

MONITORING REPORT FOR ZENGAMINA MINI HYDRO SCHEME (GS355)



Project Name: Zengamina Mini Hydro Scheme (GS355)

Period Reported: 14th July 2007 to 30th June 2010

Project Emission Reduction for the Period: 1,064.45 tCO₂e

Prepared by: Ross Ferguson, General Manager of Zengamina Power Limited

1 Project 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. The project proponent is North West Development Trust. The project site is situated 1000 km from the capital city Lusaka with exact location as 11° 07' 26.27"S, 24° 11' 40.76"E.

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 hydro electric 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
- 35 km 33 kV line is expected to be constructed

2 Project Objectives vs. Actual Progress

On July 14th, 2007 the Zambezi Rapids Hydro Project (*Zengamina Mini Hydro Scheme - GS355*) was officially opened. This event saw the completion of most of the civil and engineering work at the generation site and 6.5 kms of 33 kV High Voltage (HV) line to Kalene Mission Hospital. The North Western Zambia Development Trust had worked in conjunction with Mwinilunga Ventures to construct the hydroelectric facility, and then in October 2007 the management of the project was handed over to Zengamina Power Limited (ZPL), formed by the Trust for the purpose of managing the project as a utility company.

At the time of this handover, work was also in progress to extend the HV grid into the surrounding area. By early 2008 the work of extending the grid had reached the small town of Ikelenge (approx. 20 kms from the Hydro.) However, in April of 2008 the company discovered that many of the poles that had been erected were badly damaged by termites. Further inspection showed that the poles were damaged due to inadequate creosote treatment. For the next 6 six months, work on the grid expansion ceased and all the poles in the grid had to be removed. Negotiations with the pole supplier, a search for additional treatment methods and logistics meant that the installation of the grid did not resume until October 2008.

Between October, 2008 and March, 2009 the company reinstalled and added a total of 30.9 kms of HV line. It had also installed transformers at Sahandu, Sakeji School and Hillwood Farm. Beginning in April, 2009 work began on the installation of transformers and Medium Voltage (MV) feeder lines into the Nyakaseya and Nkemba areas. May of 2009 saw the start of work on the transformer and MV feeder lines in Ikelenge. By October of 2009 the HV grid had expanded to include 9 transformer installations and many kilometres of MV feeder line into the Nyakaseya and Ikelenge areas (see Annex 4.) Since March of 2009, over 140 customer connections have been made, including schools, residences, small businesses and farms. Currently the company is looking for financing in order to expand the grid into other local areas to build its customer base.

The original business plan submitted to the Energy Regulation Board of Zambia, estimated a connection rate of 96 connections by the end of the first year and 166 by the end of year two. Despite the major time delay due to faulty poles, in just over two years the company has been able to provide 146 connections in the Nyakaseya and Ikelenge areas. As of the beginning of March 2009 only Kalene Mission was connected, which entailed approximately 30 connections. Therefore, in the last 6 months the company has added 116 connections. If it had not been for technical (such as the pole problem), logistical and financial struggles that the company has encountered over the last 2 years, the targets set would have easily been met in terms of connections.

Since most of ZPL's customers have been receiving power for less than 5 months, it is still too early to tell what the growth rate in individual energy consumption is likely to be. In general, the pattern has been a decrease in power consumption after the initial month, due to the customer repositioning his or her cost/benefit position. Most customers stabilize in their power consumption within a couple months, once they have ascertained what they can afford. It is unlikely that the estimates of the individual customer consumption growth rate presented in the business plan will be attained (25% in year one, 10% in year two.) There are exceptions to this rule, for instance, one customer (a school) has seen a 38% increase in power consumption since the first of April, 2009. However, this will be monitored carefully in future operations, as it is so critical for the business planning.

3 Social, Economic and Environmental Impact

It is difficult to estimate the impact of this project without a focused study being done in the area, which is beyond the financial and man power limitations of the company at present. No baseline study was done at the start of this project to accurately ascertain the income levels of the general populace, so consequently it is not possible to do a comparison. However, what is readily apparent is that there are new small business enterprises starting up as a direct result of the availability of electrical power. These businesses range from hammer mills, to welding and fabrication shops, to the supply of fresh/frozen food and drinks. Entertainment has become much more readily available due to the use of video machines and satellite receivers. Lighting has enabled families to continue reading and educational activities into the night time hours. In talking to members of the community there is also planned economic activity (especially the growing of maize as a cash crop) that is being pushed by the desire of people to be able to find the income needed to pay for power.

4 Monitoring of Electricity Generated

Following laid down monitoring plan for the project and the guidelines set out by the applicable methodology, the total amount of power generated by the project are determined using two

meters which have been installed to measure the total electricity generated. The two meters are located within the Hydro substation. One meter measures the total output of the generator and one measures the portion of the output being consumed by the grid. Both meters are accurate.

