



Mini-Grid Policy Toolkit- Case Study



Country: UGANDA

Project: Kisiizi Hydroelectric Mini-grid

Hybrid Operator Model

Project Summary

The regulatory environment in Uganda that supports private power suppliers and a Public Private Partnership (PPP) programme is in place to assist them in developing projects. In this case study, a hospital used electricity from its own hydro plant for many years. Through the combination of the Government support programme and private equity, the hospital upgraded the plant and constructed a mini-grid to supply electricity to the neighbouring village. The project used a private owner-operator business model, with major financing through a public grant. This case study demonstrates how the private sector can leverage existing government funds to run a successful off-grid energy system when the regulatory framework supports isolated electricity generation and a public financial support programme exists.

Background

Ugandans, like their neighbours across East Africa, have limited access to electricity. Currently only about 12% of the total population is connected to the grid, with rural areas at only 6%.

During the early 1900s a rural Ugandan flax mill harnessed a nearby waterfall on the Rushoma river to power its generator. In the 1950s the mill was converted into the Kisiizi hospital. By 2009, with financial support from the national rural electrification programme, the system had been expanded into a mini-grid consisting of two hydroelectric turbines that run independently and one standby diesel generator set.

The mini-grid is owned and operated by Kisiizi Hospital Power Ltd (KHPL) as an independent company. The mini-grid provides a 24-hour electricity supply to the hospital plus more than 300 nearby households connected to the grid.

Basic Information

Location Kisiizi, Rukungiri District, Southwestern Uganda
Project Kisiizi Hospital Power Ltd – Joint Venture between Kisiizi Hospital and C.O.U.





implementer	North Kigezi Diocese (The Church of Uganda)
Project date	1984 (initial mini-grid with smaller turbine); May 2009 (commissioning of larger second turbine)
Beneficiaries	Over 300 connections (hospital and surrounding households), serving approximately 2,500 people
Project cost	UGX 1,750 million (USD 900,000 in 2009)

Policy & Regulatory Framework

The Government of Uganda, through the Ministry of Energy and Mineral Development's (MEMD) Electricity Act 1999, enabled private sector participation in the electricity sector and established the Electricity Regulatory Authority (ERA). Building on these acts, in 2007 a Renewable Energy Policy was developed that seeks to increase the use of renewable energy.

Under the Renewable Energy Policy, the Government instituted regulatory support in the form of Standardised Power Purchase Agreements (SPPAs) to streamline and standardize independent power production for single off-takers, and feed-in tariffs (FiTs) to guarantee a buyer and a price for independently supplied grid power. In 2012, the FiT was revised, and now Uganda is being supported under the GET-FiT programme funded by the German Development Bank (KfW) and the World Bank. The Implementation of the GET-FiT is expected to:

- Enhance the overall enabling environment for private investments in renewable energy through improvements in the renewable FiT system and its application;
- Help stabilize Ugandan power sector finances by adding least-cost generation capacity;
- Clearly define the license exemption procedure for small-scale off-grid projects by ERA (which can be still very time-consuming).

Although this particular case study, as an off-grid mini-grid, does not qualify for either SPPA or FiT support, these are important facets of an overall national energy framework and will become specifically relevant to Kisiiza should the grid arrive in that location.

The Ugandan Government has also provided a Rural Electrification Strategy and Plan for the years 2002-2012 and now 2013-2022. Under this plan, the Energy for Rural Transformation (ERT) programme, starting in 2002, was specifically focused on increasing rural energy access from 1% to 10% through a combination of grid extension, mini-grids, and solar home system programmes.

The GIZ Promotion of Renewable Energy and Energy Efficiency Programme (GIZ PREEEP) offers support to the MEMD in developing skills and resources in the fields of energy policy, disseminating modern biomass energy technologies, promoting energy efficiency, and rural electrification.

The Uganda National Grid extended its distribution system into the area of the Kisiizi mini-grid during 2011 and there is the possibility of linking to it in the future. Currently there is no specific regulatory provision for connection of an existing mini-grid to the national grid.



Technology

Overview

The Kisiizi mini-grid uses hydroelectric technology. It was built in 1984 with a 60 kVA Gilkes Turgo hydro turbine that generated just enough power for the hospital. In 2009 a 294 kVA Ossberger crossflow turbine was commissioned, raising the power output significantly. An 80 kVA standby generator is present and is only utilized as backup to the hospital during the dry season when there is reduced flow from the river and no turbines are running.

Technology Approach

At the site, a sluice gate controls the flow of water into an 80m long channel that carries water to the two penstocks, with a wider channel supplying flow to the larger turbine. An arrangement of sluice gates permits different combinations of turbine operations. Power is independently generated from the two turbines with the Ossberger turbine being the main source while the smaller Turgo turbine acts as a backup, providing enough power for the hospital. Due to different turbine rotation speeds, the two turbines cannot work at the same time. There is currently no provision for synchronizing their two outputs. However the Ossberger is equipped to synchronize with the Uganda national grid in the future.

