signed a partnership agreement with Zambia, including Zambia in the UK's Energy Africa program focused on accelerated household solar solutions across sub-Saharan Africa (Government of the United Kingdom, 2017).

### European Union (EU)

The EU is an active development cooperation partner in Zambia's energy sector. In November 2016, the EU signed an EUR 40 million grant providing support for reforms in the energy sector promoting RE and EE technologies (EEAS, 2016). The EU is additionally supporting the Rehabilitation of the Kariba Dam as well as the Lusaka Transmission and Distribution Rehabilitation Project; the latter of which an EUR 65 million financing agreement was announced in January 2017 (EEAS, 2017). The EU will be providing technical assistance to the ERB, MoE, and REA for the next four years.

### Innovation Norway

In March 2017, Innovation Norway provided a grant of USD 700,000 to finance the installation of solar PV systems at rural health clinics throughout the country (Innovation Norway, 2017). The systems will be installed through a consortium of four Norwegian companies, including Bright Products AS, W. Giertsen Energy Solutions AS, Eltek AS and Differ AS.

### Japan International Cooperation Agency (JICA)

JICA has provided substantial support to the development of rural electrification and renewable energy initiatives in Zambia, primarily through its historical support for the creation and updating of the REMP (JICA, 2017).

### OPEC Fund for International Development

The OPEC Fund for International Development has provided over USD 150 million in financing to public sector projects in Zambia, however none in the energy sector (OFID, 2017). In 2016, the Fund signed a USD 20 million debt agreement with ZESCO to support capital expenditure plans meant to increase generation and transmission capacity.

### Power Africa and USAID

Power Africa and USAID Zambia have provided USD 2 million supporting the IFC's Scaling Solar programme (Power Africa, 2017). Through the Scaling Off-Grid Energy Grand Challenge, USAID provided Fenix International and VITALITE USD 750,000 and USD 300,000 of financing respectively to scale solar home solutions in the country. Power Africa has supported the development of a Renewable Energy Feed in Tariff (REFIT) and standardized Power Purchase Agreement (PPA), and is currently providing technical assistance to the ERB.

### Swedish International Development Cooperation Agency (Sida)

Sida is financing the 'Beyond the Grid Fund for Zambia' which aims to bring clean energy access to one million Zambians and accelerate private-sector growth in energy generation and distribution in the country (REEEP, 2017). The fund will operate from 2016–2018, with a maximum funding level of EUR 20 million. Within that period, it intends to provide 1 million Zambians with access to clean electricity.

### The World Bank

The World Bank is implementing three projects aligned to the electricity sector in Zambia. Through the “Guarantee for Scaling Solar” project, the Bank approved up to USD 36.5 million of support for the construction, operation, and maintenance of the new 54 MW solar PV plant owned by the Bangweulu Power Company (World Bank, 2017b), which is formed by the NEOEN and First Solar consortium. The “Electricity Access for Low-income Households in Zambia” project is designed to provide up to USD 4.95 million largely in the form output-based subsidies to facilitate grid connections for low income households. Through the “Lusaka Transmission and Distribution Rehabilitation Project” the World Bank is providing up to USD 105 million to support ZESCO in the rehabilitation of networks within Lusaka Division. The World Bank is currently implementing a national multi-tier household energy access survey in Zambia.

## RESEARCH, CAPACITY DEVELOPMENT, AND TRAINING

### Centre for Energy, Environment and Engineering Zambia (CEEZ)

The CEEZ is a non-governmental research organization whose activities involve analysis, policy recommendations, and the provision of training in energy and environment (IRENA, 2013).

### Impact Assessment Association of Zambia (IAAZ)

The Impact Assessment Association of Zambia (IAAZ) is an association formed in Zambia to provide a forum for advancing innovation and communication of best practices in all forms of Environmental Impact Assessment (EIA). The association maintains a database of impact assessment practitioners in Zambia and meets regularly as a community of practice (IAAZ, 2017).

### University of Zambia (UNZA)

The majority of scientific renewable energy expertise at the University of Zambia is within the Energy and Environment Research Group (EERG) in the Department of Physics of the School of Natural Sciences. It focuses on energy and environment related to high quality and targeted consultancy, capacity-building and research in energy and the environment (IRENA, 2013).

### Zambia Solar Association

In March 2017, the licensed solar companies agreed to establish a dedicated solar association to promote solar energy and Zambia and advocate for a conducive enabling environment. All licensed solar companies in Zambia are eligible to join.

## ANNEX D

# ERB Solar Company Licensing Procedures

- a) Download an application form and checklist from the ERB website at [www.erb.org.zm](http://www.erb.org.zm) or obtain a hard copy from the ERB offices in Lusaka, Kitwe, Livingstone or Chinsali.
- b) Submit the completed form with the accompanying documents as specified in the checklist to any of our offices with the K50 fee for the form.
- c) An economic assessment will be made of your investment capital and a one off 0.1% or one thousand Kwacha (K1,000) minimum licence application fee will be charged.
- d) A technical inspection will be made of the premises of the applicant. The following features must be present to qualify for licence:
  - Adequate storage or warehouse facility
  - Work bench (distributors of small scale products e.g. lanterns) or workshop (large scale distributors & installers) for testing and preparing equipment to dispatch.
  - Trained Engineer/technician/technologist or craft certificate holder registered with the Engineering Institute of Zambia (EIZ). Proof of Engineering Registration Board and valid Practicing certificate issued by EIZ. In absence of valid 2017 practicing certificate, copy of Engineering Registration Board card and copy of renewal receipt for 2017 Practicing licence will be accepted. Not applicable for imports of solar lanterns and solar equipment of 10W and below.
  - Solar demonstration unit of equipment supplied by dealer. Not applicable for licensees that do not supply directly to the public or are only involved in contracting for large scale installations.