Both meters were not installed at the same time due to availability of funds and logistical problems. The meter recording the grid power consumption was installed on 18th November, 2009 and therefore, total output prior to this date has been calculated from the estimates based on the meter that reads the total generator output. This is part of the quality assurance measures put in place by the project management.

4.1 Woodward MFR 1 Meter

Total output of the generator is measured by a Woodward MFR 1 meter. This meter is part of the control computer for the generator set and measures both the power used by the turbine itself (cooling and hydraulics) and the power used on the grid. The total estimated kWhrs on this meter as of 18th November, 2009 at 16.05 was 664,728 kWhrs. These figures are arrived from actual measurements and estimation based on extrapolation based on averages for measured electricity.

However, on the 1st of October 2007 a lightning strike damaged this meter and the total kWhrs recorded were lost. For three weeks the turbine was off line while a new computer was ordered and shipped. A significant delay in locating a new computer prompted the management of ZPL to bypass the generator control computer and put the turbine back into action on 23rd October, 2007. From this date until the new control computer (with incorporated kWhr meter) was installed, no records of total kWhrs were able to be recorded. Following the installation of the new Woodward MFR 1 on 29th April 2008, recording of electricity generated again started, but due to the fact that on the date of the installation of the grid meter the figure on the Woodward was not recorded, this information is not useful in established the total kWhrs used till this date. Instead, an estimate of power consumed during the time from commissioning to the installation of the grid meter can only be done by the following method.

From September 15th to September 25th, 2007 the total kWhrs were recorded daily off the Woodward MFR 1 and the recordings were recorded in hard copy. The reading on the 15th was 37,377 kWhrs and on the 25th it was 44,746 kWhrs. This works out to an average of 736.9 kWhrs per day for that period. This is the only reliable estimate of power consumption from the period from 14th July 2007 (opening date of the Hydro) to 18th November 2009 the date on which the installation of the grid meter was completed, (*See key milestone in the table below*). During this time the load should have been relatively constant, since no connections were made during this time and the sole user was Kalene Mission. All the dates recorded above are dates taken from the station log book and both the dates and the figures presented here as recorded kWhrs are attested to be correct by Mr. Ross Ferguson, the general manager of ZPL.

Table 1: Key events on power generation

Date	Event
14/07/2007	Plant commissioned
1/10/2007	Woodward MFR 1 meter damaged by Lightning strike
23/10/2007	Generator by-pass

23/10/2007	Hydro restarted with no meter recording
29/04/2008	Installation of new MFR1 meter
28/11/2008	Last new MFR1 meter reading taken
18/11/2009	Installation of new (Iskraemeco MT831) meter
08/12/2009	Woodward MFR 1 meter damaged by Lightning strike again
30/06/2010	End of Monitored period

In summary, from the period from 14th July 2007 to 29th November, 2008, excluding 22 days from 1st October, 2007 to 23rd October, 2007 (when the turbine was out of action), the total kWhrs generated by the hydro was an estimated 196,752 kWhrs (267 days x 736.9 kWhrs/day), based on the first MFR 1 meter. The second period of 30th November 2008 to 18th November 2009, the hydro generated an estimated total of 467,975 kWh (568 days x 823.9 kWh/day) based on the reading taken for the new MFR 1 meter.

From the 30th November, 2009 recording of the total power consumes on the grid was accomplished 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. As of 30th June 2010, the meter readings are 665,830 kWhrs.

Therefore, the total kWhrs produced by the turbine up to 30th June 2010 is show below:

Meter	kWh
Estimated kWhrs (derived readings of Woodward MFR 1) prior to lightning strike.	196,752
Estimated kWhrs (derived readings of new Woodward MFR 1) prior to the installation of the Iskraemeco MT830	467,975
Meter reading on 30 th June 2010 from the Iskraemeco MT830	665,830
Total:	1,330,558

As has been noted, neither meter is fail safe. It was recently discovered that one of the CT's powering the meter was faulty and consequently power in one phase was not being recorded. It is not possible to say how long this CT has been out of action, but the net result of it not working is to reduce the total MWhrs amount by 1/3. It is likely that the CT was damaged since the beginning of the rainy season (October, 2009) and therefore the recorded MWhrs may be fairly accurate, since the inaccurate readings will only have occurred in the last one or two months. The CT has been repaired, and a daily check of the meter has been implemented.

In addition to the main grid meter, most of the connections are metered connections and a monthly database of these readings is maintained (see Annex 2 for consumption figures per customer for October 2009). However, these readings will not tally with the main meter for the following reason. ZPL's tariff structure includes a connection called a "No Meter" connection, which allows a customer to use up to 2 amps on a continual basis for a flat rate. In these cases (which are currently 30% of all connections) no accurate recording of kWhrs used by the customer is possible. Originally it was proposed that each transformer tower have a meter

to read the total demand on the transformer. However, experience on the first transformer on which this was tried, called into question the quality of the meters being used and significant variations in readings lead to the abandonment of this approach. It was felt that the most accurate and reliable method of reading the total power consumption of the whole grid was by the main grid meter at the turbine house.

