



RENEWABLE ENERGY IN AFRICA:

An opportunity in a time of crisis

Botswana

State of electricity

Botswana imports most of its electricity requirements from the Southern Africa Power Pool, which is highly dependent on supplies from South Africa. Botswana's domestic electricity supply is dominated by coal (79% of the installed capacity) followed by diesel generators. Renewable energy technology in the form of solar photovoltaic (PV) installations accounts for 0.1% of installed electricity capacity. In August 2019, the Government of Botswana issued a Request for Qualifications to identify suitable developers for two solar PV projects of 50 MW each, with the intention that these projects would be built, owned and operated by independent power producers. There was no update on this process as at January 2020.

The overall electricity sources and amounts are:

Energy source	MW
Coal	732
Diesel	195
Solar	1
Total installed capacity	927

Electricity access is estimated at 57.3% of the total population with urban communities, on average, enjoying access at a rate of 69% as compared with a rate of 31.6% in rural areas.¹ This leaves nearly 1 million people without access to electricity.

Resources for electricity generation

A UN statistical database on energy statistics in Botswana indicates that the demand for energy has been increasing continuously since 2009.² In terms of wind and bioenergy, moderately low to normal breeze speeds (2 - 3 m/s) confine wind applications to water pumping. The use of cow dung to generate biogas is not viable mainly because the grazing and animal husbandry practices, which are characterised by high levels of roaming, are not conducive to the efficient utilisation of cow dung.

The country has largely unexploited coal reserves of around 212 billion tons and there are projects underway to further utilize the country's coal through the harvesting of coal-bed methane. Botswana has a relatively high (for sub-Saharan Africa) electrification rate, and power demand has plateaued,

¹ <https://www.iea.org/sdg/electricity/>, data from the International Energy Agency, 2018. *World Energy Outlook*. Paris: International Energy Agency.

² Prasad, J. and Samikannu, R., 2018. Barriers to implementation of smart grids and virtual power plant in sub-saharan region—focus Botswana. *Energy Reports*, 4, pp.119-128. Retrieved from <https://www.sciencedirect.com/science/article/pii/S2352484717301439>



sitting at 610 MW for 2015, 2016 and 2017. Because of ongoing technical issues at the largest coal power plant, Morupule B, only a portion (approximately 450 MW of 600 MW) of its installed capacity is available to produce power, though this had reportedly started improving in in 2018.³ Botswana relies heavily on power from expensive back-up diesel plants and electricity imports (around 23%) from the Southern Africa Power Pool (SAPP).^{4,5}

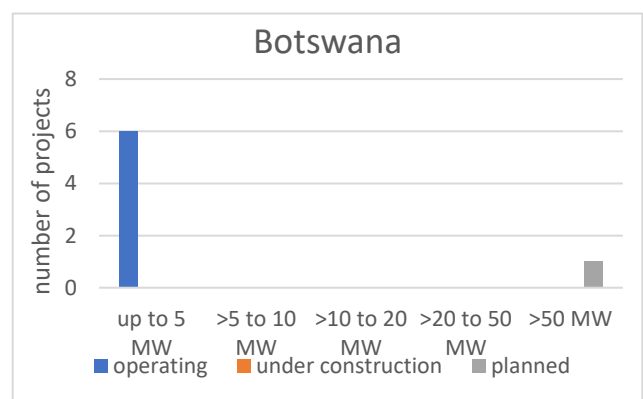
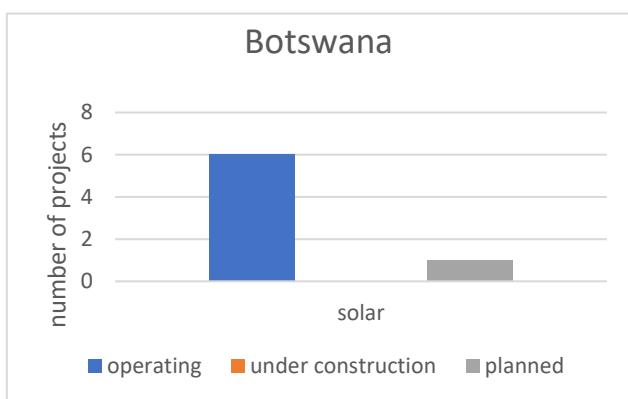
Relevant renewable energy policy, potential and ambition

The Botswana government is working with the World Bank to develop a national renewable energy strategy. This is expected to focus largely on solar energy and the financing of renewable energy projects. The Renewable Energy Roadmap⁶ presented in August 2018 includes utility plants, grid-tied mini-grids and off-grid mini-grids of 100 MW (2 x 50 MW) of solar PV currently in procurement, 12 grid connected PV plants with capacity ranging between 1 MW and 5 MW, and 20 solar PV off-grid projects for remote villages at the inception stage at the time of publishing. The graphs below show some of the plans for Botswana to extend their supply of renewable energy, with a particular focus on solar.

Bloomberg analysts consider the two open tenders for a 100 MW solar plant and 20 small hybrid off-grid plants to be somewhat ambitious in terms of scale, both because they will represent almost 10% of the total installed capacity of the country in a single project, and because the size of the tenders are a first for the country. The only operational renewable project is 1.3 MW. Previous experiences raise questions about the reliability of the process: a tender in 2015 failed to move forward after attracting 118 bids.⁵

Renewable energy projects

Botswana has no large renewable energy power plants connected to the national electricity supply grid. In October 2017, Tobela Solar Power, a subsidiary of the private company Kgalagadi Resource Development Company, trading as Solar Power in Botswana, signed a power purchase agreement to supply electricity from a 1 MW solar operation located in Tobela village near Shoshong.



