

Mwenga Hydro Project Report to Tanzanian Investment Centre

November 2012

Introduction

Mwenga Hydro Ltd applied for and was awarded a TIC certificate (#120026) on the 28th April 2010 for the implementation of a 4 MW hydro electric facility, complete with an associated Rural Electrical Distribution Network feeding an estimated 2600 new rural users.

This project was initially planned to take approximately 2 years to implement, but unfortunately ran into unforeseen delays in the award of all of the necessary permits that are necessary to begin construction. The most notable delay encountered came from the Water Use Permit, which took approximately one year longer to award than originally forecast. This delay arose from the repeal of the then existing Water Act, and the subsequent replacement with a new Act, which unfortunately was issued without the associated Regulations – which we had to wait for, and took 13 months for the authorities to complete.

The project has since made very substantial progress in the implementation of its planned activities, completing and commissioning the hydro electric facility, and constructing the majority of the 33 kV Distribution Network. It is however yet to complete the connection of all of the planned rural customers, though the first connections have now commenced. It is anticipated that the process of connecting the planned quantity of customers will only be properly completed by the middle of 2013.

Owing to the unavoidable (more than) one year delay of the required licensing, the project would wish to respectfully request that the TIC certificate applicable to this project be extended so that it is valid up until the time in which the planned works can be completed – this being the 30th of June 2013.

Planned Activities and Corresponding Progress Made

The original submission to TIC listed some tasks that were completed whilst the TIC application process was underway.

These tasks included the following-

- Feasibility Study – Completed in August 2009
- Environmental Impact Assessment – Approval Certificate awarded at end of November 2009
- Purchase of pickup – Completed in August 2009
- Project setup – Completed with the signature of the SPPA contract with TANESCO in January 2010
- Basic Project Design – Completed in early 2010, which resulted in the project being upgraded to a 4 MW installation (up from a 3 MW previously conceptualized)

Tasks that either were ongoing at the time prior to the completion of the TIC application process, or not yet started included the following-

- **Construction and Commissioning of the 4 MW Hydro Facility -**

Site work preparation work began on site in July 2010, when a site camp was established, basic road works to site commenced and stockpiling of the necessary construction materials was begun.

We were not permitted to undertake any construction works within 200 meters of the river up until the point when we were actually awarded our Water Use Permit, which only effectively occurred in early November 2010, immediately prior to the onset of the rains.

On receipt of the Provisional Water Use Permit we fortunately managed to complete the weir foundations during the season's very short low water period, just before the 2010 - 2011 rains properly set in. This was critical to us being able to commence work on the weir itself prior to the next low water period at the end of 2011, and effectively managed to save one calendar year construction time for the river diversion wall that forms a key part of the project.

We also managed to construct a formal site office facility on our neighboring coffee estate whilst we waited for the award of the Water Use Permit, and completed the construction of this facility in November 2010.

We also used the period spent waiting for the award of the related permits to progress our loan application to the point where financial closure could be quickly obtained on presentation of the finalized permits (which included the Generation and Distribution Licenses, which could only be awarded following the Water Use Permit award). The loan facility letter was signed in July 2010, and financial closure occurred only once the necessary permits were physically obtained by the project. Additionally we used this period to make substantial progress on the completion of the turbine tender documents and procedures, and on the preparation of the electrical equipment tender documentation.

Financial closure triggered the launching of the various tender procedures, including the turbine tender, the electrical tender, the civils construction tender and the steelwork tenders. These procedures were followed by the placing of the various contracts associated with these activities.

Construction work effectively ceased during the 2010-2011 rains, due to the inaccessibility of the site by construction vehicles. Only environmental protection works continued over the rains, mainly in the form of road drainage works and grass planting operations.

The main civils contractor established site at the end of June 2011, and effectively completed his scope of works by the end of January 2012. The civil works at the power house fell behind schedule due to delays encountered in removal of a larger quantity of hard rock through blasting than had previously been expected, and through delays arising due to the onset of the rains at the end of November 2011, which hampered material deliveries to site.

Once the civils works were completed, the steelwork contractor established site and erected the power house facility. This proceeded as planned, together with the 25 ton overhead crane commissioning, and the turbine supplier then established site at the end of February 2012 to install the key generating equipment. Fortunately all of the heavy equipment had already been delivered to site by the end of November, before the rains set in, so equipment installation during the rains was actually possible.

The turbine and associated equipment were installed completely by the end of June, when a 'White Test' was performed to check that all the electrics and protection equipment was installed properly, and that it was safe to proceed to test the generating equipment.

Unfortunately the turbine testing could not be done immediately after completion of the 'White Test', as both the power line and the penstock had not yet been properly completed.