5 Emission Reduction

As per the monitoring plan outlined in the PDD, the emission reduction from the project will be achieved through measurement of electricity using installed. The meter reading is done monthly and entered in a database. The database also contain a list of all connections, see annex 2.

Based on the meter reading, the total true and estimated reading for the reported period is 1,330,558 kWhrs. By multiplying this value with emission default emission factor of 0.8 tCO_{2e}/MWh, The total emission reduction from the project is **1,064.45 tCO_{2e}** for the period from 14th July 2007 to of 30th June 2010. This figure is well below the estimates calculated in the PDD, for year one and two (1,965.09 tonnes CO_{2e}).

Yearly breakdown of emission reduction is shown in the table below:

Year	Emission Reductions (tCO _{2e})
2007	86.66
2008	232.89
2009	314.49
01/01/2010 to 30/06/2010	430.41
Totals	1,064.45

There are two principle reasons for the project not being able to reach its target on emission reduction:

- i. Technical, financial and logistical problems encountered by the project – delaying construction of the grid and consequently slowing customer connections,
- ii. Overly optimistic estimations of customer demand, both in connection rates and consumption rates.

6 Sedimentation and Water Levels.

Due to the small size of the river and the low dry season flow rate, daily inspection of sedimentation was deemed unnecessary. To support this, available literature show that when the reservoir storage capacity is less than 0.1 percent of the average annual inflow, the sediment trap efficiency would be nearly zero and this is the case with the project¹.

Inspection of the basin above the weir on a random basis has shown that sediment build up above the weir has occurred to a minor degree, but has stabilized and is not continuing. This build up is not in the main flow of the river, but off to one side and has not changed over the last season.

¹ <http://www.usbr.gov/pmts/sediment/kb/ErosionAndSedimentation/chapters/Chapter8.pdf> page 4 and 9. The table on page 9 shows that under normal river erosion, by opening up sluice gates, all the sedimentation is washed down.

Sedimentation changes at the bottom of the rapids (below the hydro plant) are unperceivable and not of any concern. On the 27th to the 29th of October 2009, a shut down of the hydro plant was scheduled for maintenance purposes. During the shutdown the canal and sediment ponds were drained and it was found that the design of the weir, sluice gates and sediment ponds had contributed to there being very little sediment deposited in over 2 years of operation. This is largely due to the company practice of opening the all sluice gates during the floods and only closing them when dry season water level drop dictates. This policy has also contributed to the main river channel above the weir being free from sediment build up, since during the time of major sediment movement (the floods) much of the river's flow is free to past through the weir almost unobstructed.

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 up stream of the weir are minorly affected for some 1000 meters, but well below normal historic flood levels and there is little opportunity for sedimentation to occur¹. Please see above point for methodology for dealing with what sedimentation does occur.

8 Employment Numbers

ZPL employs 10 people on a permanent, full time basis. Of the permanent staff, all of them were employed from people living in the area serviced by the project. The permanent staff are employed as technicians, linesmen, drivers, stores keepers 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.

In addition to the permanent staff, there are currently 4 part time community representatives employed to assist in payment collection and community interface.

Annual clearing of the 35 plus kms of way leaves employs casual workers (both men and women) from the villages through which the HV and MV lines pass. Other casuals are employed on an "as needed" basis to assist in line erection of new MV and HV lines. Specific projects, such as the recent maintenance of the canal and weir, also make employment for both casual labour and semi skilled labour (such as masons.) It is estimated that in 2009, ZPL employed part time labour in excess of 25,000 man hours.

9 Access to Energy Services

Access to energy services is available to everyone that lives within 30 meters of an existing MV feeder line. However, technical realities during project implementation have shown that the project is finding it expensive to distribute the power to households. For instance there are customers who want power, but live too far from a feeder line and sometimes this make it economically hard for ZPL to service that customer. It was originally planned that houses would be located in a "cluster" pattern (based on the village model), but experience has shown that houses are in a linear or random scattered pattern, making the expense on providing power to an area much higher than expected. Additionally, the percentage of customers in a given area that are willing to purchase the power is quite low, probably in the neighbourhood of 20% of the total number of customers in an area. However, this percentage varies considerably depending on the area. For instance, in areas of government housing (like a school compound) the percentage would be almost 100%, while areas close to large institutions or commerce centres would see a figure between 30 – 50%. However, beyond

those areas the number drops back. Please see Annex 1 and 3 for further customer connection details.



Plate 1: Household with Electricity



Plate 2: Children studying



Plate 3: Household Security Light

10 Livelihood of the Poor in Relation to Poverty Alleviation

ZPL has been providing power into some areas for only a few months and still has not been able to completely expand into the entire area, making it very hard to ascertain the impact on the community at this early stage.

