



MONITORING REPORT FOR ZENGAMINA Mini HYDRO SCHEME (GS355)

Project name: Zengamina Mini Hydro Scheme

Period reported: 1st July 2011 to 31st December 2012

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1 Project Description Summary

Zengamina Mini-hydro Scheme (GS355) project is a 700KW project which is located at Kalene Hills, North-Western province at a site known historically as the Zambezi Rapids about 1000 km from the capital city Lusaka with the following coordinates; 11⁰ 07' 26.27"S, 24⁰ 11' 40.76"E. The project proponent is North West Development Trust.

The project which is renewable energy mini-hydroelectric power plant generates electricity which replaces diesel electric plants at the Kalene Hills hospital, Hillwood farm and Sakeji School and provides electricity to previously unserved areas which include schools, clinics and commercial/industrial entities. The project is delivering tangible benefits to sustainable development such as improving access to energy services and increasing of the number of employment in the region.

The project is a run-of-river hydroelectric power plant on river Zambezi (a small river at the location where the project is located) that flows along granite dome, falling about 17meters over about 300 m length of rapids. The fall provided suitable slope which supported the development of a mini hydroelectric project. The rapids were chosen since the river drops 5.4metres over the 300metre distance, and the water pressure “head” is used to operate a small turbine.

The project has the following technical specifications:

- Weir of 1.5m height
- Canal (1.2m deep x 7.5m wide, 350m long)
- Penstock (1.9m diameter x 75m long)
- Tailrace (10.5m wide, water re-enters river at 1.5 m/s)
- Use cross-flow turbine
- 400v/33 kV Step-up Transformer

2 Monitoring Summary

The period of 1st July 2011 to 31st December 2012 experienced growth for the company in terms of grid expansion, with increased new connections. New residential connections did continue throughout the period and the utilisation capacity of the power plant is almost being reached.

The project has had increased and beneficial impact to the community (see Impact of Electricity Social Survey-2012.xls). The electrical power offered by the company has seen considerable rise in small businesses within the community in addition to those which have been implemented from the previous monitoring period such as irrigation system, pineapple processing, hummer mills and internet cafes. A lot of customers now have access to electricity and they use it for lighting and other home entertainment. With access to electricity, majority of them now see their standard of live having improved.

3 Total Electricity Generated

The total power demand of the grid is recorded by an Iskraemeco MT831, 3 phase multifunction meter. This meter measures the power being used on the grid, through three pairs of current and voltage transformers (one on each phase), located in the Hydro substation. This meter complies with the IEC 62952-11, IEC 62053-21 (IEC 61036), IEC 62053-22 (IEC 60687) and IEC 62053-23 (IEC 61268) standards, VDEW demands, and is manufactured in compliance with the ISO 9001 standard. Each day the output of this meter is recorded and the data entered into the company's database at the end of the month.

Metering of the customer connections is accomplished through standard electromechanical single phase or three phase meters. At the end of each month these readings are recorded by ZPL representatives and the data is entered into ZPL's database (and forms the basis of company's billing system).

All metered accounts are recorded this way, but the usage of the non-metered connections cannot be recorded and both metered and non-metered power has been used in calculating the emission reductions by the project for the period.

Within this monitoring period of July 1st, 2011 to December 31st, 2012, recorded customer usage was on average 94.10% of the overall usage on the grid and this shows that around 45.51% of the power usage is attributed to non-metered accounts.

4 Power Consumption Trends

There has been a steady increase in kWhrs consumed by the grid due to increased demand by new connections. Although during dry months, in September/October, the supply is low.

Connections for the company have risen to 356 customers, - 94.10% of which are residential connections (see excel sheet for Monthly Contracts Summary).