Note that the expedience with which the licence will be processed depends on the completeness of the information and supporting documentation supplied with the licence application. Licence applications will not be rushed through the process as a result of solar equipment being stopped at the point of entry into the country. Importers are advised to apply for the licence before making importation orders.

## ANNEX E

# Contact Information for Government Institutions

### Energy Regulation Board (ERB)

Plot No 9330,  
Off Alick Nkhata Road  
P.O. Box 37631,  
Lusaka, Zambia  
Phone: +260 211 258844-49  
Fax: +260 211 258852

### Office for Promoting Private Power Investment (OPPI)

Stand 4529, Corner of Pandit Nehru and United  
Nations Avenue, Longacres  
Phone: +260 211 253970

### Rural Electrification Authority (REA)

Longolongo Road  
Phone: +260 211 241298

### Zambia Electricity Supply Corporation (ZESCO)

Great East Road, Stand No. 6949  
P.O. BOX 33304, Lusaka Zambia  
Phone: +260 211 361111

### Zambia Environmental Management Agency (ZEMA)

Corner Church and Suez Roads Plot No. 6975,  
Lusaka 10101, Zambia  
Phone: +260 211 254023

### Zambia Bureau of Standards (ZABS)

Lechwe House, Freedom Way  
Phone: +260 211 231385

## ANNEX F

# ADDITIONAL INFORMATION

### Household Income by Province

**Table 8** provides an overview of household income by Province, which demonstrates a strong concentration of economic activity in the North-South, Lusaka-Copperbelt corridor and comparatively lower incomes away from this central region. Additional income data is provided in the 2015 LCMS.

### Rural Income and Access to Electricity<sup>85</sup>

The REMP notes that average monthly income for off-grid households in non-electrified RGCs was approximately EUR 214, compared with EUR 273 for electrified households in electrified RGCs, and EUR 151 for off-grid households in electrified RGCs. As

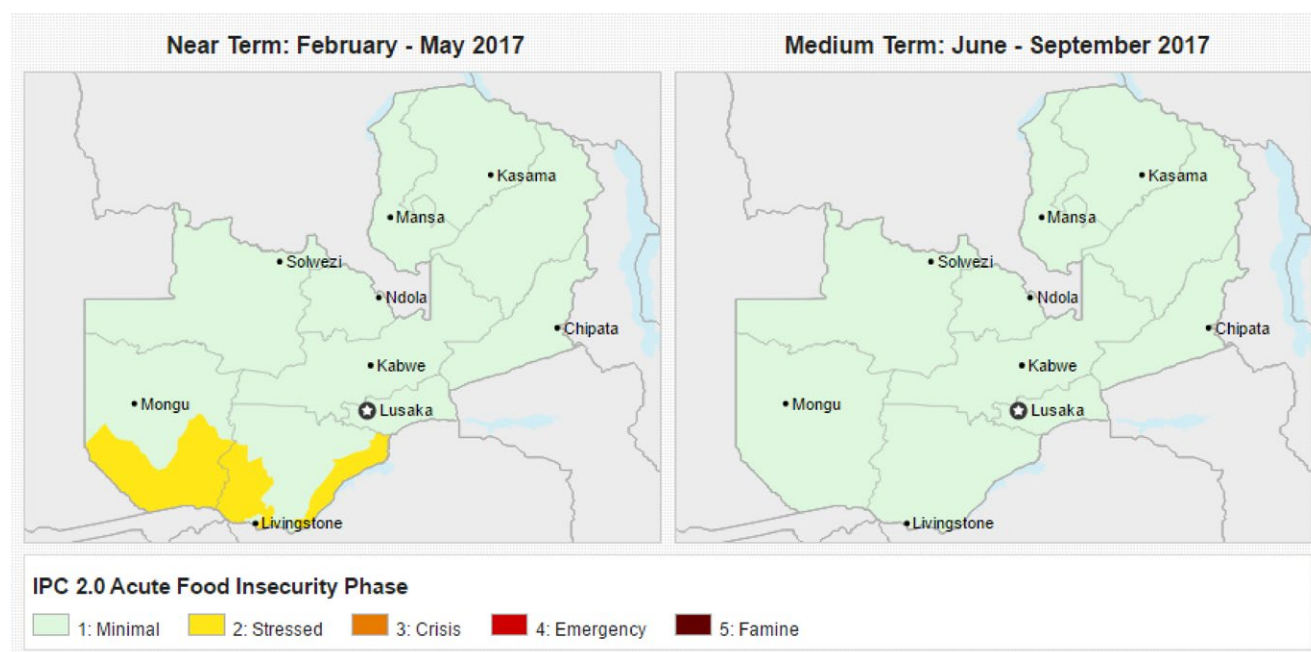
per the REMP (page 4–12): “Thus, the average incomes in unelectrified households in unelectrified RGCs is better than those for unconnected ones in electrified RGCs, but not as good as the electrified ones in electrified RGCs.” Average monthly income for off-grid businesses in unelectrified RGCs was noted as EUR 1,051, as opposed to EUR 566 for off-grid businesses in electrified RGCs. Moreover, it was found that off-grid households in unelectrified RGCs spend approximately EUR 14/month on energy (or EUR 170 annually), while off-grid households in electrified RGCs spend approximately EUR 12/month on energy. While the numbers reported here are higher than those recently estimated by Bloomberg New Energy Finance, a clear willingness and ability

