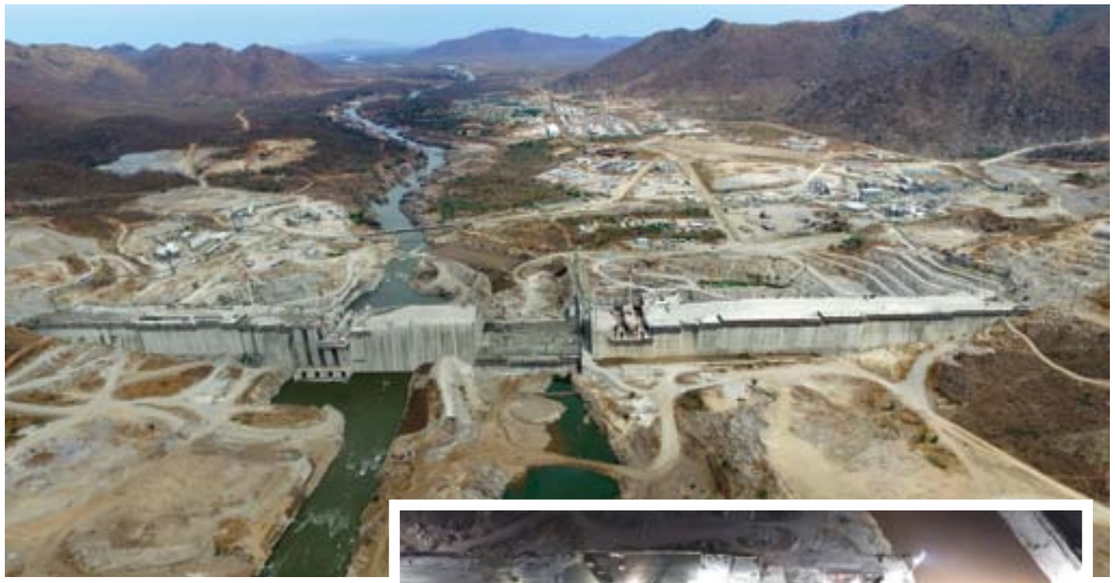


Grand Ethiopian Renaissance Dam on the Blue Nile in Ethiopia. Inset: Saddle dam being built for the project. Images courtesy of Salini Impregilo.

A number of key projects are under development across Africa.

African hydro developments

Energy poverty is a way of life in Africa, with over half of the continents populations lacking access to electricity – and rapid population growth looks set to strain the existing services even further. As a result, countries in the region are looking to exploit their vast, untapped hydropower potential, making it a key market for hydropower and dam developers.

Ethiopia

Ethiopia's energy policy is an important driver in the country's development by exploiting its most precious natural resource: water.

About 85% of the energy produced comes from hydroelectricity and its weight is destined to increase both inside and outside the country in the coming years. Ethiopia is investing the equivalent of a third of its gross domestic product in hydroelectricity, totaling €12 billion. This enormous commitment has the objective of generating 40,000MW of energy by 2035 by taking advantage of the big rivers that cross its territory.

The government's 2010-2020 Growth and Transformation Plan, which is being executed in two phases, aims to use the country's natural resources to transform Ethiopia into a renewable energy hub for the entire eastern region of Africa.

A number of major hydropower schemes are currently in the construction or development stage in Ethiopia. Most notably is the Grand Ethipian Renaissance Dam, a project that has recently seen its capacity increase to 6450MW, with generator upgrades.

Initially designed to generate 5250MW, with the power plant upgrades, the dam's generation capacity was raised to 6000MW in 2011. Six years later, the capacity was increased by an additional 450MW. The generation capacity now matches those of Tekeze, Beles and Gibe-II hydropower plants combined.

The project is well on its way to being completed. It is located 700km from Addis Ababa in the Benishangul-Gumaz region near the border with Sudan. As part of the project Salini Impregilo is building what will become the biggest dam in Africa to rank among the top 10 in the world.

Located along the waters of the Blue Nile, the GERD consists of a hydroelectric plant with a main dam built of roller-compacted concrete (RCC) with a power plant on either side of the river. Once it is put into service, the GERD will increase the amount of electricity produced in the country by 270% and bolster Ethiopia's role as an energy exporter to neighboring countries. By transmitting electricity to Sudan, Djibouti, South Sudan and Yemen, it will be able to generate $2 billion in revenue a year.