In addition to the employment opportunities mentioned in Section 6, there are businesses starting up that are purpose build to make use of the power available. Below is a photo of a hammer mill business that was build and is operational based entirely on the availability of electrical power.



Plate 4: Household within project boundary



Plate 5: Hammer Mill

Since the introduction of electrical power to the town of Ikelenge, two such mills have been started, where as in years previous to this, no milling services were available. Such business activities have a tickle down effect, spurring maize production and opening the way for business opportunities through the supply of agricultural chemicals and supplies. Additional businesses in the metal fabrication and food sectors have been introduced, but all on a small scale.

In the markets, battery and cell phone charging has been make easy and lighting has facilitated the extending of shop hours into the night.

The project is also serving the nearby hospital where it provides reliable power which is used to power medical equipment. The hospital is now providing the necessary medical attention and cared needed by the community without any interruption². See pictures below:



Plate 6: Kalene Mission Hospital Operation Theatre



Plate 7: Kalene Mission Hospital Incubator



Plate 8: Patient undergoing x-raying

11 Adherence to the Environmental Impact Assessment (EIA)

Significant effort has been made to reduce the projects impact on the environment. The major disruption in the environment was during the construction stage of the civil works at the hydro electric generation site. Below are two photos – one was taken at the end of construction in April 2008 and the other was taken in April 2009.

² <http://www.kalenehospital.com>



Plate 9: Plant site after Completion in April 2008.



Plate 10: During operation in April 2009

From these two photos it is clear to see that there has been much restoration of vegetation around the site and that care has been taken to make the facility esthetically pleasing. In the right hand picture the weir can be seen at the top of the photo and above this the reservoir formed by the weir. This body of water is approximately a hectare in size and as can be seen, the trees in this area have died off due to water logging. Other than this effect on the vegetation, there have been no other signs of vegetation damage either on the rapids themselves or in the river below the rapids and turbine house. The effects on fish populations have been significant and conversations with local residents has established that the small reservoir created by the weir has established breeding and feeding grounds for fish and the numbers of fish harvested in the area has increased.

Annex 1

Zengamina Power Limited - Connection Report

<i>Area</i>	<i>Tariff Category</i>	<i>Number</i>	
<i>Hillwood</i>	Community Service	1	
	Residential	3	
	Standard Commercial	1	
<i>Ikelenge</i>	Community Service	1	
	No Meter	24	
	Residential	25	
	Standard Commercial	2	
<i>Kalene</i>	Community Service	1	
	No Meter	1	
	Residential	28	
	Standard Commercial	3	
<i>Kalene High School</i>	Residential	15	
<i>Mungwayanga</i>	Standard Commercial	1	
<i>Nkemba</i>	No Meter	7	
	Residential	14	
	Standard Commercial	1	
<i>Nyakaseya</i>	No Meter	5	
	Residential	7	
<i>Sahandu</i>	No Meter	2	
	Residential	2	
	Standard Commercial	1	
<i>Sakeji</i>	Standard Commercial	1	
<i>All Connections</i>	Community Service	3	2.1%
	No Meter	39	26.7%
	Residential	94	64.4%
	Standard Commercial	10	6.8%
	Total:	146	