**TABLE 8.** Gross annual household income (off-farm) per household member by province (EUR, 2012)<sup>85</sup>

	MEAN	PERCENTILE 25	MEDIAN	PERCENTILE 75
Central	397.57	88.9356	177.099	405.9744
Copperbelt	377.64	88.1088	189.6726	373.074
Eastern	235.72	66.7992	125.3616	230.9346
Luapula	341.20	68.0706	140.1036	284.388
Lusaka	663.53	132.4206	264.0378	679.809
Muchinga	242.38	44.2962	92.9136	209.6094
Northern	303.11	67.1814	129.207	262.9614
North-western	349.81	74.49	155.2746	336.3594
Southern	318.94	77.1888	155.844	326.1258
Western	219.93	50.661	106.8678	210.405
National	318.30	68.1876	140.322	293.1786

85) IAPRI (2015)

**FIGURE 15.** IPC food insecurity map of Zambia<sup>86</sup>



to pay for energy services among rural and off-grid households exists, and at approximately the same levels as those expected by PAYGO SHS companies. The REMP identified 241 RGCs out of 1,217 that may be best suited for electrification via SHS, as opposed to grid extension or hydro-based mini-grids.

#### Food Insecurity by Province

A March 2017 map of food insecurity shows that the South-eastern and South-western parts of the country are the only areas currently experiencing food stresses. According to The Famine Early Warning Systems Network (FEWS), this is due to limited purchasing power nearing the end of the seasonal lean period. The medium-term forecast depicts minimal food insecurity nationwide following the harvest season. This suggests that the southern parts of the country may experience tightened cash flows during the end of the “warm and wet” season, and may be unable to support the initial down payments of acquiring a SPL or PAYG-enabled SHS during this time period.

#### Agricultural Productivity and Sales by Province

A review of crop productivity (Table 9) reveals that agricultural yields are depressed in the Southern, Eastern, and Western Provinces. This may be attributed to decreased soil fertility and climactic conditions, however could also suggest limited agricultural extension services and less access to agricultural inputs. Farmers may be located in highly remote areas of low population density, for which distribution channels may be difficult to create. The percentages of households engaged in the retailing own agricultural production is comparatively lower in these regions (Table 10). This could be due to decreased yields, or potentially limited market access given limited physical infrastructure or high dispersion. Developers are encouraged to review systemic as well as supply and demand-side dynamics that may yield reduced rural economic activity in certain provinces.

86) FEWS (2017)

**TABLE 9.** Average yield per household by crop, mT/ha<sup>87</sup>

CROP	AVERAGE	CENTRAL	COPPER-BELT	EASTERN	LUAPULA	LUSAKA	MUCHINGA	NORTHERN	NORTH-WESTERN	SOUTHERN	WESTERN
Maize	2.13	2.37	2.3	2.12	2.51	2.19	2.7	2.69	2.24	1.6	1.06
Sorghum	0.68	0.84	0.82	0.53	0.8	1.42	1.02	0.88	1.44	0.4	0.46
Rice	1.3	—	—	1.71	1.38	—	1.36	1.25	1.58	—	1.14
Millet	0.86	0.97	1.41	0.45	0.85	1.13	1.03	1	1.76	0.46	0.31
Groundnuts	0.67	0.76	0.71	0.58	0.77	0.79	0.75	0.61	0.73	0.63	0.61
Soya beans	0.85	1.06	0.84	0.77	0.48	1.18	0.57	0.82	0.73	0.64	0.2
Seed cotton	0.98	0.76	3.52	1.02	—	0.78	1.33	—	—	0.83	—
Mixed beans	0.51	0.57	0.52	0.46	0.47	0.45	0.47	0.5	0.64	0.49	0.45
Cowpeas	0.56	0.94	0.39	0.39	0.52	0.31	3.64	0.49	0.23	0.5	0.44
Sweet potato — white or yellow	4.03	4.85	4.8	4.8	3.87	9.55	2.83	3.69	3.76	3.42	3.02
Cassava	1.61	1.04	2.21	2.21	1.93	1.41	0.87	1.35	2.69	1.49	1.22
Sweet potato — orange	3.75	2.97	4.55	4.55	3.87	4.45	1.51	3.53	2.72	7.12	6.45

87) IAPRI (2015)

**TABLE 10.** Percentage of households selling crops from own production<sup>88</sup>

CROP	AVERAGE	CENTRAL	COPPER-BELT	EASTERN	LUAPULA	LUSAKA	MUCHINGA	NORTHERN	NORTH-WESTERN	SOUTHERN	WESTERN
Maize	52.5	68.6	63.8	40.8	59.8	42.4	59.2	70.3	64.4	48.8	21.3
Sorghum	14.6	33.8	46.6	30.4	—	70.9	16.2	14.9	36.7	8.5	1.2
Rice	67.2	—	—	50.6	72.3	—	58.4	76.5	72.5	—	68.1
Millet	43.5	50.6	62.5	32.4	65.9	45.5	52	53.9	54.3	22.6	2.6
Groundnuts	56.1	63.4	67.1	50.9	66.4	36.1	53.9	64.2	68.8	43.2	45.3
Soya beans	83.6	95.4	79.3	90.1	30.3	81.6	60.5	65.5	82.2	92.2	—
Seed cotton	99.1	99.3	100	99.7	—	100	93.3	—	—	100	—
Mixed beans	67.3	73.6	41.3	51.1	63.3	21.9	62.2	74.3	84.1	41	44.6
Cowpeas	35	62.9	21.8	38.4	9.1	20.3	11	—	56.6	43.2	18.4
Sweet potato — white or yellow	60.8	66.6	84.2	61.8	61	47.6	54.5	43.9	66.9	56.2	29.7
Cassava	22.3	10.5	39.8	70.7	36.2	16.2	5.8	19.4	13.5	11.5	19.8
Sweet potato — orange	46.8	36.7	100	15.5	34.3	—	—	49.5	20.7	94.8	100

88) IAPRI (2015)

### Loans and Credit by Province

Despite comparatively lower yields and household incomes, a review of loans and credit behaviour (Table 11) suggests that rural households in the Eastern Province are most familiar with lending. With a relatively high population density and a comparatively high percentage of households receiving loans through outgrower schemes (at almost 3x the national average), this region may present strong distribution partnership opportunities as well as elevated rates of comfort with financed products.