The actual construction of the dam is already having a big impact on the territory. About 8500 people work on the site, 8200 of which come from local communities. Another 1250 are indirectly employed by the project, working for suppliers and subcontractors for a value of €450 million.

The undertaking is massive. Once complete, the dam will be 1800m long, 155m high and have a water basin 74 billion m^3 in size.

Like the GERD, another project that is just as grand is the Koysha scheme, the construction of which was assigned to Salini Impregilo in March 2016. The €2.5 billion contract foresees the construction of a dam using RCC. Some 170m in height, it will create a basin of six billion m^3. Its power plant will have eight Francis turbines.

With an installed capacity of 2160MW and an annual production capacity of 6460GWh, the Koysha hydroelectric project is the fourth to be built along the Omo River and, along with the recently inaugurated Gibe III and the future GERD, will contribute to transforming Ethiopia into one of the biggest producers of renewable energy on the continent.

Five years of work are envisaged for the project.

Another project that has recently been inaugurated in the country is the 1870MW Gibe III scheme, a project that feature the tallest dam of its kind in the world. Again built by Salini Impregilo, the project has almost doubled the eastern African country's electricity production as it strives to modernize its economy and become a regional energy hub.

Ethiopian Prime Minister Hailemariam Desalegn presided over the inaugural ceremony of the €1.5 billion project in December 2016 in the presence of Water, Irrigation and Electricity Minister Eng Sileshi Bekele, Ethiopian Electric Power Chief Executive Azeb Asnake and Ethiopian Electric Power Chairman Debretsion Gebremichael. Salini Impregilo Chief Executive Pietro Salini, General Manager International Operations Claudio Lautizi were also present. Ethiopian Electric Power commissioned the project.

"What was considered a dream – after years of hard work – has now become a reality," said Salini Impregilo Chief Executive Pietro Salini in a speech during the inauguration. "We are grateful to Ethiopian Electric Power and the Federal and Regional Governments for dealing with us as partners in development, and for trusting our capacity for completing Gibe III. Salini Impregilo is honoured to have given service both to them and to this great nation."

Gibe III will generate up to 6500GWh of electricity a year. It is an extension of a greater complex that includes two other hydroelectric dams: Gibe I and Gibe II.

Gibe III is the first dam in Ethiopia to be built using roller-compacted concrete (RCC). Standing at 250m, it is the tallest of its kind in the world. Its crest length is 630m.

The volume of concrete used to build the dam totaled 6.2 million m^3, two and a half times the amount of material used for the Great Pyramid of Giza in Egypt. The water reservoir created by the dam holds 15 billion m^3, equal to half the volume of Lake Tana, the largest in Ethiopia.

The benefits of the project were already evident during its construction, contributing enormously to the local economy. It created jobs for a combined total of 20,000 Ethiopians during the various phases of its construction. Its complexity also called for the greatest expertise in the field, involving people from 32 countries.

Lesotho

Earlier this year, Multiconsult announced it was building on its long history in Lesotho with a new award. The company said it will undertake feasibility studies for suggested hydropower and pumped-storage schemes in Lesotho – a project which is part of the Phase II of the Lesotho Highlands Water Project, financed by the World Bank.

Lesotho Highlands Development Authority appointed Multiconsult UK and Multiconsult Norway, in a Joint Venture with EdF (France) and GIBB (South Africa), to prepare feasibility studies of hydropower potential including a pumped storage scheme for Phase II of the Lesotho Highlands Water Project.

The contract was awarded late autumn 2016 and signed in January 2017. The study constitutes all relevant technical, economic, environmental and social issues related to pumped storage schemes as well as conventional hydropower from screening level (multiple projects) down to feasibility of the most bankable candidates.

"We are very proud to be working with GIBB and EdF on this landmark project. The numerous benefits realised by this project will benefit both Lesotho and South Africa and bring much needed renewable energy to the area. This commission once again highlights how our extensive expertise in hydropower engineering and environmental and social management is very well received by clients" says Knut Norén, Managing Director of Multiconsult UK.

