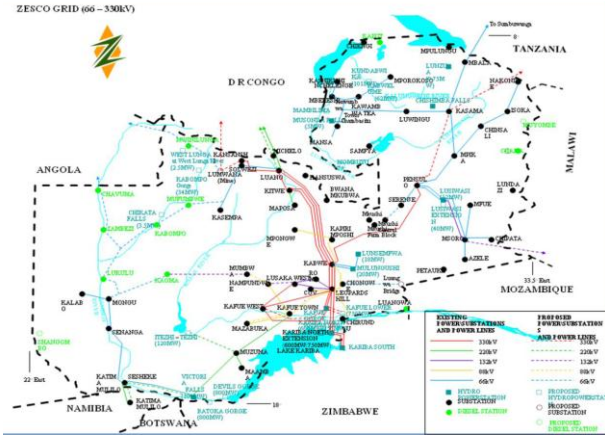
Power Sector Market Brief: Zambia

Background

Zambia is a landlocked country located in Southern Africa with a rapidly growing economy and population, especially in urban areas. Over the last 30 years, the country's investments in expanding its energy infrastructure have struggled to close gap between energy supply and demand.

Zambia is the fourth largest copper producer and its copper resources account for 6% of global reserves. The mining sector accounts for the biggest share of its economy and for half of the country's electricity demand. The country also has high hydropower potential, as it possesses 40% of the water resources in the Southern African Development Community (SADC). As a result, most of the electricity is generated through hydropower.

The present market brief was prepared in the context of a series of activities organised by Zambia's Government, the EUEI PDF, Practical Action and the Alliance for Rural Electrification with the main purpose to inform participants about the country's power sector potential.



Zambian Power System (MEWD 2008)

General[1]	
Surface (km^2)	752,612
Population (millions)	13.5
Pop. Annual Growth (%)	2.4
Population Density (inhab/km^2)	35
Urbanisation (%pop/year)	3.2%
Share of urban pop. (%)	39.6
GDP ($bn)	19.219
GDP per capita ($)	$ 1,426
GDP growth rate (%)	7.7
Inflation rate (%)	6.5
ODA % of GNI	5.8
Human dev. (rank)	163/186
Governance levels (rank)	272/600
Ease of doing business (rank)	94/185

Power sector[2]	
Electrification rate (%)	22%
Rural elect. Rate (%)	3.5
Electricity use p.c./year (kWh)	771
Growth in elec. Access (%pop/year)	0.5
Power Dem., Growth (%pop/year)	4
Total electricity demands (MW)	2000
Total electricity installed (MW)	1,982
Share of hydro in energy mix (%)	10.8
Interconnected installed capacity	1,950.5
Off-grid diesel capacity (MW)	6.5
Off-grid SHP capacity	23.75
Grid losses (%)	23
Hydropower potential (MW)	6,000
Biomass to power potential (MW)	447

[1] Sources: UN, CIA, WB 2010-2012
[2] Sources: ESMAP, MEWD, 2008-2012

Institutional, legislative, policy and regulatory framework

The Government targets are to: (i) Improve delivery of energy services by reducing power outages and increasing electrification rates; (ii) increase the installed capacity of hydropower and other renewable energies; (iii) improve energy efficiency and conservation; (iv) open the transmission network to private operators; (v) improve organisational management as well as the operational and financial performance of the Zambia Electricity Supply Company (ZESCO); (vi) gradually phase out subsidies and raising electricity tariffs to total cost recovery.

Through its 2030 Vision, the Government aims at increasing rural electrification rates up to 51% by 2030. Its Rural Electrification Master Plan provides a concrete roadmap to achieve this target through grid extension, individual PV systems as well as small hydropower (SHP) and biomass mini-grids. Its renewable energy goals are further supported by the National Energy Policy, the Power System Master Plan and the Renewable Energy Strategy. In order to monitor progress of Zambia's goals, the Energy Regulation Board (ERB) and ZESCO agreed on a set of Key Performance Indicators (KPIs).