Annex 2

Consumption for the Month of October 2009

qryAllCustomerkWhrs

ID	Location	Area	kWhrs	MonthID	ID	Location	Area	kWhrs	MonthID
290	2531001	Ikelenge	266	200910	201	2612801	Nyakaseya	66	200910
291	2521610	Ikelenge	56	200910	214	2613501	Nyakaseya	75	200910
292	2531703	Ikelenge	0	200910	295	2613201	Nyakaseya	0	200910
307	2511601	Ikelenge	0	200910	246	2612901	Nyakaseya	0	200910
310	2510401	Ikelenge	0	200910	279	2631601	Nyakaseya	133	200910
312	2510201	Ikelenge	125	200910	207	2631301	Nyakaseya	57	200910
328	2542301	Ikelenge	0	200910	217	2600004	Nyakaseya	0	200910
329	2500003	Ikelenge	0	200910	293	2630009	Nyakaseya	0	200910
330	2500009	Ikelenge	0	200910	296	2600005	Nyakaseya	0	200910
304	2522401	Ikelenge	50	200910	301	2611402	Nyakaseya	0	200910
220	2020010	Nyakaseya	54	200910	302	2611301	Nyakaseya	56	200910
221	2020011	Nyakaseya	182	200910	303	2600017	Nyakaseya	0	200910
222	2060002	Nyakaseya	337	200910	280	2611802	Nyakaseya	0	200910
204	2030001	Nyakaseya	183	200910	237	2711701	Nyakaseya	63	200910
105	2030002	Nyakaseya	194	200910	238	2711801	Nyakaseya	112	200910
206	2030003	Nyakaseya	18	200910	239	2720101	Nyakaseya	115	200910
106	2030004	Nyakaseya	273	200910	244	2722001	Nyakaseya	151	200910
208	2030005	Nyakaseya	247	200910	245	2712101	Nyakaseya	65	200910
209	2030006	Nyakaseya	449	200910	202	2721101	Nyakaseya	163	200910
107	2030007	Nyakaseya	246	200910	259	2721201	Nyakaseya	144	200910
211	2030008	Nyakaseya	445	200910	203	2721601	Nyakaseya	0	200910
103	2040001	Nyakaseya	3260	200910	260	2712401	Nyakaseya	-1	200910
104	2040002	Nyakaseya	214	200910	251	2810501	Nyakaseya	20	200910
223	2040004	Nyakaseya	119	200910	252	2810701	Nyakaseya	44	200910
224	2040005	Nyakaseya	193	200910	253	2820701	Nyakaseya	39	200910
225	2040006	Nyakaseya	334	200910	258	2821401	Nyakaseya	269	200910
226	2040007	Nyakaseya	1	200910	205	2821001	Nyakaseya	58	200910
227	2040008	Nyakaseya	213	200910	273	2820801	Nyakaseya	415	200910
228	2040009	Nyakaseya	0	200910	294	2810201	Nyakaseya	106	200910
281	2010002	Nyakaseya	219	200910	298	2820701	Nyakaseya	-22	200910
108	2020004	Nyakaseya	146	200910	299	2821202	Nyakaseya	65	200910
110	2040003	Nyakaseya	201	200910	320	2821201	Nyakaseya	36	200910
247	2050001	Nyakaseya	306	200910	306	2820802	Nyakaseya	112	200910
249	2050003	Nyakaseya	255	200910	323	2810602	Nyakaseya	78	200910
250	2050004	Nyakaseya	98	200910	100	2020001	Nyakaseya	5545	200910
233	2611201	Nyakaseka	126	200910	112	2310001	Ikelenge	2930	200910
235	2611501	Nyakaseya	47	200910	102	2010001	Nyakaseya	1448	200910
241	2611701	Nyakaseya	97	200910	212	2020002	Nyakaseya	1	200910
242	2612101	Nyakaseya	76	200910	218	2020008	Nyakaseya	127	200910
243	2621401	Nyakaseya	62	200910	219	2020009	Nyakaseya	173	200910
240	2611401	Nyakaseya	59	200910	313	2100002	Ikelenge	135	200910
274	2612401	Nyakaseya	27	200910	311	2121701	Ikelenge	126	200910
284	2611601	Nyakaseya	72	200910	316	2110501	Ikelenge	0	200910
300	2612102	Nyakaseya	0	200910	254	2521503	Ikelenge	88	200910

255	2521202	Ikelenge	78	200910
256	2521001	Ikelenge	227	200910
257	2522101	Ikelenge	54	200910
261	2520505	Ikelenge	130	200910
262	2520601	Ikelenge	117	200910
263	2511301	Ikelenge	0	200910
264	2532302	Ikelenge	0	200910
265	2511304	Ikelenge	68	200910
266	2511305	Ikelenge	0	200910
267	2520606	Ikelenge	141	200910
268	2532004	Ikelenge	0	200910
269	2510101	Ikelenge	0	200910
270	2511401	Ikelenge	807	200910
271	2511502	Ikelenge	478	200910
272	2511402	Ikelenge	93	200910
276	2520901	Ikelenge	100	200910
113	2521401	Ikelenge	237	200910
282	2540701	Ikelenge	120	200910
287	2521107	Ikelenge	45	200910
288	2520808	Ikelenge	119	200910
236	2510301	Ikelenge	209	200910
278	2521901	Ikelenge	154	200910
283	2532303	Ikelenge	0	200910
285	2531101	Ikelenge	128	200910
286	2532202	Ikelenge	0	200910
111	2410001	Ikelenge	3245	200910
229	2420001	Ikelenge	215	200910
230	2420002	Ikelenge	18	200910
231	2420003	Ikelenge	0	200910
232	2420004	Ikelenge	508	200910