The Lesotho Highlands Water Project (LHWP), commenced in the mid eighties and constitutes four development phases overall. It is one of the most monumental water transfer schemes in the world, where the primary purpose is to transfer water from the Lesotho highlands to the water thirsty Gauteng Region (Johannesburg, Pretoria) in South Africa, and secondly to provide renewable energy from hydropower in Lesotho.

Multiconsult has worked in the energy sector in Lesotho and the Southern African region for more than 35 years.

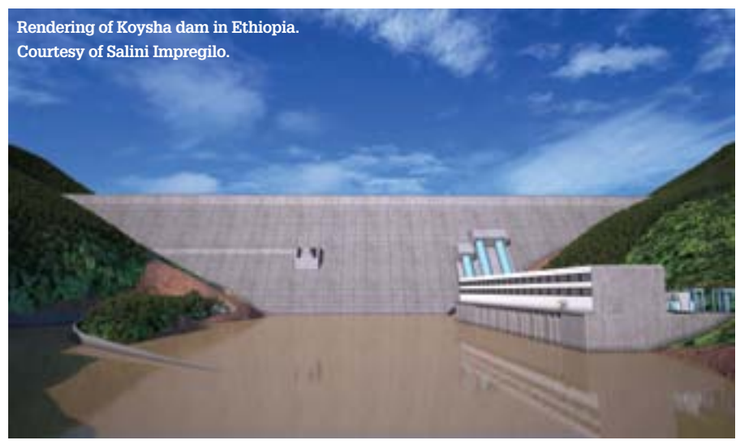
"One of our very first hydropower projects was in fact in Lesotho in the early 80s. We carried out feasibility studies, detailed design and construction supervision of the Mantsonyane and Semonkong small-scale hydropower projects for the Lesotho Highlands Water Projects Unit. We have since then participated in numerous energy-related projects in the region and it is therefore with great excitement that we embark on this new era of hydropower development in Lesotho," said Tom Ødegaard, Senior Vice President for Market and Sales Renewable Energy.

Burundi, Rwanda and Tanzania

On March 30, 2017, the groundbreaking ceremony was held for the 80MW Regional Rusumo Falls hydroelectric project, at the project site on the Kagera River. The event was witnessed by Ministers of Energy, Water and Finance from the three countries that will benefit from the project - Burundi, Rwanda and Tanzania – as well as Board Members of Rusumo Power Company Limited from the respective shareholder countries, representatives of financiers the World Bank and the African Development Bank, and other key stakeholders.

Construction of the plant has been financed by the World Bank at a cost of US$340 million while the transmission lines that will connect the power plant to the national grids in the three countries is financed by the African Development Bank (AfDB) at a cost of US$121 million.

Among the numerous benefits, the project will provide an additional 26.6MW to each of the beneficiary Member States and strengthen



Rendering of Koysha dam in Ethiopia. Courtesy of Salini Impregilo.

Sendje project in Equatorial Guinea.

the regional power interconnection between the countries. It will improve livelihoods of the 7000 households in the beneficiary districts under the local area development program and another 188 households directly affected by the projects through livelihood restoration program. This is in addition to providing job opportunities for over 500 skilled, non- skilled and casual workers from the three beneficiary countries.

Construction of the power plant is expected to last three years, until 2020. CGCOC Group Ltd - Jiangxi Water & Hydropower Construction Company Ltd Joint Venture (CGCOC - JWHC JV) of P.R. China will execute the Civil Works/Supply and installation of hydromechanical equipment, while the Consortium Rusumo Falls Andritz Hydro GmbH (Germany) and Andritz Hydro PVT Ltd (India),will supply and install the plant's electro-mechanical equipment.

It will include a concrete gated dam with a height of 12m and a spillway structure with three water passages. The passages will be equipped with three radial gates, each measuring 9m-wide and 9.5m-high. A two-lane road will be built on top of the dam.

The water intake and headrace tunnel of the plant will be 11m-wide and 14m-high and feature a shotcrete and rock bolts support system. A concrete-lined vertical surge shaft with a diameter of 8m and a surge chamber with a diameter of 41m will also be part of the plant.

The plant will include a 260m-long diversion canal with a width of 17m and a 250m-long tailrace canal with a width of 40m. A 220kV substation switchyard is also part of the plant and will be located on the northern side of the Kagera River bank in Rwanda.