At the same time, it may also present households that are limited in their ability to take on additional debt, given existing financial obligations. The average value of loans was noted at approximately EUR 90<sup>89</sup> (IAPRI, 2015). At a national scale, only about 30% of Zambian adults have borrowed money in the past year, whether formally or informally, with anxiety about the ability to repay debt being the most frequently cited reason for not borrowing money.

**TABLE 11.** Households acquiring loans by source<sup>90</sup>

LOAN/CREDIT SOURCE	AVERAGE	CENTRAL	COPPERBELT	EASTERN	LUAPULA
Number of farmers	1,512,378	173,812	77,988	281,672	156,634
% receiving loans	15	23	6	39	8
Government-run program	0.2	0	0	0.6	0
Commercial bank	0.3	1.3	0.2	0.2	0
ZNFU Lima Credit Scheme	0.3	0.6	0.1	0.5	0
Farmers' union or cooperative (excluding ZNFU Lima Credit Scheme)	0.5	0.8	0.7	0.6	0.5
Micro credit institution / community credit scheme	0.2	0.1	0.3	0.2	0.3
Out-grower scheme	9.7	17.3	0.3	35.1	0
Input credit from private company (excluding outgrower schemes)	0.6	0.9	0	1.5	0
NGO /faith-based organization / church	0.2	0	0.3	0.2	0.5
Friend /relative /informal money lender (e.g. kaloba)	3.3	2.9	3	2.7	6.7
Company leasing equipment to own (e.g. Rent to Own)	0	0	0	0	0
Community-based savings group (e.g. SILC, VSLA etc)	0.4	0.1	0.9	0.3	0
Average value of loans (ZMW)	924.93	964.8	1465.05	817.07	1049.76

89) The IAPRI (2015) Rural Agricultural Livelihoods Survey notes an average loan value of K 925.

90) IAPRI (2015)

LOAN/CREDIT SOURCE	LUSAKA	MUCHINGA	NORTHERN	NORTH- WESTERN	SOUTHERN	WESTERN
Number of farmers	48,508	125,151	184,101	106,563	206,397	151,553
% receiving loans	6	12	6	2	9	5
Government-run program	0.8	0.1	0.1	0	0	0
Commercial bank	0.8	0.5	0.3	0.1	0.1	0
ZNFU Lima Credit Scheme	0.7	0.8	0.2	0	0.1	0.1
Farmers' union or cooperative (excluding ZNFU Lima Credit Scheme)	0.4	0.4	0.2	0.4	0.5	0.3
Micro credit institution /community credit scheme	0.4	0.1	0	0	0	0.5
Out-grower scheme	2.1	6.9	0.1	0	3.7	0.2
Input credit from private company (excluding outgrower schemes)	0	0.4	0.2	0.1	0.5	0.3
NGO /faith-based organization / church	0	0.5	0.7	0	0.1	0.1
Friend /relative /informal money lender (e.g. kaloba)	0.4	2.5	3.2	1.2	4.9	3.1
Company leasing equipment to own (e.g. Rent to Own)	0	0.3	0	0	0	0
Community-based savings group (e.g. SILC,VSLA etc)	0.5	0.2	1.2	0	0.2	0.5
Average value of loans (ZMW)	3141.8	587.97	1566.06	1601.76	847.66	794.71

## DOCUMENT REFERENCES

**TABLE 12.** References for **Table 1** – Electricity sector in Figures

Installed Generation Capacity (MW, 2016)	<a href="http://www.zambiainvest.com/energy">http://www.zambiainvest.com/energy</a> — accessed March 2019
Installed Fossil Fuel Capacity (2016), % of total installed capacity	<a href="http://www.zambiainvest.com/energy">http://www.zambiainvest.com/energy</a> — accessed March 2019
Hydro Capacity (2016), % of total installed capacity	<a href="http://www.zambiainvest.com/energy">http://www.zambiainvest.com/energy</a> — accessed March 2019
Other RE Capacity (2016), % of total installed capacity	<a href="http://www.zambiainvest.com/energy">http://www.zambiainvest.com/energy</a> — accessed March 2019
Renewable electricity output as % of total electricity output excl. hydro (2013)	<a href="http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS">http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS</a> — accessed March 2019
Average distribution and transmission losses as % of output (2013)	<a href="http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS">http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS</a> — accessed March 2019
Net electricity imports (2014), kWh	<a href="https://www.cia.gov/library/publications/resources/the-world-factbook/geos/za.html">https://www.cia.gov/library/publications/resources/the-world-factbook/geos/za.html</a> — accessed March 2019
Electrification rate, total (2016) %	<a href="http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx">http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx</a> — accessed March 2019
Electrification rate, urban (2016) %	<a href="http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx">http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx</a> — accessed March 2019
Electrification rate, rural (2016) %	<a href="http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx">http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2016Electricity.xlsx</a> — accessed March 2019
Peak demand (2015), MW Country specific documentation	see endnotes
Per capita electricity consumption (kWh, year)	<a href="http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC">http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC</a> — accessed March 2019

**AECF (2017)** Africa Enterprise Challenge Fund.  
Link: [www.aecfafrica.org](http://www.aecfafrica.org) — accessed March 2019