5 Emission Reduction

For the monitored period of 1st July 2011 to 31st December 2012, a total 2,042,490 kWh of power was consumed from the project. With an emission factor of 0.08 tCO₂/MWh, the project realised emission reduction of 1,633.99 tCO₂e as shown below;

Period	MWh	ER (tCO ₂ e)
1 st July 2010 to 31 st December 2011	638,890	511.00
1 st January 2012 to 31 st December 2012	1,403,600	1,122.00
Total	2,042,490	1,633.00

6 Sedimentation

Based on previous operating conditions, daily inspection of sedimentation on the dam was determined to be unnecessary due to inspection of the basin above the weir on a random basis which showed that sediment buildup above the weir occurred to a minor extent and it stabilised. Sedimentation changes at the bottom of the rapids (below the hydro plant) were unperceivable and not of any concern.

The dam has continued to operate and undergo scheduled maintenance during the monitoring period aimed at flushing out the sediments. In order to ensure that sedimentation does not affect the dam operation, the one sluice gate in the canal is left open continually during the dry season, thereby increasing the flow rate in the canal itself.

7 Reservoir Flushing

The design of this hydro project does not include a reservoir as such. The total land area covered by water as a result of the construction of the weir is about a hectare. Water levels in the river upstream of the weir are slightly affected for some 1,000 meters, but are well below normal historic flood levels. Thus there is little opportunity for sedimentation to occur. However, during scheduled maintenance, the reservoir is flashed.

8 Employment numbers

Zengamina Power Limited has 14 employees on a permanent at the end of the monitoring period. During the previous monitoring period, the total staff were 11, but there has been an additional staff employed.

The permanent staff are employed as operation managers, linesmen, drivers, plant operators and watchmen. These staff members have been trained on the job for the most part and are able to handle all line erection (both HV and MV) and customer connections. They also man the hydro facility and do all the emergency maintenance on the HV and MV grids. Additionally, the company hires three people on a contractual basis to read meters, deliver statements and collect payments. Part time work is given out to the community for jobs such as the annual clearing of leaves, replacement of poles, road work, meter box fabrication and repair of civil works.

9 Access to Energy Services

Access to energy services is available to anyone who lives within 30 meters of an existing MV feeder line. In some instances there are customers who want power but are located too far from a feeder line to make it economical for ZPL to service them.

Due to random location of homes it has proved expensive to provide power to a household located far away from the main grid line. However, the main centre and institutions have been provided with power and also for households who are located

within the grid lines or near such centres. Most of the customers are domestic households who account for 94.10% of the connections.

During this monitoring period, additional households who were able to afford electricity were connected. The company managed to achieve 105 new connections during this period (see excel sheet for Monthly Contracts Summary). By end of 2012, a total of 356 customers were connected to the project.



Community Meeting



Hospital Laundry

10 Livelihood of the poor in Relation to Poverty Alleviation

The presence of electricity has improved the lives of the community in many ways, such as new business establishment which creates jobs as well as income to the community.

Schools are now using extending their learning time at night due to presence of lights and this has an improvement on the academic performance.

Other community projects which benefits the locals such as hospital has now reliable electricity and they are expanding by adding new buildings. The Sakeji Mission has finished building the new kitchen/dining room which incorporates a fully electrified food processing equipment. The government has elected to establish Ikelenge as the seat of a new district and construction is poised to begin on all the government buildings and new housing.

The Nchila Wildlife irrigation program is running well and it's employing several locals and the produce from the farm is being sold to the locals at reasonable prices.

The survey report (Impact of Electricity Social Survey-2012) which was commissioned and conducted during the current monitoring shows how the community has benefited from the project and the impacts it has on the community.



Sewing machine



Chicken Rearing

11 Forward Action Requests (FARs)

In the previous monitoring period, 1 FAR was issued requesting the project proponent to carry out a survey to determine the impact of the project to the livelihood of the community. The project proponent carried the survey in the month of August and September 2012, whereby the community member, both with electricity connection and those who are yet to get connected were asked to their views on the project and how it has impacted on their lives.

The survey established that the electricity from the project has helped the community in several ways, such as; start of new business, purchase of electrical goods for use at home, lighting is used for school for extended learning, community hospital can now order new machines and stock medicine and irrigation farm are coming up which end up employing more people.