The Rusumo Power Plant is being implemented by the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU) mandated by the three countries through the Special Purpose Vehicle, the Rusumo Power Company Ltd (RPCL). The RPCL is a jointly owned utility company by the three countries, institutional mechanism set-up for the co-management of power generation and supply to national power utilities.

The Rusumo falls was identified as a potential area for hydropower generation as early as 1970s, to address inadequate energy, which is one of the major socio-economic development challenges facing Burundi, Rwanda and Tanzania, which still have low rates of electricity access.

Although the three partner states discussed over several years to move Rusumo falls project forward, implementation of the highly needed project was not forthcoming due to a number of reasons, including lack of commitment from the partner states, lack of investment finance, civil conflict as well as absence of a joint institution to coordinate the project.

The development of the Regional Rusumo Hydroelectric Project idea was revived in 2006 and championed by Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU), the investment arm of the Nile Basin Initiative (NBI).

The Project design is a Run-of-River Development Scheme with a normal operating water level of 1320m above mean sea level. The Run of River Development Scheme was selected by the beneficiary governments because it maintains the natural flow of the river and does not significantly modify the natural environment; it minimizes environmental and social impacts of the project and provides for the least cost implementation for environmental management and resettlement.

Equatorial Guinea

Due to be completed in 2019 is the 200MW Sendje hydroelectric plant in Equatorial Guinea.

On February 20, 2012 Duglas Alliance Ltd. together with the Head of the State of the Republic of Equatorial Guinea – Obiang Nguema Mbasogo laid the corner stone in the foundation of the future power plant, which is constructed by Duglas Alliance Ltd. on a turnkey basis. The project is funded entirely by the Government of Equatorial Guinea, at a cost of 292,790 million CFA francs, and and is being developed in the framework of the Government program in the face of Horizon 2020, in compliance with the recommendations of the second National Economic Conference.

French engineering company Alstom (now GE Renewables), was awarded the contract to execute the supply of hydropower equipment for the project, with Duglas Alliance Ltd appointed general contractor for the project construction.

Duglas Alliance realized the Wele river closure on September 12, 2015. The works on closure started by preparing areas on the right bank. In advance, the company planned the pilings of rock and loamy soil as well as the need for oversized materials for final closure, all of which were continuously transported for formation of the cofferdams body closing the river. Aorund 2000m^3 of soil was used for river closure, with the the total volume of cofferdams piling equal to 66,000m^3.

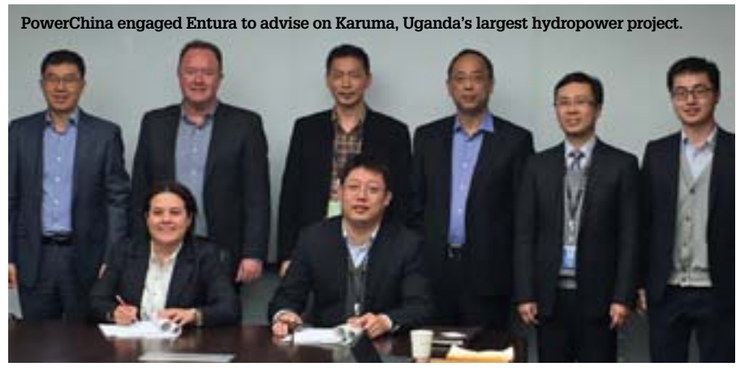
Sudan

In February, The Upper Atbara and Setit Dam Complex's 320MW (4x80MW) hydroelectric power plant was officially inaugurated in Eastern Sudan, in a ceremony attended by Sudanese President, His Excellency Omar Hassan Al Bashir.

The US$1.9 billion complex consists of the Rumela Dam on the Upper Atbarah River and Burdana Dam on the Setit River. The twin dams hold a storage capacity of 2.7 billion m^3.

The project is a multipurpose scheme to reinforce agriculture production and generate much needed electricity. It was part funded by a US$90 million concessionary loan from the Abu Dhabi Fund for Development (ADFD).

The dams create the Upper Atbara Reservoir with a total storage volume of 3,688 million m^3 at Maximum Operating Level (MOL=El. 521.00 m) and an active storage volume of 2,548 million m^3. Through this impoundment a maximum gross head of 41.4m is created.