Annex 3

ZPL - All Connections

<i>Area</i>	<i>Village</i>	<i>Connection Date</i>	<i>Name</i>	<i>Institution Name</i>	<i>Service Type</i>
Ikelenge					
	<i>Catholic Mission</i>				
		11-Jun-09	Werner Iten	Catholic Mission - Mill	3
		12-Jun-09	Senior Sister	Sacred Heart Deaf School	2
		18-Jun-09	Werner Iten	Catholic Mission, Franciscan Fathers	2
	<i>Chimbila</i>				
		27-Aug-09	Weston Chilenge		1
		27-Aug-09	Richard Katumoya		1
		11-Sep-09	Jimmy Chilengi		1
	<i>Hillwood Farm</i>				
		01-Apr-09	Paul Fisher	Hillwood Children's Home	5
		02-Apr-09	Peter Fisher	Nchila Wildlife Reserve	3
		11-Apr-09	Helen Finney		2
		11-Apr-09	Esther Townsend		2
		13-Apr-09	Ross Ferguson		2
	<i>Ikelenge</i>				
		17-Aug-09	Stephen Kateule		2
		21-Aug-09	Sandra Mbaulu	Catholic Rental	2
		08-Sep-09	Paul Ntambu		1
		23-Oct-09	Arnold Makuya		1
	<i>Ikelenge Central</i>				
		04-Sep-09	Margaret Kapita		2
		08-Sep-09	Fridah Mupepe Chu		2
		10-Sep-09	Annie Kaleji		1
		16-Sep-09	Amon Mupila		1
		03-Oct-09	Yoram Nyendwa		1
		12-Oct-09	Elijah Chimwanga		2
		12-Oct-09	Bernard and Joyce		2
		12-Oct-09	Winstone Hachibi		2
		26-Oct-09	Rennox Mbewe		1
	<i>Ikelenge High School</i>				
		09-Jun-09	Cletus Mwandwe		2
		30-Jun-09	Robson Kambele		2
		30-Jun-09	Remmingtone Chik		2

(Service Types: 1-No meter, 2-Residential, 3-Standard Commercial, 5-Community Service)

<i>Area</i>	<i>Village</i>	<i>Connection Date</i>	<i>Name</i>	<i>Institution Name</i>	<i>Service Type</i>
		30-Jun-09	Mercy Kanyama		2
		30-Jun-09	Jacob Kayeyi		2
		03-Jul-09	Francis Mubambe		2
		08-Jul-09	Kafumbu Mukendi		2
		22-Jul-09	Presley Kampuyu		2
		22-Jul-09	Kino Koma		2
		17-Aug-09	Andrew Musesa		2
		18-Sep-09	Headmaster or Hea	Ikelenge High School	5
		07-Oct-09	Womba Machayi		2
		23-Oct-09	Geoffrey Petulu		1
		10-Nov-09	Harrison Kapapa		2
	<i>Ikelenge Market</i>				
		14-Aug-09	Salumayi Chilengi	Kaza-Buka Bottle Store	1
		18-Aug-09	Gideon Chipoya	Hikakehangaku Bottle Store	1
		03-Oct-09	Boaz Maidon	Chakufuma Kuluwi	1
		26-Oct-09	Kefasoni Kalosa		1
		18-Nov-09	Patrick Ntambu	Kukenga KwaNzambi	1
	<i>Kajinga</i>				
		01-Sep-09	Pastor Makangu	Kakolonga C. C. C.	1
	<i>Kameya</i>				
		22-Jul-09	Oggy Kasongo		2
		27-Jul-09	Kena Kajimili		1
		14-Sep-09	Leo Fumbelo		1
		07-Oct-09	Robert Soki		1
		07-Oct-09	Kefason Kaloza		1
		26-Oct-09	Arron Kaumba		2
	<i>Mandumbwa</i>				
		10-Sep-09	Charity Mukosayi		2
		29-Sep-09	Joseph Makina		1
	<i>Mungwayanga</i>				
		01-Oct-09	Zain Zambia	Mungwayanga Zain Tower	3
	<i>Muzeya</i>				
		14-Aug-09	Skytone Kanyungul		2
		27-Aug-09	Heavyson Chingem		1
		01-Sep-09	John Wallis		3

(Service Types: 1-No meter, 2-Residential, 3-Standard Commercial, 5-Community Service)

<i>Area</i>	<i>Village</i>	<i>Connection Date</i>	<i>Name</i>	<i>Institution Name</i>	<i>Service Type</i>
Nyakaseya	<i>Sahandu</i>	24-Apr-09	Zain Zambia	Sahandu Zain Tower	3
		01-Aug-09	Denson Kajinga		2
		05-Sep-09	Daniel Rea	Widows at Sahandu	1
		11-Sep-09	Godfrey Kakisa		2
	<i>Sakeji School</i>	02-Apr-09	Pam Ronald	Sakeji Mission School	3
	<i>Kalene Basic School</i>	24-Jun-09	Sunday Kaumba		2
		24-Jun-09	Mayumbelo Mwend		2
		01-Oct-09	Roy Kaposi		2
	<i>Kalene High School</i>	24-Jun-09	Patrick Kamau		2
		24-Jun-09	Pierson Miyoba		2
		24-Jun-09	Oliver Tulisha		2
		30-Jun-09	Brian Sankela		2
		24-Jul-09	Edward Banda		2
		22-Aug-09	Brian Kabamba		2
		22-Aug-09	Victor Sangenjo		2
		22-Aug-09	Chinyama Mungili		2
		25-Aug-09	Headmaster or Hea	Kalene Day High School	2
		07-Sep-09	Julius Kayenda		2
		24-Sep-09	Charles Chaulezo		2
		11-Nov-09	Judith Kamalondo		2
	<i>Kalene Mission</i>	01-Apr-09	Rachel Woodfield	Kalene Mission	3
		01-Apr-09	Rachel Woodfield	Kalene Mission Hospital - Staff House	2
		01-Apr-09	Bruce Podivin	CMML Flight Service	3
		01-Apr-09	Mr. Mutale		2
		01-Apr-09	Barbara Rose		2
		01-Apr-09	Rachel Woodfield	Kalene Mission Hospital	5
		01-Apr-09	Mr. Simwanza		2
		01-Apr-09	Daniel Lungu		2
		01-Apr-09	Rachel Woodfield	Kalene Mission Hospital - Daniel	2
		01-Apr-09	Alice Turner		2
		01-Apr-09	Rebecca Stitt	Kalene Mission - Guest House	2