Although revenue collection in 2011 was high (96.5%), the cost recovery (39.1%) was very low due to non-reflective tariffs. The World Bank (WB) estimates that under-pricing and related subsidies cost the country $152 million a year. Total hidden costs were estimated at 93.3% of revenue. Zambia has one of the lowest electricity tariffs in Africa.

Categories of tariffs[3]	U.S. cents
Residential at 75 kWh	2.9
Commercial at 900 kWh)	4.4
Industrial at 50,000 kWh)	2.9

In order to stimulate private investment, Zambia has initiated power sector reforms which entail the unbundling and privatisation of the national power utility; the increase of the power tariffs; as well as and stimulate private sector involvement in the sector through additional incentives (For the list of additional incentives, please refer to TKN/IISD 2012).

3 Source: World Bank, March 2011

Demand

As in many other Sub-Saharan African countries, wood fuel (mainly used as thermal source for cooking) remains Zambia's main energy demand source (79%). Hydropower is the second most used source, contributing to 10%. Petroleum products cover 9% of the national energy requirements and their demand grows at 40% per annum. Coal also represents a small share of the energy supply.

Mining, namely the Copperbelt Province, remains the area with the highest energy consumption representing more than half of Zambia's total electricity demand. The industry (other than mining) and commerce's electricity demand is estimated at 4% and that of households at 19%.

Access to electricity in Zambia remains low (22%), particularly in rural areas (3.5%). Annual growth of total electricity access rates is estimated at 0.5% of the population and only covers 12.5% of the annual population's growth. Peak demand is estimated at 2,000 MW. Growth in power demand is estimated at approximately 6% per year (150-200 MW) and is expected to remain below 3,000 MW by 2020. The rate of power outages represents 49.8 days/year. The private sector's reliance on self-generation is estimated at 19.5% of its power consumption.

Supply

As of June 2013, installed capacity was estimated at 2,000 MW. The level of available generation is however slightly lower. Out of the total installed capacity, 1895 MW comes from hydro (~90%). About 93% of the total interconnected installed capacity and most of the off-grid (including SHP) installed capacity are still owned by ZESCO providing power to 55,699 customers. LHCP and CEC are the biggest private operators in the

country owning a capacity of 52.5 MW and 80 MW respectively.

Power station[4]	Capacity (MW)	Type	Operator
Kafue Gorge	990	Hydro	
Kariba North Bank	720	Hydro	ZESCO
Victoria Falls	108	Hydro	
Lusiwasi	12	Hydro	
Off-grid[5]	49.	Hydro/Diesel	
Lusemfwa	28	Hydro	LHPC
Mulungushi	24	Hydro	
Gas Turbine	80	Gas	CEC
TOTAL	**2,001**		

CEC is also responsible for providing high voltage electricity to the copper mining sites. In addition, there are two other private distributors in the country: NWEC, providing electricity to the Lumwana Mining Corporation's housing complex with 386 customers, and the ZPC which owns 750 kW off-grid system and supplies electricity to 745 customers in North Western Province.

Zambia's network is owned by ZESCO and CEC and consists of 66 kV, 132 kV, 220 kV and 330 kV totalling 3,200 km. The grid has high losses of 22%, of which distribution losses account for 12%. Zambia has developed several inter-connections with its neighbouring countries and is a net exporter to its Southern and Eastern neighbours.

Main challenges

There is an urgent need for additional generation in order to reduce the increasing demand-supply gap. In parallel, there is the need to accelerate the decision-making process to approve new projects, encourage more actors in the sector as well as to improve capacities to package and design bankable projects. This and increasing the power tariffs will help stimulate development in the power sector.

[4] For a list of on-grid projects: ZDA, June 2013
[5] For a detailed list of off-grid systems, please contact the authors of the paper.