PowerChina engaged Entura to advise on Karuma, Uganda's largest hydropower project.

For flood control and protection of the embankment dams from overtopping, large reinforced concrete spillway structures, one at the Rumela dam and one at the Burdana dam, supplemented the construction works. Both spillways are equipped with gated bottom outlet and gated surface sluices for a maximum discharge of 6,150m^3/sec (Rumela) and 9,810m^3/sec (Burdana) at the Maximum Operating Level (MOL) of 521.00 m.

During the releases of water from the Upper Atbara Reservoir to the New Halfa irrigation scheme via the Kashm El Girba Reservoir the existing head is utilised for power generation. The power station is located on the right bank of Upper Atbara River and comprises a power intake, four surface penstocks and a power station which will house four generating sets driven by vertical axis Kaplan turbines, each of 80MW capacity.

An irrigation outlet structures is constructed for a future irrigation canal to be connected to the Upper Atbara Reservoir at the Rumela site (100m^3/sec).

Uganda

Just last month it was announced that specialist power and water consulting firm Entura has been engaged by PowerChina Huadong to deliver

hydropower advisory services for the 600MW Karuma Hydropower Project.

Located in northern Uganda, the Karuma Hydropower Project includes a 314m long diversion weir fitted with radial gates, six shafts and associated power tunnels leading to an underground power house containing six 100 MW Francis turbines and two 8.6km long tailrace tunnels.

When completed, it will be the largest power station in the country.

PowerChina Huadong is the lead designer for the project and sister-company, SinoHydro, the engineering, procurement and construction contractor. Entura will assist PowerChina Huadong with managing a range of project stakeholders, undertaking design reviews, and advising on compliance with international standards.

"We're pleased to welcome Entura to the Karuma project team," said Mr Wu Haifeng, PowerChina Huadong's Deputy Design Project Manager for the Karuma Hydropower Project. "Entura brings a wealth of expertise in hydropower design and international standards, which will make an invaluable contribution to the delivery of this landmark project for the people of Uganda."

Commenting on the appointment, Entura's Managing Director Tammy Chu said: "We're delighted to be partnering with PowerChina Huadong on this significant and complex project."

"We're confident that our hydropower design expertise and knowledge of international standards, built up through the delivery of our own designs and review of other international projects, will improve the efficiency of the design approval process."

The Karuma Hydropower Project is expected to be completed by the end of 2018.

As part of Hydro Tasmania, Australia's largest renewable energy producer and water manager, Entura draws on more than 100 years of experience of planning, building, managing and maintaining the many assets of Tasmania's hydroelectric power system.

The firm has been working with clients around the globe, undertaking the design of a number of international hydropower projects over the past decade, including Dordi Khola in Nepal, Nam Pha Gnai in Laos, and Neusberg in South Africa.

Cameroon

Renewable energy developer and operator Joule Africa has recently signed, alongside Cameroon's Minister of Water Resources and Energy, H.E. Basille Atangana Kouna and the CEO of ENEO, Joel Nana Kontchou , a Letter of Intent to take the Kpep Hydropower project in Cameroon to the next stage in its development.

As part of the agreement, Joule Africa will undertake comprehensive feasibility studies to build on the pre-feasibility study it commissioned in 2012, which highlighted the potential for creating 485MW of installed capacity.

Commenting on this announcement, Mark Green, President of Joule Africa, said: "Kpep has the opportunity to transform the economic landscape in the North of Cameroon. It should provide up to 3000 jobs during the construction phase; create significant direct and indirect employment once operational; benefit the local communities; and go a long way towards satisfying the country's ever-increasing demand for energy by boosting Cameroon's current energy capacity by up to 40%."

"It is also a significant milestone for Joule Africa as we look to develop other power projects alongside the Bumbuna II hydro project in Sierra Leone."

The Kpep Hydropower project is the initial site to be developed as part of a cascade of five sites on the Katsina Ala River in North West Cameroon. The full feasibility studies will include topographical surveys, geotechnical investigation works, preliminary engineering design and a full internationally-compliant environmental and social impact assessment. It is estimated that the feasibility study will take two years with a further four years of construction in order to commission the plant during 2023. ■

Karuma Hydropower project in Uganda.