The penstock fabrication and installation began only at the end of 2011, almost 4 months behind schedule. This was as problems were encountered with the steel tender process yielding uneconomic results, requiring the cancellation of the formal tender process, and the implementation of a substitute procurement procedure – a time consuming process under the EU procurement rules that apply to this project.

The penstock delivery process was also delayed by the onset of the rains, which made delivery to site of the 10 meter long, 1.5 meter diameter, 5 ton steel pipes virtually impossible. The penstock erection work obviously suffered due to this, and only once the rains had eased off in early June 2012 could real progress be made in the installation works. Erection was complete in August 2012, at about the same time as the power line, and initial testing of the turbine facility could then begin.

TANESCO witnessed and signed off on the final commissioning of the facility, which was interconnected with the TANESCO grid for the first time on the 1st September 2012, after which commercial production began.

- **Construction of the 33 kV power lines, 400 V distribution lines, transformer erection, and final customer connections**

This second category of the projects works was specifically mentioned in the original TIC application, and so is being reported upon separately

(though has already been touched on in the hydro plant works description above)

A line route survey was undertaken at the beginning of 2010, and the position of the main 33 kV power line established, with the corner points marked with permanent concrete markers. A non invasive GPS technology was used to set up this route, so as to minimize disturbance to the people whose land we would have to traverse until a suitable compensation contract could be closed with them, and the related compensation paid.

Additionally this survey accurately established all of the power line pole support elevations and positions that would be necessary to maintain a safe working clearance of the power line to the ground all along the power line route, and proved an essential part of the power line design.

A decision was taken during 2010 that the project would not try to use 'load limiters' for the final customer connections as had been previously planned. Instead we opted to make use of the new pre paid metering technology that was now freely available in the sub region.

This decision was judged necessary for three main reasons –

- The load limiters would require substantial organizational effort to collect the payment from the final customer, who was typically located far from the central offices, and generally used only very small quantities of electricity that therefore did not justify the effort and cost required to collect this money.
- Load Limiters are prone to tampering from customers who might require a larger supply to be provided. Pre paid meters can much better (and fairly) accommodate a customer's evolving electricity needs.
- Pre paid electricity could be set up to be sold via a cellular phone delivery chain in a similar manner to cell phone airtime. Such a vending channel was ideally suited for use in a remote rural area, providing a realistic and affordable solution, which additionally removed the risk of customer non payment.

The pre paid metering was considerably more expensive, but was finally judged as the only sustainable solution for this application.

The construction contract was finalized at the end of 2010, and work began on the preparation and publication of the International Supply tender applicable to this procurement process. This tender process was completed as planned, though significant delays were seen in closing the Supply Contract applicable to the pre paid metering systems, which proved far more complex to close than originally anticipated owing to the technological complexities associated with this innovative solution.

The lands compensation evaluation exercise was completed by mid 2011, and the power line wayleave clearance begun shortly afterwards where it

was possible to do so, a process which continued to take place up until the middle of 2012 in conjunction with the then ongoing compensation payment process.

Formal construction activities started at the end of 2011 after completion of the delivery of the power line transmission poles to the various depots that were set up along the line route. The balance of the power line materials were delivered in early 2012, with the exception of the pre paid meters, which only arrived in September 2012 - unfortunately after the expiry of the TIC certificate applicable to the project.

Construction work on the main power line did not keep to the planned construction schedule, falling behind by more than 4 months. Fortunately this delay matched the delays seen by the civils and steelwork contractors, and did not have a material impact on the project.

The power line was first energized mid August 2012 by the electrical contractor, a process which was witnessed by TANESCO as part of the formal interconnection procedures.

Work currently continues on the remaining village spur power lines, and on the LV (400 Volt) distribution networks that actually supply the final customers. Several village transformers have now been energized, and we are now making steady progress on connecting our rural customer base to our pre paid metering system.

It is currently anticipated that we will complete the connection of the planned 2600 rural connections by the middle of 2013.

Financing

The actual project spend to date split into the TIC expenditure categories is as follows-

Land and Buildings	€ 808,500
Plant and Material	€ 3,947,050
Vehicles	€ 19,500
Furniture	€ 1,500
Office Equipment	€ 3,200
Insurance, Financial Charges (Interest, guarantees, etc.), Taxes	€ 565,100
Pre Project Expenditure	€ 767,650
Total	€ 6,112,500

We still expect to spend approximately € 900,000 by the end of the project as the remaining contractual payments become due.

Financing of the project has generally proceeded as planned, with 49.17% of the eligible costs of the project being met by a Grant from the European Union. The

balance of the funds required by the project either came from project equity, or from the project's commercial loan (which was secured from CRDB).