**African Development Bank (2017)** Zambia — African Development Bank, 2017. Link: <https://www.afdb.org/en/countries/southern-africa/zambia/> — accessed March 2019

**African Economic Outlook (2017)** Zambia — African Economic Outlook, 2017. African Economic Outlook, Link: <http://www.africaneconomicoutlook.org/en/country-notes/zambia> — accessed March 2019

**Aidun and Muench (2015)** Financing DESCOs — A Framework.  
Link: [https://docs.wixstatic.com/ugd/4c83e3\\_6de2aea07130463f8c7746640807aa5c.pdf](https://docs.wixstatic.com/ugd/4c83e3_6de2aea07130463f8c7746640807aa5c.pdf) — accessed: March 2019

**allAfrica.com (2014)** Zambia: Chinese FDI in Zambia Hits \$2.6 Billion. Times of Zambia. Link: <http://allafrica.com/stories/201404030446.html> — accessed March 2019

**allAfrica.com (2015)** Zambia: Network Coverage. Times of Zambia. Link: <http://allafrica.com/stories/201510271533.html> — accessed March 2019

**BBC (2017)** Zambia Country Profile. Link: <http://www.bbc.com/news/world-africa-14112449> — accessed March 2019

**Bloomberg (2015)** Zambia's Electricity Shortfall Widens to Half of Peak Demand, 2015. Link: <https://www.bloomberg.com/news/articles/2015-09-22/zambia-s-electricity-shortfall-widens-to-half-of-peak-demand> — accessed March 2019

**Bloomberg (2016)** Off-Grid Solar Market Trends Report 2106. Link: <https://about.bnef.com/blog/off-grid-solar-market-trends-report-2016/> — accessed March 2019

**Bloomberg (2017a)** Q1 2017 Off-Grid and Mini-Grid Market Outlook. Link: <https://data.bloomberglp.com/bnef/sites/14/2017/01/BNEF-2017-01-05-Q1-2017-Off-grid-and-Mini-grid-Market-Outlook.pdf> — accessed March 2019

**Bloomberg (2017b)** Q2 2017 Off-Grid and Mini-Grid Market Outlook. Last accessed March 2017, link no longer available

**BNEF (2016)** Off-Grid Solar Market Trends Report 2016, 2017. Bloomberg New Energy Finance. Link: <https://about.bnef.com/blog/off-grid-solar-market-trends-report-2016/> — accessed March 2019

**CIA (2017)** The World Factbook, 2017. The Central Intelligence Agency. Link: <https://www.cia.gov/library/publications/resources/the-world-factbook/geos/za.html> — accessed March 2019

**City Population (2017)** Zambia: Provinces, Major Cities, and Urban Centres, 2017. Citypopulation.de. Link: <https://www.citypopulation.de/Zambia-Cities.html> — accessed March 2019

**Climatescope (2017)** Climatescope — Zambia. Climatescope. Link: <http://global-climatescope.org/results/zm> — accessed March 2019

**CSO (2011)** Zambia 2010 Census of Population and Housing, February 2011. Central Statistical Office. Link: <https://unstats.un.org/unsd/demographic/sources/census/wphc/Zambia/PreliminaryReport.pdf> — accessed March 2019

**CSO (2015)** 2013–14 ZDHS Key Findings, March 2015. Rockville, Maryland, USA: Central Statistics Office (CSO), Ministry of Health (MOH), and ICF International. Link: <https://www.dhsprogram.com/pubs/pdf/SR219/SR219.pdf> — accessed March 2019

**DoS (2017)** Zambia, 2017. U.S. Department of State. Link: <https://travel.state.gov/content/passports/en/country/zambia.html> — accessed March 2019

**EEAS (2016)** The Government of Zambia and the European Union signed a Financing Agreement for the Support to the Zambia Energy Sector. European Union External Action. Link: [https://eeas.europa.eu/headquarters/headquarters-homepage/16118/government-zambia-and-european-unionsigned-financing-agreement-support-zambia-energy-sector\\_ro](https://eeas.europa.eu/headquarters/headquarters-homepage/16118/government-zambia-and-european-unionsigned-financing-agreement-support-zambia-energy-sector_ro) — accessed March 2019

**EEAS (2017)** EUROPEAN UNION SIGNS €65 MILLION GRANT WITH ZAMBIA TO IMPROVE ACCESS TO ENERGY. European Union External Action. Link: [https://eeas.europa.eu/headquarters/headquarters-homepage/18954/european-union-signs-eu65-million-grant-zambia-improve-accessenergy\\_en](https://eeas.europa.eu/headquarters/headquarters-homepage/18954/european-union-signs-eu65-million-grant-zambia-improve-accessenergy_en) — accessed March 2019

**EEP Africa (2017)** The Energy Environment Partnership Southern and Eastern Africa. Link: <http://www.eepafrica.org> — accessed March 2019

**Enel (2017)** ENEL SIGNS 25-YEAR PPA WITH ZAMBIAN NATIONAL UTILITY ZESCO, 2017. Link: <https://www.enel.com/media/press/d/2017/04/enel-signs-25-year-ppa-with-zambian-national-utility-zesco> — accessed March 2019

**ERB (2015)** Energy Sector Report, 2014. Lusaka. Energy Regulation Board — Ministry of Energy and Water Development.

**ERB (2017a)** Energy Regulation Board. Link: <http://www.erb.org.zm/viewpage.php?page=news> — accessed March 2019

**ERB (2017b)** Energy Regulation Board. Speech by the ERB Board acting chairman Prof. Francis Yamba on the ZESCO application to vary electricity tariffs — 2017. Link: <http://www.erb.org.zm/press/statements/tariffDecisionSpeech10.05.2017.pdf> — accessed March 2019