Power is distributed 8 km towards Nyarushanje community and 2 km to Upper Kisiizi community. There is a 315 kVA step up transformer at the turbine house which takes the voltage to 11,000 volts. Power then passes through an auto-recloser, which disconnects these 11 kV lines in the event of a fault. Power to the hospital, which is situated close to the turbine house, is distributed at 415 V by an underground cable. Eight 50 kVA and two 25 kVA transformers step the voltage down for local distribution to customers.

The majority of customers use single-phase power, while small businesses such as wood workshops, grinding mills, and battery charging outlets use three-phase. Currently the system is running at full capacity, and some shortfalls during the dry season are expected, especially as the hospital load is increasing, with new appliances and buildings planned. During the dry season, as water flow drops, the larger turbine must run on reduced capacity, although the smaller can run at full power throughout the year. An “OWL” three phase monitor tracks electricity usage online.

Operator Model

Ownership and operations

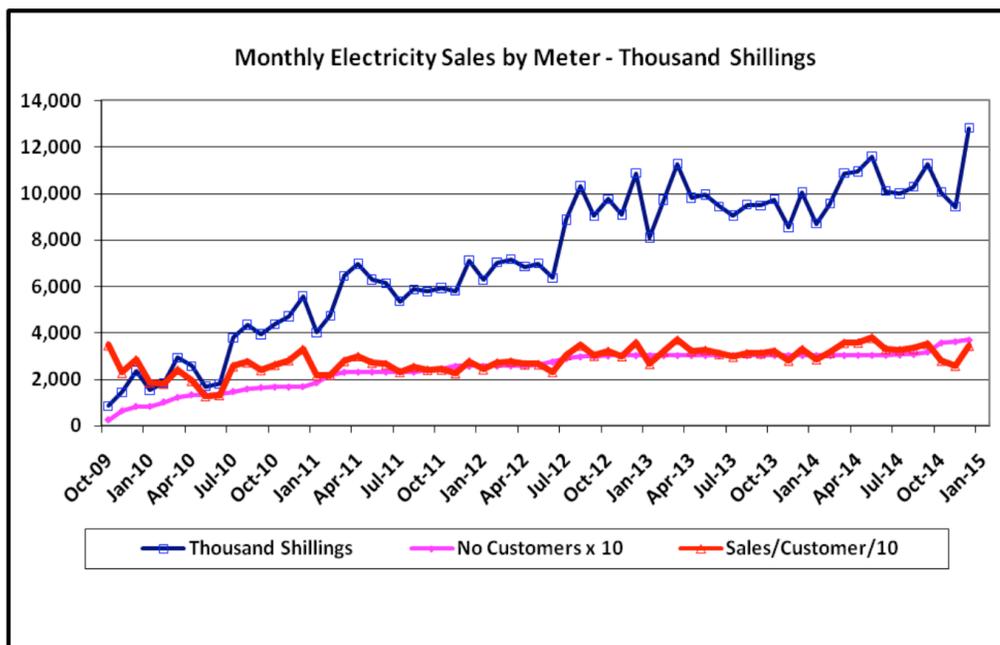
The Kisiizi mini-grid uses a hybrid operator model. Kisiizi Hospital Power Ltd, a JV between the Kisiizi Hospital and the C.O.U. North Kigezi Diocese (The Church of Uganda), owns and operates the system. The total project cost was approximately USD 900,000, of which 75% was on the power generation system and 25% on the distribution system. It was funded using 30% equity and a 70% grant from the World Bank through the Energy for Rural Transformation (ERT) programme.



Pricing and Tariffs

The additional 294 kW hydro turbine and generator were installed for about USD 2,300 per kW, which is reasonable by international standards. Tariffs are not disclosed but are subsidized through the grant for the equipment.

Until 2012 the hospital had provided power free to its own staff, but found that usage was very high. However, a new policy was implemented by which hospital staff received a set amount of power each month for free, above which it is charged at a discount.



Monthly power sales (source: Kisiizi Hospital Power Ltd. December 2014 Annual Report)

Power customers of the mini-grid pay, on average, UGX 25,000 monthly (USD 10); in 2012 the power company collected UGX 135 million (USD 52,000) gross in from power sales, off-taker sales, and new customer connection fees.

Lessons Learned

- ✓ The sustainability of a privately owned and operated mini-grid is affected by its role in the host community. In the case of Kisiizi Hospital Power, it is closely affiliated with a non-profit, community and church oriented hospital, and as such may not have a profit concern (although it does need to cover expenses). The company has had to adjust more lenient policies, such as provision of free electricity to hospital staff, after this was found to be depleting the system's resources.
- ✓ Due to capacity constraints, the Kisiizi mini-grid is not able to handle new customer requests,



which has created a less optimal avenue for the resale of power by the already connected customers.

- ✓ During earlier stages, when new customers were being connected, some in the community were unwilling to pay full connection fees and chose instead to either go without power or to buy it on resale from their neighbours.