The project was also fortunate to secure some additional grant funding from the TEDAP performance grant facility that is administered by the Rural Energy Agency. Some of these funds have entered the project recently (unfortunately after purchase of all of the necessary materials had been completed), and are now being used mainly for further additional rural network expansions.

Problems and Solutions

As is usual with technologically complex projects of this nature, we encountered many problems during project implementation. The problems could be split into three general categories-

- Legislative Delays – This category proved to be the most difficult problem for the project to deal with, as the solutions to this problem lay outside of the project's control. In all, the project spent more than 15 months longer than originally anticipated acquiring all of the necessary Licenses and Permits to commence.

Some comfort can be drawn from the fact that the Mwenga Hydro project was effectively the first private mini hydro to pass through all of the required Licensing and Permit stages. As this was a new process to most of the Government Institutions concerned, more time was required for the relevant staff to become familiar with the necessary procedures than would normally be expected. Subsequent projects should enjoy a shorter processing time thanks to efforts put in by all concerned and should realistically shorten the learning curve for all who follow.

The repeal of the Water Act during the course of our Water Use Permit Application probably created the single biggest delay to the project, and the only solution that we could use here was patience.

- Capacity Delays – The project ran into several delays to its implementation due to capacity constraints of the contractors that were engaged for the various project activities.

The Civils contractor fell almost 3 months behind schedule when an unexpected amount of hard rock was encountered at the power house site, which had to be removed through a combination of controlled blasting and hand breakers. We were unable to ramp up the capacity of the rock removal team adequately when it became clear that this was required, and so lost a significant amount of time in the process.

The Electrical contractor also ran into construction capacity constraints, mainly due to commitments with a second (different) project that required some of his usual construction gangs to be used. He tried to utilize subcontractors to boost his erection speed, but this proved to be unsuccessful and in one case, counterproductive, requiring a substantial amount of rework to be performed. This capacity constraint resulted in

the power line works falling well behind schedule, and a decision was taken to concentrate efforts on the main transmission backbone at the expense of the village feeder spurs and Low Voltage distribution work, which could be done later after turbine commissioning.

The production capacity required to fabricate the steel penstock sections was badly underestimated by the Steelwork contractor, and the pipe fabrication work fell significantly behind the planned schedule. Further complicating this was the fact that the steel required for the pipe fabrication was procured later than expected due to the failure of the International Tender procedure to deliver an economically acceptable supply contract. This steel supply delay meant that the majority of the penstock deliveries would have to occur during the rains – something that proved impossible to achieve safely. The project decided to delay delivery of the majority of penstocks to site till after the 2011 – 2012 rains had completed, whilst boosting the number of fabrication teams at the contractor's premises so that lost fabrication time could be caught up.

- Technological Problems – There were several minor problems encountered during the course of the project that were relatively easily resolved through project layout changes, or redesign work. The single most significant technological problem that was encountered by the project was the development, integration and implementation of the cellular phone based pre paid electricity vending system within the existing communications infrastructure within Tanzania. This new and technologically advanced process took significantly longer to set up and commission than originally planned. We were fortunate that the communication infrastructure service providers were interested in our product and assisted the pre paid meter supplier in the set up and implementation of the same.

Future Plans

Over the course of the next 8 months we expect to concentrate on completing all of the rural electrification work associated with the connecting of approximately 2600 new rural connections within the project area.

This work will involve completion of the few remaining 33 kV supply spurs leading into those villages not located on the main line, the erection of the 'in village' 400 V distribution lines, the erection of all of the initial transformers, the installation of all of the meters into each rural customer's premises, and the subsequent commissioning of all of the above.

It is anticipated that we will have to procure at least another €200,000 worth of additional transformers and associated 400 Volt distribution network materials in order to satisfy the basic demand within the villages concerned. We expect to procure these additional materials during this coming period, and wish to use the TIC exemption procedures for this purchase.

Additionally we have been invited to consider supplying a number of neighboring villages to the project area, and may well embark on this expansion plan within the next 8 months if we can secure enough additional funding in order to do so. If this occurs, we will inform the TIC accordingly and request a change of original project scope, along with an additional TIC certificate extension.

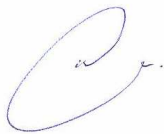
Recommendations and Comments

From the report above, it is clear that this project has been a success, and is likely to achieve its ambitious goals by the middle of 2013.

This resultant time line is approximately 14 months longer than that given in the original TIC proposal, primarily due to unforeseen delays in the issuing of the relevant Permits and Licenses by the authorities concerned.

Under the circumstances, we recommend that the TIC consider extension of the Mwenga Hydro TIC certificate #120026 till at least the end of June 2013, in order to allow completion of the project under the Certificate of Incentives as originally planned by the project.

Report submitted by



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