Distribution of renewable energy projects in Botswana by technology and scale, by stage of development ('operating', 'under construction', or 'planned'). Source: Authors' estimates from African Energy Live database, September 2019.

³ <http://botswanaenergy.blogspot.com/2017/11/>

⁴ <https://www.usaid.gov/powerafrica/botswana>

⁵ <http://global-climatescope.org/results/BW>

⁶ Map of renewable energy projects, from a Botswana Power Corporation presentation at the Botswana-China Business Forum, August 2018. (Source: https://www.gobotswana.com/sites/default/files/china_mission_bpc_presentation_27_august_2018.pdf)



Off-grid

Botswana Power Corporation (BPC), the country's public utility, commissioned a project to implement 20 solar PV off-grid installations in isolated rural villages, starting in 2018. There was no readily available update on this project at the time of publishing this report. This project had been planned as a public private partnership and its outcomes may bring interesting insights for similar future projects.⁷

Botswana's first bidirectional grid-connected project was installed in 2016 when the University of Botswana built a 20 kW experimental solar operation in Mokolodi village just outside Gaborone, with the first component being a 5 kW system on the roof of the village clinic. Excess solar energy is fed into the BPC grid and, on days with little solar power generation, BPC supplies most of the electricity for the Clinic's operation.

The eco-tourism industry installed in the region of 1-2 MW capacity of off-grid solar, mainly around the Okavango Delta. Wilderness camps have done particularly well, installing 500 MW of photovoltaics. Chobe Safari Lodge uses solar-powered boats and electric game vehicles.

Government installed solar water heaters in all public institutions (schools and universities, hospitals, police and government housing and military camps), but these have suffered a high rate of failure. The Solar Industries Association Botswana suggests that this high failure rate is due to a lack of standards, incorrect technology, the absence of an adequate procurement framework resulting in a higher risk of procuring poor quality products and poor maintenance.

Local market

Botswana has a large unskilled workforce and unemployment rate of around 40%. Local manufacturing of solar water heaters and solar PV was not in evidence at the end of 2018. Energy theft is a problem, for example, at a well-known PV project in Pakhalane, Gaborone in Botswana, six panels were stolen from the facility and large amounts of grounding cables were stolen for their copper value, thus making the facility unusable. Theft of equipment, including of batteries for solar-powered equipment deployed in remote sites, is a problem according to the Botswana Communications Regulatory Authority (BOCRA) 2018 Annual Report.

Intervention

Botswana's slow uptake of renewable energy is explained by a lack of regulations supporting independent renewable energy production, the low and subsidised cost of largely coal-generated electricity in Botswana, and the absence of renewable energy incentives. Lack of experience with renewable energy, both on- and off-grid, is considered to be one of the biggest constraints to renewable energy uptake.⁸

Independent experts voice concerns about prospects for the growth of a local market for renewable technologies. Bankable projects are limited and primarily focus on larger-scale, on-grid solutions. The Renewable Energy Feed in Tariff (REFIT) framework is only applicable to small scale IPPs of under 5 MW. The solar PV market is limited, and standards have yet to be applied to ensure that quality technologies are being sold. In 2018, an Austrian Development Agency-led assessment stated that in light of these market

⁷ https://www.entwicklung.at/fileadmin/user_upload/Dokumente/Regionen/Volume_II_Market_Landscape_-_Study_-_EEP-SEA_CountryProfiles_StakeholderMaps-1.pdf

⁸ https://www.usaid.gov/sites/default/files/documents/1860/Botswana_-_November_2018_Country_Fact_Sheet.pdf



limitations, there may be need for more in-depth study to identify potentials to stimulate the renewable energy technology markets in Botswana.

Botswana, much like other sub-Saharan countries, has an import duty exemption on all equipment and machinery, a category that includes solar panels, inverters and other parts. The manufacturing investment incentive is a broad policy that was brought in to bolster the manufacturing sector. The incentives make no special provisions for the renewables industry.

There is offtaker risk, the risk of not getting paid for electricity produced, as BPC has historically run at a considerable loss and only made a profit once in the last ten financial years. In recent years, BPC has managed to reduce its losses. Botswana has little currency risk – the pula has strengthened to the dollar by 33% over the last seven years. While the environment for private renewable energy rollout is not outstanding, these are indications that it may be improving.

A solar energy trade organisation, the Solar Industries Association of Botswana (SIAB), has been established to promote the wide-scale use of solar energy. The group serves as a liaison between government, solar industries, academic institutes, and other groups working in the solar energy field in the country. The Clean Energy Research Centre (CERC) was established by the University of Botswana to advance interdisciplinary research, education, and advocacy for renewable and sustainable energy. CERC is involved in research, teaching, and advocacy in the areas of renewable energy and energy efficiency with a view to preserving the environment. The centre operates the solar research project at Mokolodi and is the local partner for the SOLTRAIN solar hot-water initiative in Botswana.

Visit the report webpage at <https://350africa.org/renewable-energy-report>.