**FCO (2017)** Zambia Travel Advice, 2017. U.K. Government Foreign and Commonwealth Office. Link: <https://www.gov.uk/foreign-travel-advice/zambia/safety-and-security> — accessed March 2019

**Focus Economics (2017)** Focus-Economics website. Link: <http://www.focus-economics.com/country-indicator/zambia/gdp> — accessed March 2019

**GFSI (2017)** Global Food Security Index, 2017. Link: <http://foodsecurityindex.eiu.com/> — accessed March 2019

**GOGLA (2017)** Global Off-Grid Solar Market Report, Semi-Annual Sales and Impact Data, January — June 2017. Link: [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth12017\\_def.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth12017_def.pdf) — accessed March 2019

**Gov.uk (2017)** UK and Zambia sign Energy Africa Partnership Agreement. Link: <https://www.gov.uk/government/world-location-news/uk-and-zambia-sign-energy-africa-partnership-agreement> — accessed March 2019

**IAPRI (2015)** Zambia Rural Agricultural Livelihoods Survey Report, 2015. Indaba Agricultural Policy Research Institute. Link: [https://images.agri-profocus.nl/upload/post/RALS\\_2015\\_Survey\\_Report\\_Finalv-edited1456827249.pdf](https://images.agri-profocus.nl/upload/post/RALS_2015_Survey_Report_Finalv-edited1456827249.pdf) — accessed March 2019

**IEA (2014)** Zambia: Electricity and Heat for 2014. International Energy Agency. Link: <http://www.iea.org/statistics/statistics-search/report/?year=2014&country=Zambia&product=ElectricityandHeat> — last accessed March 2017, link no longer available

**IGC (2016)** Lights out: Zambia's Electricity Crisis, 2016. International Growth Centre. Link: <http://www.theigc.org/blog/lights-out-zambias-electricity-crisis/> — accessed March 2019

**Imelda K. Moise, Ezekiel Kalipeni & Leo C. Zulu (2011)** Analysing Geographical Access to HIV Sentinel Clinics in Relation to Other Health Clinics in Zambia, *Journal of Map & Geography Libraries: Advances in Innovation Norway* (2017). News on the Solar4Health-project. Innovation Norway, 2017. Link: <https://www.tandfonline.com/doi/abs/10.1080/15420353.2011.599756> — accessed March 2019

**Geospatial Information, Collections & Archives**, 7:3, 254–281, DOI: 10.1080/15420353.2011.599756

**IAAZ (2017)** Impact Assessment Association of Zambia. Link: <https://www.iaaz.org/> — accessed March 2019

**IDC (2017)** Industrial Development Corporation. Link: <http://www.idc.co.zm/> — accessed March 2019

**International Rivers (2012)** A Risk Climate for Southern African Hydro. Available: [https://www.internationalrivers.org/sites/default/files/attached-files/zambezi\\_climate\\_report\\_final.pdf](https://www.internationalrivers.org/sites/default/files/attached-files/zambezi_climate_report_final.pdf) — accessed March 2019

**IRENA (2013)** Renewables Readiness Assessment: Zambia, 2013. IRENA. Link: [https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2013/RRR\\_Zambia.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2013/RRR_Zambia.pdf) — accessed March 2019

**IRENA (2017)** Global Atlas, 2017. IRENA. Link: <http://irena.masdar.ac.ae/> — accessed March 2019

**IWS (2017)** Zambia Internet Stats and Telecommunications Reports, 2017. Internet World Stats. Link: <http://internetworldstats.com/af/zm.htm> — accessed March 2019

**JICA (2017)** Japan International Cooperation Agency — Zambia, 2017. Link: <https://www.jica.go.jp/zambia/english/index.html> — accessed March 2019

**Johnson, O.; Muhoza, C. (2016)** Renewable energy mini-grids: An alternative approach to energy access in southern Africa. Nairobi. Stockholm Environment Institute — Africa World Agroforestry Centre. Link: <https://mediamanager.sei.org/documents/Publications/SEI-DB-2016-SADC-mini-grids.pdf> — accessed March 2019

**Knoema (2015)** World Bank Education Statistics, 2017. Knoema. Link: <https://knoema.com/WBES2017/world-bank-education-statistics> — accessed March 2019

**Kumar and Winiecki (2014)** Access to Energy via Digital Finance: Overview of models and prospects for innovation. Link: [https://www.gogla.org/sites/default/files/recource\\_docs/digitally\\_financedenergy\\_final.pdf](https://www.gogla.org/sites/default/files/recource_docs/digitally_financedenergy_final.pdf) — accessed March 2019

**LCMS (2015)** 2015 Living Conditions Monitoring Survey Report. Republic of Zambia Central Statistical Office. Link: [https://www.zamstats.gov.zm/phocadownload/Living\\_Conditions/2015%20Living%20Conditions%20Monitoring%20Survey%20Report.pdf](https://www.zamstats.gov.zm/phocadownload/Living_Conditions/2015%20Living%20Conditions%20Monitoring%20Survey%20Report.pdf) — accessed: March 2019

**Lusaka Times (2017)** ZESCO applies to raise tariffs by 75%, 2017. Lusaka Times. Link: <https://www.lusakatimes.com/2017/03/27/zesco-applies-raise-tariffs-75/> — accessed March 2019

**Lusaka Times (2017a)** Mining firms could face \$276 million bill in power dispute-CEC. Lusaka Times. Link: <https://www.lusakatimes.com/2017/03/21/mining-firms-face-276-million-bill-powerdispute-cec/> — last accessed March 2017, link no longer available