The government also faces big challenges in operationalising the KPIs.

When it comes to rural areas, poor access to finance, geographic remoteness, demographic dispersion, low income and demand levels make rural electrification challenging and unattractive for the private sector.

Expansion plans and renewable energy potential

Zambia expects to have a surplus of 600 MW by 2016, mostly coming from additional hydropower generation. Cross-border interconnections will also allow for exchange of power with its neighbours.

The country has given priority to the instalment of new thermal plants to rapidly increase Zambia's installed capacity. Maamba Collieries Ltd. is building a 300 MW coal fired plant for self-generation with excess sold to the national grid. There are plans to upgrade it up to 900 MW. The Government has initiated the 50 MW Ndola Heavy Fuel Oil Thermal Power Plant Project.

The Government has planned the construction and upgrade of several national transmission lines serving mining sites (Muliashi Project, Konnoco Project and Chingola Refractory Ore and concentrator projects). Several interconnectors are already planned or under construction (Tanzania and Kenya, Namibia and Zimbabwe, DRC).

In spite of Zambia's high hydropower potential, only around 32% of the 6,000 MW of hydropower potential is currently being exploited. Nonetheless, the Government is already studying the development of several projects (for a list of projects, refer to TKN/IISD, 2012). The estimated small hydropower potential is of 45MW. The Rural Energy Master Plan has e.g. identified 29 locations for new mini-hydro schemes in Northern Luapula and Northern-western provinces. Studies and designs for five new sites have been approved.

Regarding biomass, ZESCO, in conjunction with GEF/UNIDO, plans to install a 1 MW biomass co-

generation to power a mini-grid in the Kaputa District. Jatropha is currently the most commonly produced biofuel with 6,000 hectares. Approximately 84 million litres of bio-diesel and 43 million litres of bio-ethanol are required per annum to allow for 20% blending. Total electricity generation capacity from biomass is estimated at 500 MW, of which 447MW from agricultural waste.

The country enjoys between 2000 and 3000 hours of sunshine per year. Annual PV sales are in the range of US$ 2-3 million. 70% is financed by donors. As regards rural electrification, systems have already been installed in at least 250 schools and buildings of traditional authorities as well as 400 households under the ESCO pilot project.

The Rural Electrification Authority (REA) is developing a 60 kW solar mini-grid to supply a community of approximately 50 households in Samfya district of Luapula Province.

Wind speeds remain low with an average of 2.5 m/s which is only suitable for mechanical applications such as water pumping. The Western Province has nonetheless areas with wind speeds of 6 m/s. The Government has plans to develop a wind atlas to identify potential areas.

Zambia has more than 80 hot springs, 35 of which are suitable to produce energy. At present, there is only one small-scale 240 kW pilot-project that was developed with the support of Italy in 1987. The construction of a 2 MW geothermal plant in Kapisya is being considered.

Institutions	Role/Information
Ministry of Energy and Water (MEWD)	Promotion and management of sustainable development in the water and energy sector
Energy Regulation Board (ERB)	Regulation of the energy sector (e.g. tariff setting, issuing licenses, standards)
Rural Electrification Authority	Management of Zambia's rural electrification scheme.
Zambia Electricity Supply Company Ltd. (ZESCO)	Vertically integrated state owned company responsible for power generation, transmission and distribution. Privatisation and unbundling was initiated in 2005.
Central African Power Corporation (CAPC)	Jointly owned by Zambia and Zimbabwe, operating the Kariba hydropower complex
Office for Promotion of Private Power Investors	Promotion of private sector involvement in the power sector through re-regulation
Zambia Development Agency	Stimulation of investments and exports
Private operators	Copperbelt Energy Corp. (CEC), Lusemfwa Hydropower Comp. (LHPC), North Western Energy Corp. (NWEC), Zengamina Power Comp. (ZPC), Lunzua Power Authority
Donors	UNIDO, World Bank, JICA, SIDA

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