(Service Types: 1-No meter, 2-Residential, 3-Standard Commercial, 5-Community Service)

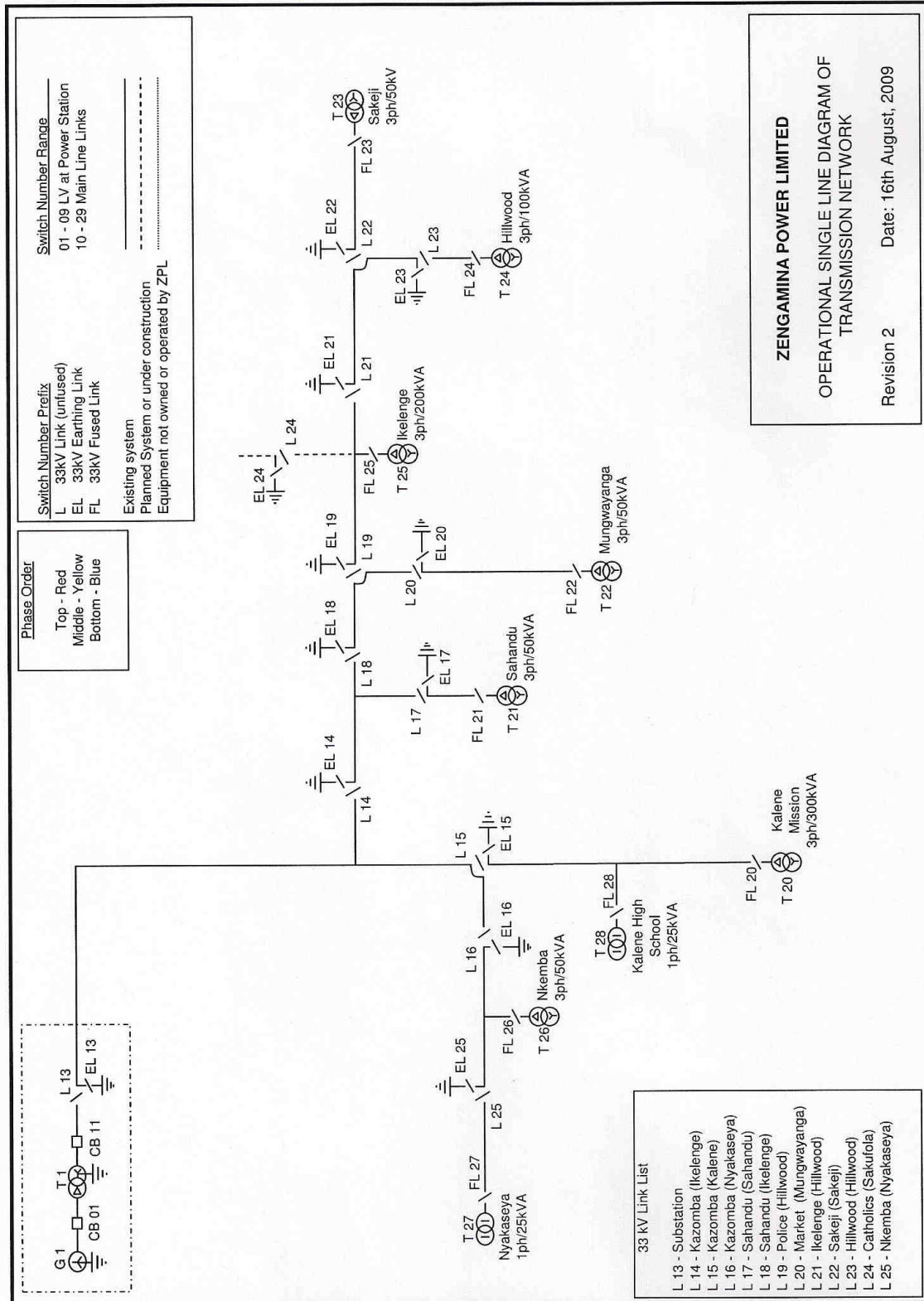
<i>Area</i>	<i>Village</i>	<i>Connection Date</i>	<i>Name</i>	<i>Institution Name</i>	<i>Service Type</i>
		01-Apr-09	John Woodfield		2
		01-Apr-09	Richard Reed		2
		01-Apr-09	Paul Hanney	Kalene Mission - Mission House	2
		01-Apr-09	George	Bamboo Cottage	2
		01-Apr-09	Thomas Phiri		2
		01-Apr-09	Isaac Kabongu		2
		01-Apr-09	Kalene Assembly	Kalene Mission Assembly	1
		01-Apr-09	Bornface Besa		2
		01-Apr-09	Ozwell Kajimana		2
		01-Apr-09	Crispine Savita		2
		01-Apr-09	James Samudata		2
		01-Apr-09	Principal Tutor	Kalene School of Nursing - Main Bloc	3
		01-Apr-09	Justine Phiri		2
		01-Apr-09	John Mundongu		2
		01-Apr-09	Clement Chipule		2
		01-Apr-09	Rachel Woodfield	Kalene Mission Hospital - Nurses	2
		01-Apr-09	Francis Muchayans		2
		01-Apr-09	Anthony Kasonde		2
		01-Apr-09	Lloyd Samantha		2
		01-Apr-09	Rachel Woodfield	Hillview House	2
		01-Apr-09	William Zulu		2
		01-Apr-09	Principal Tutor	Kalene School of Nursing - Hostel	3
		01-May-09	Aaron Banda		2
		24-May-09	Kasongu Muke		2
		24-May-09	Godfrey Mwila		2
		24-May-09	Rachel Woodfield	Mission Staff House - new section 1	2
		30-Jun-09	Annie Kafunda		2
		01-Sep-09	Starcion Kamanga		2
	<i>Kalomba</i>				
		30-Jul-09	Edson Mapapayi		2
	<i>Kayekesi</i>				
		22-May-09	Thomas Kutela		2
	<i>Mpwampu</i>				
		30-Jul-09	Chrispine Katemba		2
	<i>Munyase Market</i>				
		11-Nov-09	Starcion Kamanga		1