**MEWD (2015)** Energy Policy in Zambia. Link: [http://www.grips.ac.jp/teacher/oono/hp/course/student\\_slides/2015/lufunda\\_energy.pdf](http://www.grips.ac.jp/teacher/oono/hp/course/student_slides/2015/lufunda_energy.pdf) — accessed March 2019

**MEWD (2017)** Ministry of Energy and Water Development — Government of the Republic of Zambia. Link: <http://www.mewd.gov.zm/> — last accessed March 2017, link no longer available

**MoE (2015)** 2015 Educational Statistical Bulletin, 2015. Ministry of General Education. Link: [http://www.moge.gov.zm/?wpfb\\_dl=49](http://www.moge.gov.zm/?wpfb_dl=49) — accessed March 2019

**MoH (2012)** The 2012 List of Health Facilities in Zambia. Ministry of Health. Link: <http://www.moh.gov.zm/docs/facilities.pdf> — accessed March 2019

**MSU (2009)** Identifying Regions of Staple Food Net Consumption and Supply, April 2009. Michigan State University. Link: [https://msu.edu/~longabau/gis\\_project/](https://msu.edu/~longabau/gis_project/) — accessed March 2019

**Muench (2015)** Currency Risk and Mitigation Strategies for the Off-Grid Energy Sector. Link: [https://docs.wixstatic.com/ugd/4c83e3\\_242d019d9d904df3b6e7caf69447acf0.pdf](https://docs.wixstatic.com/ugd/4c83e3_242d019d9d904df3b6e7caf69447acf0.pdf) — accessed March 2019

**Nations Encyclopaedia (2017)** Zambia, 2017. Nations Encyclopaedia. Link: <http://www.nationsencyclopedia.com/Africa/Zambia.html> — accessed March 2019

**Nations Online (2017)** Political Map of Zambia, 2017. Nations Online. Link: <http://www.nationsonline.org/oneworld/map/zambia-political-map.htm> — accessed March 2019

**Neoen (2017)** PPA Signature in Zambia, 2017. Neoen. Link: <https://www.neoen.com/en/ppa-signature-in-zambia> — accessed March 2019

**OECD (2017)** Zambia, 2017. The Observatory of Economic Complexity. Link: <http://atlas.media.mit.edu/en/profile/country/zmb/> — accessed March 2019

**OPPI (2017)** Office for Promoting Private Power Investment. Link: <http://www.oppi.gov.zm/> — accessed March 2019

**Power Africa (2017)** Power Africa — Zambia. Link: <https://www.usaid.gov/powerafrica/zambia> — accessed: March 2019

**REA (2017)** Rural Electrification Authority. Link: <http://www.rea.org.zm/> — accessed March 2019

**RECP (2017)** Africa-EU Renewable Energy Cooperation Programme Website, 2017. Africa-EU RECP. Link: <https://www.get-invest.eu/> — accessed March 2019

**REEEP (2017)** Power Africa: Beyond the Grid Fund for Zambia Website, 2017. Renewable Energy and Energy Efficiency Partnership. Link: <https://www.reeep.org/bgfs> — accessed March 2019

**REMP (2009)** Rural Electrification Master Plan: 2008–2030, 2009. Government of the Republic of Zambia. Link: [https://openlibrary.org/works/OL16212731W/Rural\\_electrification\\_master\\_plan\\_for\\_Zambia\\_2008-2030](https://openlibrary.org/works/OL16212731W/Rural_electrification_master_plan_for_Zambia_2008-2030) — accessed March 2019

**Scaling Solar (2017)** Link: <https://www.scalingsolar.org/> — accessed March 2019

**Scott, A., Diecker, J., Harrison, K., Miller, C., Wheeldon, S. (2016)** Accelerating access to electricity in Africa with off-grid solar — Off-grid solar country briefing: Zambia. London. Overseas Development Institute.

**SE4ALL (2017)** Sustainable Energy for All — Africa Hub Official Website. Link: <https://www.se4all-africa.org/se4all-in-africa/country-data/zambia> — accessed 13 March 2017

**Solargis (2017)** Solar Resource Maps for Zambia, 2017. Solargis. Link: <http://solargis.com/products/maps-and-gis-data/free/download/zambia> — accessed March 2019

**Trading Economics (2017)** Zambia. Link: <https://tradingeconomics.com/zambia/indicators> — accessed March 2019

**UNCDF (2016)** Consumer Behaviours in Zambia, 2016. UNCDF. Link: <http://www.uncdf.org/article/871/consumer-behaviors-in-zambia> — accessed March 2019

**UNCDF (2017)** State of the Digital Financial Services Market in Zambia, 2016. Link: <http://www.uncdf.org/article/2776/state-digital-financial-services-market-zambia-2016> — accessed March 2019

**UNECA (2015)** Zambia Country Profile, 2015. United Nations Economic Commission for Africa. Link: <http://www.uneca.org/sites/default/files/images/ORIA/CP/zambia.pdf> — accessed March 2019

**UNICEF (2017)** Zambia Nutrition, 2017. UNICEF. Link: [https://www.unicef.org/zambia/5109\\_8461.html](https://www.unicef.org/zambia/5109_8461.html) — last accessed March 2017, link no longer available

**UNIDO (2017)** UNIDO Official Website. Link: <http://www.unido.org/africa/selected-projects/zambia-mini-grids.html> — accessed March 2019

**USAID (2009)** Powering Health: Options for Improving Energy Services at Health Facilities in Zambia, 2009. USAID. Link: [http://www.poweringhealth.org/Pubs/zambia\\_assessment\\_report.pdf](http://www.poweringhealth.org/Pubs/zambia_assessment_report.pdf) — accessed March 2019

