

Financing hydropower in Africa

Africa has the potential to increase electricity access through a greater use of hydropower. Here, Ryan T Ketchum describes a hydro project planned for the Ruzizi River, and details how the project will work commercially.

On 21 December 2012, the General Assembly of the United Nations declared 2014–2024 the decade of sustainable energy for all. In passing the resolution, the General Assembly noted that 1.3bn people live without access to electricity and that 2.6bn people in developing countries rely on traditional biomass sources for cooking and heating needs. Half a billion of those living without access to electricity live in Africa.

Hydropower is undoubtedly the most common form of sustainable and renewable energy. In 2008, it accounted for around 16% of global electricity production. In Europe and North America, 25% and 29% of potential hydropower projects have been developed. In Africa, one of the continents with the greatest need for additional generation capacity, only 5% of potential hydropower is in use today.

Hydropower has the potential to provide a significant percentage of the energy that is necessary to realise the objectives of the General Assembly's resolution. The CEPGL Organisation for Energy in the Great Lakes Region (Energies des Grands Lacs, or EGL), a forward-looking international organisation operating under the auspices of the Economic Community of the Great Lakes Countries, has long been working to achieve these objectives. It is now positioned to make the Ruzizi III hydroelectric dam – the third in a series of four projects on the Ruzizi River – a reality.

Ruzizi dams

The Ruzizi River forms the border between the Democratic Republic of Congo (the DRC) and Rwanda. The south-flowing river connects Lake Kivu with Lake Tanganyika. Two projects located on the river are currently in operation. The 30 MW Ruzizi 1, which is owned and operated by SNEL, the parastatal electricity utility of the DRC, is located 3 km downstream of the outlet from Lake Kivu and was commissioned in 1959. The 44 MW Ruzizi II is owned and operated by SINELAC, a multi-national organisation established by a treaty among Burundi, the DRC and Rwanda, and was commissioned in 1989.

EGL has been steadily working to promote the third project in the cascade – the Ruzizi III Regional Hydroelectric Project – for some time. Engineering firm Fichtner completed the feasibility study commissioned by EGL in 2010, and a detailed

design report in May of 2011. In June of 2012, EGL launched a request for proposals for the selection of a private investor to develop Ruzizi III on a Build–Operate–Transfer basis. In September 2012, EGL declared the consortium of Sithe Global and Industrial Promotion Services (Kenya) as the preferred bidder for the project. This is the same consortium that developed the 250 MW US\$900mn Bujagali Hydroelectric Dam on the River Nile in Uganda, which achieved commercial operations in July of 2012.

The proposed technical solution for Ruzizi III envisions a run-of-river project comprising a diversion dam, a 7 km head-race tunnel, penstock and surge chamber, surface powerhouse, three Francis-type turbine generator units, a 220 kV switchyard, and a 10 km transmission line to a substation which will be located at Kamanyola in the DRC. The design also includes a small generating unit at the dam site to produce energy from the ecological flow that will be released to the bypassed reach of the river between the dam and power station. The proposed technical solution would have a total installed capacity of 147 MW, with each turbine designed for a maximum flow rate of 50m³/s giving a total plant discharge of 150 m³/s (not including the small unit at the dam site).

Given the hydrology of the river, it is anticipated that the nominal mean annual energy production will equal approximately 710 GWh, which equates to a capacity factor of approximately 56%.

Finance and development

The project's capacity will be purchased by Régie de Production et Distribution d'Eau et d'Electricité, SNEL, and the Energy and Water Sanitation Authority – the parastatal utilities of Burundi, the DRC, and Rwanda respectively. Each offtaker will purchase one third of the capacity of the project under a common power purchase terms agreement (CPPTA) and separate power purchase agreements.

The tariff will be structured so that the offtakers will pay for the capacity made available by the project company, which is measured during each hour of each day. The capacity the project company makes available will be adjusted from actual hydraulic conditions (the actual net head height) to nominal hydraulic conditions (the net head height with the head pond at the full supply level) during each hour to determine an hourly availability pay-



The planned Ruzizi III site

ment. At the end of each month, the hourly availability payments will be summed to determine the monthly availability payment.