(Service Types: 1-No meter, 2-Residential, 3-Standard Commercial, 5-Community Service)

<i>Area</i>	<i>Village</i>	<i>Connection Date</i>	<i>Name</i>	<i>Institution Name</i>	<i>Service Type</i>
	<i>Musokola</i>				
		22-May-09	Obby Samakayi		2
		30-May-09	Maurice Musokola		2
	<i>Nkemba</i>				
		15-Apr-09	Moses Chipoya		2
		20-May-09	Ezron Muke		2
		20-May-09	Davies Kuchaya		2
		20-May-09	Isaac Kabongu	Munyase Best Lodge & Business Co	3
		22-May-09	Rodwell Muluwa		2
		22-May-09	Davison Saisada		2
		22-May-09	Sydney Nkemba	Two Ways	3
		15-Jun-09	Truman Lemba		2
		17-Jul-09	Stephen Mufwakolu		2
		18-Aug-09	Fordson Kamukusu		2
		24-Aug-09	Kennedy Kutela		1
		24-Aug-09	Patrick Chipweti		1
		31-Aug-09	Alice Muhandu		2
		01-Sep-09	Kamus Kanyampa		1
		09-Sep-09	Jane Malichi		1
		16-Sep-09	Golden Sondoyi		1
		10-Nov-09	Winford Masumba		2
		25-Nov-09	James Itenda		1
	<i>Nyakaseya</i>				
		17-May-09	Donald Kalamba		2
		20-May-09	Alexander Zaza		2
		20-May-09	John Kambanjela		2
		20-May-09	Enock Kambanjela		2
		31-May-09	Nyakaseya C.C.C.	Nyakaseya Christian Community Chur	1
		14-Jul-09	Haggai Likambi		2
		12-Aug-09	Shimo Sandumba		1
		23-Aug-09	Charles Shimo		1
	<i>Nyakaseya Basic School</i>				
		18-Sep-09	James Chipweti		1
	<i>Nyika</i>				
		18-Aug-09	Zilla Chiyuka		2

(Service Types: 1-No meter, 2-Residential, 3-Standard Commercial, 5-Community Service)

Annex 4



Anne 5

ZPL - New Customer Contracts

<i>Year</i>	<i>Month</i>	<i>Number</i>
<i>2009</i>		
	March	1
	April	50
	May	19
	June	12
	July	18
	August	20
	September	24
	October	11
	November	8
	December	14
<i>2010</i>		
	January	9
	February	3
	March	9
	April	8
	May	8
	June	14
	July	5