**USAID (2017)** USAID ANNOUNCES \$4 MILLION TO SOLAR START-UPS FOR AFRICAN OFF-GRID ENERGY, 2016. USAID. Link: <https://www.usaid.gov/news-information/press-releases/oct-14-2016-usaid-announces-4-million-solar-start-ups-african-grid-energy> — accessed March 2019

**Vidiani (2017)** Vidiani: Maps of the World. Link: <http://www.vidiani.com/> — accessed October 2019

**WEO (2017)** World Energy Outlook — Energy Access Database, 2017. International Energy Agency. Link: [https://www.iea.org/publications/freepublications/publication/WEO2017Special\\_Report\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017Special_Report_EnergyAccessOutlook.pdf) — accessed March 2019

**WFP (2017)** World Food Programme Official Website. Link: [www.wfp.org/countries/zambia](http://www.wfp.org/countries/zambia) — accessed March 2019

**WIPO (2016)** The Global Innovation Index 2016, 2016. World Intellectual Property Organization. Link: [http://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2016.pdf](http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf) — accessed March 2019

**World Atlas (2017)** The World Atlas Official Website. Link: <http://www.worldatlas.com/articles/top-copper-producing-countries-in-the-world.html> — accessed March 2019

**World Bank (2010)** Zambia's Infrastructure: A Continental Perspective, 2010. The World Bank. Link: [http://siteresources.worldbank.org/INTAFRICA/Resources/Zambia-Country-Report\\_03.2011.pdf](http://siteresources.worldbank.org/INTAFRICA/Resources/Zambia-Country-Report_03.2011.pdf) — accessed March 2019

**World Bank (2012)** Zambia poverty assessment: stagnant poverty and inequality in a natural resourcebased economy. World Bank Africa region Poverty reduction and economic management. Washington DC; World Bank.

**World Bank (2016a)** Zambia Economic Brief, June 2016. The World Bank. Link: <http://documents.worldbank.org/curated/en/804591467989562427/pdf/106508-WP-P157243-PUBLIC.pdf> — accessed March 2019

**World Bank (2016b)** Zambia Overview, 2017. The World Bank. Link: <http://www.worldbank.org/en/country/zambia/overview#1> — accessed March 2019

**World Bank (2016c)** Zambia Economic Brief: Raising Revenue for Economic Recovery, December 2016. Link: <http://www.worldbank.org/en/country/zambia/publication/zambia-economic-brief-raising-revenue-for-economic-recovery-in-zambia> — accessed March 2019

**World Bank (2016d)** World Bank SSA Electricity Tariff Database, October 2016. The World Bank. Link: <http://databank.worldbank.org/data/download/avpfa/avpfa-tariff.xlsx> — accessed March 2019

**World Bank (2017)** Data — The World Bank Official Website. Link: <http://data.worldbank.org> — accessed March 2019

**World Bank (2017a)** GINI Index estimate — The World Bank Official Website. Link: <http://data.worldbank.org/indicator/SI.POV.GINI?locations=ZM/> — last accessed March 2017, data no longer available

**World Bank (2017b)** World Bank Official Website. Link: <http://www.worldbank.org/en/news/loans-credits/2017/02/16/zambia-west-lunga-scaling-solar-energy-project> — accessed March 2019

**World Bank (2017c)** Zambia Poverty Assessment — The World Bank Official Website. Link: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPA/0,,contentMDK:20204786~menuPK:435735~pagePK:148956~piPK:216618~theSitePK:430367,00.html> — accessed March 2019

**World Top Exports (2017)** World Top Exports Official Website. Link: <http://www.worldstopexports.com/zambias-top-10-exports/> — accessed March 2019

**ZABS (2017)** Zambia Bureau of Standards. Link: <http://www.zabs.org.zm/> — accessed March 2019

**Zambezi River Authority (2017)** Zambezi River Authority. Link: <http://www.zaraho.org.zm/> — accessed March 2019

**Zambia Tourism (2017)** Zambia Distance Chart 2017. Zambia Tourism. Link: <http://www.zambiatourism.com/map> — accessed March 2019

**Zambiainvest.com (2016)** Zambia Invest Official Website. Link: <http://www.zambiainvest.com/economy/investment-opportunities-zda> — accessed March 2019

**ZBT (2017)** Top 10 companies in Zambia, 2017. Zambia Business Times. Link: <http://zambiabusinesstimes.com/2017/02/12/top-10-companies-in-zambia/> — last accessed March 2017, link no longer available

**ZDA (2017)** Zambia Development Agency Official Website. Link: <http://www.zda.org.zm/?q=content/energy> — accessed March 2019

**ZEMA (2017)** Zambia Environmental Management Authority. Link: <http://www.zema.org.zm/> — accessed March 2019

**ZESCO (2017)** Zambian Electricity Supply Corporation Official Website. Link: <http://www.zesco.co.zm> — accessed March 2019

**ZICTA (2015)** Information and Communications Technology & Postal Services Investment Profile. Zambia Information and Communications Technology Association, 2015. Link: <https://www.zicta.zm/Views/Publications/ICTandPostalServicesInvestmentProfile.pdf> — accessed March 2019

**ZICTA (2017)** ZICTA Statistics Portal. Link: <http://onlinesystems.zicta.zm:8585/statsfinal/ICT%20Indicators.html#> — accessed March 2019

**ZIPAR, (2013)** The Distribution of Household Income in the Middle Class in Zambia, December 2013. Zambia Institute for Policy Analysis and Research. Link: <http://www.saipar.org:8080/eprc/bitstream/handle/123456789/607/the%20distribution%20of%20household%20income.pdf?sequence=1&isAllowed=y>  
— accessed March 2019

**ZRA (2017)** Zambia Revenue Authority. Link: <https://www.zra.org.zm/> — last accessed March 2017, link no longer available





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