



WIND-SOLAR HYBRID MINI-GRIDS AND WIND ENERGY DEVELOPMENTS IN KARAMOJA, UGANDA

SITE VISIT REPORT



Prepared by:

Mbaine Benard

Chairman – Wind Power Association of Uganda (WPAU), P.O Box 27475, Kampala
Email: infowpaul@gmail.com/benardmbaine1992@gmail.com, Tel: +256777838002

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INTRODUCTION

Overview

Uganda is still very low with over 70% of the population still in the outskirts of this energy mix. The current total installed generation capacity stands at just over 1.1GW which is partitioned among hydro, thermal, cogeneration and solar. But this is not enough to cater for the growing energy demand in Uganda, the annual energy demand growth as per the national energy sector development plan 2015 report stands at 10% per annum which calls for more investment and innovation in the sector.

It is evident that wind energy is yet to play a role in Uganda's electricity sector; however it has shown a slow growth past. This is largely due to the many misleading sources that rule out the feasibility of wind energy potential which is not the case. The government through the Ministry of Energy has shown interest in the sector and has since carried out a feasibility study in the districts Kotido & Napak. The proposed first grid connected 20MW wind power plant has also been licensed by Electricity Regulatory Authority and is expected to start construction by mid 2021, following the feasibility study which showed high wind potential of about 6-7m/s which is sufficient for wind energy generation. Our neighbour country Kenya shows in the northern part how logistic questions and maintenance of turbines can be organized, this is based on their recently completed 310 MW Wind Power project in the Turkana region which is also one of Africa's biggest wind projects.

The second priority of the Energy and Mineral Development Sector Development Plan (EMDSDP) medium term goals is to increase access to modern energy services through electrification and renewable energy development. This is in line with Uganda's vision 2040 which focuses on establishing a transformed modern and prosperous society. We believe for this to occur, energy has to be the centre piece that enables Ugandans to do work and be productive.

So far, wind energy in Uganda has majorly been harnessed through windmill projects such as in Karamoja where more than 20 Kijito wind powered water pumps have already been installed by various parties such as NGOs, churches and government. This was so as to enable the locals in this region have easy access to water since it is a semi-arid region with only 2 rainy seasons and an intense hot and dry season from October to April. This further displays the other productive uses of harnessing wind energy as a resource and the need to build capacity in this sector

About WPAU

Wind Power Association of Uganda (WPAU) is a not-for-profit Civil Society Organization formed as a national platform to bring together various stakeholders so as to promote sustainable development of Wind Power Technology in Uganda.

WPAU was incorporated in Uganda in 2016 as a company limited by guarantee and has currently over 15 members both companies and individuals. WPAU is also a member of Uganda National Renewable Energy and Energy Efficiency Alliance (UNREEEA).

WPAU's mission is "to contribute to the global development and sound management of wind power resources for sustainable access energy and improved social economic progress."

WPAU aims at various aspects which among others include; Building capacity of members through trainings, networking, partnerships and other knowledge exchange programmes, Research and development in new wind power technologies and innovations, Developing a platform for advisory and advocacy roles to government and private sector on behalf of wind power stakeholders, Promoting and supporting the development and management wind power resources in Uganda, To initiate, conduct and support various programs aimed at promoting the use of wind power technology and services, and To Promote, support and participate in the enforcement of quality standards of wind power technology and services.

Back ground

The Ministry of Energy in 2018 piloted 3 small wind-solar hybrid mini-grid systems of 2kW each in different locations i.e. one system in Kacheri T.C in Kotido District, one system in Lokopol T.C in Napak District all in Karamoja region and one in Lufudu, Namayingo District; these were mainly aimed at understanding the available wind potential for small scale generation of electricity, as well as demonstrating the use and application of wind power technology to generate electricity for off-grid households and communities in order to promote wind power technology in Uganda.

This project was funded by the Ministry of Energy and implemented by the Renewable energy department. The project components mainly included; feasibility study and Design, procurement of equipments, installation, commissioning and Monitoring. The procurement, installation and commissioning of the project equipment was done by Power Trust Company under the supervision of the representatives from the Renewable energy department, Ministry of energy.

This project was a follow up of the first project in which the Ministry of Energy had installed seven 1kW wind turbines in different schools in several parts of the country in 2014/2015.

WPAU and Electricity Regulatory Authority (ERA), a Government entity under the Ministry of energy mandated to regulate the electricity sector in Uganda planned a joint visit to one of the installed mini-grids in Napak, Karamoja in order to monitor and understand the current status of the operation of the said project. The visit to Lokopo site was conducted on 25th 11/2020 and was attended by Mr. Benard Mbaine the chairman of WPAU and Mr. Albert Kasoba from ERA. Remote interviews were also conducted on phone with the caretakers of the Kacheri and Lufudu mini-grids.

FINDINGS

Lokopo Site in Napak District

The mini-grid is located in Lokopo Trading centres in Lokopo Sub-county, Napak District which is about 14km off Soroti-Moroto road at Matanyi junction. It's approximately 25-30 minutes drive from Matany junction. Site coordinate: WGS84 36N 649587E, 274271N.