This structure achieves two objectives – it incentivises the project company to ensure that the plant is available; and it allocates day-to-day hydrological risk to the offtakers. The risk of a significant and adverse shift in hydrology will, to some extent, be shared by the offtakers and the project company as the offtakers will have the right to terminate the CPPTA following a significant and long-term reduction in water flows.

Large and medium-scale hydroelectric projects generally involve high upfront costs for feasibility studies, social and environmental impact assessments, social and environmental impact mitigation plans, detailed engineering and design, and, for hydroelectric projects undertaken as independent power projects, commercial and legal structuring. In order to bring the project to market more quickly, EGL elected to conduct the tenders for the project in two phases.

During the first phase (which is now drawing to a conclusion) the investors/developers (the sponsors) have been chosen. The terms of the tender for the first phase did not require bidders to bid a price for the capacity the project company will make available. This enabled the bidders to bid for the project without having a firm engineering, procurement and construction (EPC) solution and price in place and without knowing the financing costs the project company will incur to pay interest on, or to repay, the project debt. Instead, bids were evaluated on the basis of:

- the return on equity the investors will have an opportunity to earn;
- a cap on the soft development costs the investors can seek to recover through the availability payments; and
- a fixed monthly operations and maintenance charge.

During the second phase, which will be undertaken after the CPPTA and power purchase agreements have been executed, the project company will conduct an international competitive tender to select the EPC contractor that will construct the project. The project company will also arrange financing for the project during the second phase.

It will be possible to enter into the CPPTA and power purchase agreement before firm pricing is known because the tariff will be set using a so-called regulation by contract method. This effectively enables the project to be constructed using a form of regulation that is similar in many respects to the return-on-rate base form of regulation that is widely used in the US, Europe and other well-developed markets. Such ex post regulation is feasible in those markets given the long history regulators in those markets have of successfully balancing the interests of investors and ratepayers. It is unlikely that a system of ex post regulatory review would be feasible in countries that are in an earlier stage of

development, including in most of Sub-Saharan Africa.

In order to overcome this problem and allow for a system of regulation that entails many of the benefits of return-on-rate base regulation, the regulation by contract method establishes the methodology that will be used to establish the final tariff in an agreement that is subject to international arbitration. This agreement is entered into before the investment is made.

In this case, that agreement is the CPPTA. The tariff annex contained in the CPPTA does not, therefore, set out the price. Instead it contains the detailed series of formulas that will be applied to recognised project costs in order to calculate a price per MW per hour of availability that will apply during each year of the 25-year supply period under the agreement.

Proven record

This same structure was used on the Bujagali Hydroelectric Project. The strength of this structure is evidenced by the lenders that ultimately provided financing for Bujagali, including: the International Finance Corporation, the European Investment Bank, KfW, DEG, AfDB, Agence Française de Développement, Proparco, FMO, Standard Chartered, and ABSA Capital.

Many of the same lenders have

expressed an interest in, or have already provided significant funding for the Ruzizi III project. Lenders that have been actively involved in Ruzizi III to date include the AfDB, KfW, DBSA, the European Investment Bank, Agence Française de Développement, Proparco, and FMO among others. The World Bank's International Development Association is in discussions with EGL with respect to a partial risk guarantee which should enable private lenders to provide debt financing for the project. The sponsors are expected to request the issuance of political risk insurance by the World Bank's Multilateral Investment Guarantee Agency.

The successful development of Ruzizi III would be a small step towards the realisation of the goals described in the resolution so recently passed by the United Nations. It would also enable Burundi and Rwanda, both of which are members of the East African Power Pool (EAPP), to contribute the types of tradable resources that are necessary for the successful realisation of the EAPP's goal of integrating the region's disparate power systems into a single interconnected system with the scale and diversification required to dramatically lower the cost of electricity in East Africa. ●

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Energy Institute Process safety survey (EIPSS)



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