Kikuletwa II Small Hydro Power Project

Proposed Installed Capacity - 8.00 MW

Kikuletwa River, Kilimanjaro Region, Tanzania

Executive Summary

Kikuletwa II Small Hydro Power Project (hereafter referred to as "the Project") is a proposed run-of-the-river development on the left bank of Kikuletwa River in Hai District, Kilimanjaro region within the United Republic of Tanzania. The proposed total installed capacity for the Project is **8.0MW**, comprised of two hydro turbine generator sets of 4.0MW each. The gross head available for power generation is ~75m, and the proposed design discharge is ~14.5 cumecs. The electricity generated is to be delivered to the National Grid (Tanzania Electric Supply Co Ltd; TANESCO) via a 14 km long 66KV transmission line to the Kiyungisubstation.

The Kikuletwa II project site is located around 22 km from Moshi town in the south-westdirection. The site is around 32km from the Kilimanjaro International Airport. Kikuletwa II Power Project is sponsored and owned by Africa Power Investment Ltd (API Ltd), a registered company in Tanzania, with offices at: Ninety-Two, Shekilango Road, Plot number 9, Block F UBUNGO, PO Box 79983, Dar-es-Salaam, Tanzania. Strategic Consulting Group (SCG), a hydro power consulting firm from India has been hired as technical consultants for the project.
Tanzania has an estimated hydro power potential of around 4,700MW but only 561 MW of it has been developed so far. In the recent years, the Kilimanjaro region which comprises Moshi, Hai, Arusha, Rombo, Mwanga & Same areas has seen rapid development in economic activity as well as population growth. Given the low access to electricity, heavy dependence on fossil fuels, low installed capacity and potential available, the Kikuletwa II SHP is justified from all angles.

The river Kikuletwa originates in the south-western slopes of Mount Meru and Mount Kilimanjaro. The rivers Himo, Karanga, Weru Weru & Kware are the main tributaries of the River Kikuletwa. The river flows into the man-made reservoir called Nyumba Ya Munga and then merges into River Pangani. The Kikuletwa

River has a total catchment area of 2,280 sq.km at the Kikuletwa II Power Station intake (including the catchment of its tributaries). The region generally has two rainy seasons. A long rain season from March to May & a short rain season in November-December. Although the precipitation of the catchment is fairly distributed throughout the year substantial amount of it occurs during months of April & May.

A team of Senior Engineers from the consultants visited the site and did a preliminary reconnaissance of the project site. The principal components of the project were identified and placed on the map. Subsequently, visits were conducted for carrying out detailed topographical surveys to freeze the layout of the site and establish the feasibility of the project. The Survey sheets for the project area are 56/3, titled Sanya Chini & 56/4, titled Moshi.

From the available geological information for the site, the site is considered satisfactory for the construction of structures involved in a small hydro power project. The bearing capacity of all the proposed locations is adequate and no major problems are expected at this stage. Construction material such as aggregates, sand, boulders are available at locations near the site. The daily discharge for the Kikuletwa River for the years 1971 – 2013, was obtained from the Gauging and discharge station maintained by the Ministry of Water at the Kikuletwa I power station (1DD54). The obtained data was subjected to rearrangement and statistical analysis.
Based on the statistical analysis, the year 2004 was identified as the 75% dependable year in the data of 43 years. Based on incremental analysis for capacity, an 8.0 MW installed capacity was finalized as most economical and beneficial for the project.

The major civil structures involved in the project are:
1. A gated non-overflow weir with under-sluice gates on the river bed
2. An intake structure to collect water from the weir & direct it to the water conductor
3. A free flow water conductor system consisting of part channel & part tunnel to carry the water to the forebay
4. A surface forebay (with storage of water equivalent to 3 minutes of operation) &

penstock
5. A powerhouse at the base of the penstock to house the machines
6. Tail race pool & Channels.

The design for civil structures was carried out in accordance with civil design principles & the estimated 100 year flood value of 200 cumecs. Two horizontal axis Francis turbine-generator units of 4.0 MW each have been proposed for the project. The turbine and generating units with other associated equipment will be accommodated in a surface powerhouse on the left bank of the river. The generation voltage is proposed to be 6.6 kV. This voltage will be stepped up to 66 kV level by two generator step-up transformers, rated (5 MVA), 6.6 kV/66 kV. On the LV side, the transformer will be connected to the generator by means of 6.6 kV isolated phase bus duct. On the HV side, the transformer will be connected to a 66 kV outdoor conventional type switchyard by a 66 kV overhead transmission line (link lines). Power will be evacuated through 66 kV Outdoor Switch Yard through single/double circuit 66 kV transmission line to the Kiyungi Substation of TANESCO at a distance of 14 km. The main items of work for civil works have been estimated on the basis of drawings prepared after carrying out the designs of civil components. Surveys have been conducted to assess the availability and suitability of construction materials in the vicinity of the project area.

The construction of Kikuletwa II HEP will have to be supported by relevant infrastructure works such as permanent and temporary colonies, office, roads and bridges, workshops, etc. situated within the projected area. The project is planned to be completed in a construction period of 18 months and a 6 - 7 month period will be devoted for creation of infrastructure facilities such as roads, housing, shelters, storage areas etc. The construction of the project is proposed to be carried out through contracting agencies entrusted with suitable contract packages. Suitable work force will be hired by the developer to execute the project in a judicious manner.

The Environmental & Social Impacts Assessment (if required for this project) will be carried out in accordance with the terms of reference granted by the appropriate authority. This is a run-of-river type small hydro power project and is an

environment friendly activity without any adverse impacts on the ecology of the area.

In order to arrive at an estimate for the Project Cost, the major activities involved in theconstruction of the project have been identified and rates determined for the same. Also, themarket rates & working rates for the major commodities involved in the construction of the project have been calculated.

Based on these estimates, an estimate for the project cost is arrived at. Various activities involved during development of the project, cost of land, & other items are factored in. A financial model is built to calculate the financing cost, working capital requirement etc. After adding all these costs, the total project cost is calculated to be around USD 16.77 Million or USD 2.10 Million per MW of capacity installed.