The system was commissioned in 2018 mainly to provide electricity to the community of Lokopo trading centre for basic electricity purposes like internal lighting, security and street lighting, charging, among others. The system was connected to a total of 200 lights (5W each) and other sockets provisions in selected areas that are utilised by the community for charging and such related functions; this is equivalent to approximately 80 households.

The system is mainly composed of one 1kW 3 blade horizontal axis wind turbine, four 250Wp PV Panels, wind s-solar hybrid controller, 2kVA Inverter, Battery system, distribution cables, internal and external wiring in houses and lights.

We were informed that the system stopped functioning in April 2019, allegedly due to failure of the inverter (the inverter ice got damaged), since then the system has been idle and no attempts have been made to repair it even when communications were made to the concerned person at the Ministry of Energy.

In March 2020, one of the PV panels fell off from the stand to the ground and got shattered. This was mainly due to the strong wind that was blowing at the time.

Photos: On the left, PV panels showing one that fell off. On the right, the inverter & controller



| # | System Component | Current status | Comment |
|---|-------------------------------|--|---|
| 1 | Wind turbine | Looks to be working properly, no physical damages noticed except the generator housing cap which is seen hanging on the tail. | -There is a need for routine maintenance such as lubrication, blade cleaning, etc; this should be done regularly to prevent tear and wear of the rotating components. |
| 2 | Solar PV panels | - One PV panel fell down and got damaged; other PV panels seem to be working. - The PV panel stand and frame looks weakened and shaking. This may have been due to strong wind or may be due to people and animals that may lean on it. | - One solar PV panel needs to be replaced - The stand and frame of the panels also needs to be repaired and made stronger to withstand the wind and other forces |
| 3 | Inverter | Inverter Ice got damaged in April 2019 | -Needs to be replaced/repared |
| 4 | Charge controller | Looks to be functioning well | -Only checking and cleaning required |
| 5 | Batteries | They look to be in good condition | -Only cleaning required |
| 6 | Distribution/connection wires | Some of the connection and internal wires have been damaged either by rats biting them or even by people during house renovations | -Some wires need to be replaced |
| 7 | Lights | Most lights are still in a good condition though they look so darkened by internal and external smoke and dust which may affect their light output. | -Some bulbs need to be replaced and others cleaned. |

Kacheri site in Kotido District

Kacheri site is located at Kacheri trading centre, Kacheri Sub-county in Kotido District. The system was commissioned in 2018 and was acting as a source of electricity for lighting and domestic charging for the community in Kacheri trading centre.

The system and power house were hosted by Mr. Kilama who is the care taker of the system and was responsible maintaining the system in good condition. Mr. Kilama was also responsible for collecting some money from the community which would be used for funding the maintenance costs for the system.

Through a phone interview with the Community Development Officer (CDO) of Kacheri Sub-county and Mr. Maxwell, a Sub-county representative at the time of installation, we were informed that system is not functioning as earlier intended; He noted that the wind turbine stopped rotating and most of the distribution wires were damaged hence cutting off supply to the households. However, it was

Mr. Maxwell informed us that this damage was allegedly done by the host who selfishly decided to utilise the remaining power from the solar PV panels alone in disguise that he is not being paid any money for hosting the system.

It is also noted that the grid power will be extended in Kacheri very soon, since a 33kV line has been extended and some people have started wiring their houses preparing to receive grid power.

Lufudu Site in Namayingo District

Lufudu site is located at Lufudu landing site, at the shores of lake Victoria in Mutumba Sub-county in Namayingo District. The system was installed and commissioned in 2014 and is acting as a source of electricity for lighting and domestic charging for the fishing community at Lufudu landing site.

The system and power house are hosted of Mr. Akuku Jacob who is the care taker of the system and was responsible maintaining the system in good condition. Mr. Akuku is also responsible for collecting some money from the community for repairing and maintaining the system when need arises.

Through a phone interview with Mr. Jacob, we were informed that system components are well functioning except the wind turbine which no longer rotates and 1 battery which shows signs of not functioning well. He said that the turbine stopped working at the start of 2020 and has since not been repaired since they do not have any knowledge on how to repair it. The Ministry of Energy was notified on this matter through the concerned person.

RECOMMENDATIONS & CONCLUSION

1. A clear operation and maintenance strategy should be put in place, this should include identifying and training a locally based technical to do basic routine maintenance and troubleshooting; a team (preferably including local leaders) should also be setup to handle social aspects.
2. The solar systems should be provided with stronger stands (preferably 4 pole) well anchored in the ground to prevent them from shaking and damage from wind, animals or even humans. Fencing off the sites with barbed wire or chain link can also be used to prevent intruders into the site.

3. Installation of solar panels on movable frames with solar tracking capabilities would also be considered, this would help to maximise the solar irradiation capture throughout the whole day as well as putting panels in defence position to guard against strong winds.
4. The local community should be well sensitized about the operation of the system and the associated benefits to the community so as to promote local ownership and protection of the system components.
5. The contractor should provide a warranty of at least two years on the main system components to ensure value for money.

Photos



Photos above were taken during installation of the wind turbine at Lufudu site in 2014



Photos above show installation of cables and wires to peoples' houses in Lokopo in 2015