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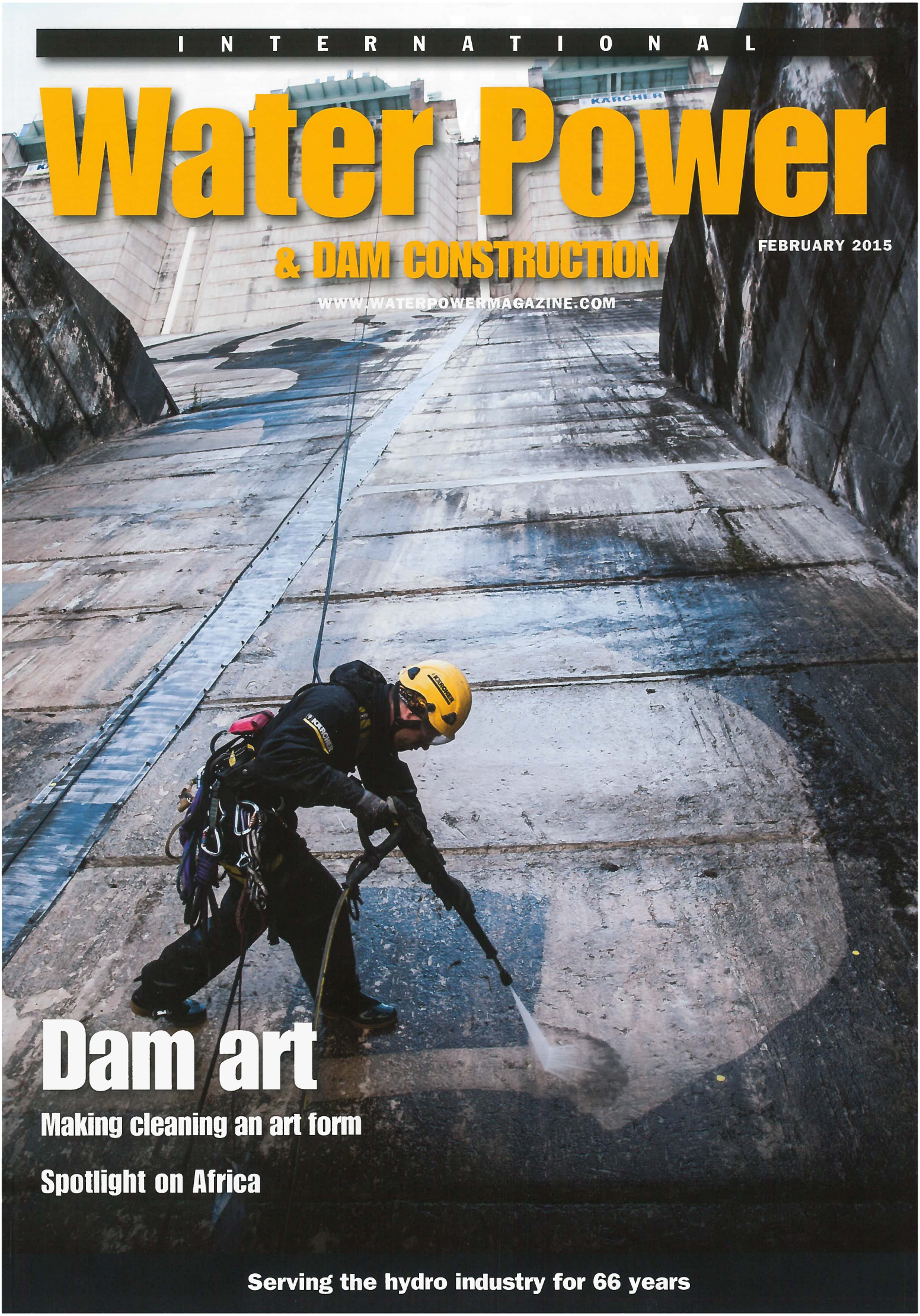

Dam art

Making cleaning an art form

Spotlight on Africa

Serving the hydro industry for 66 years

Five big builds in Africa

Some large projects under construction in Africa have been both lauded for their benefits while also being subject to controversy with regards to issues such as potential environmental impacts and cross border relationships. IWP&DC profiles five of the most talked about hydroelectric and dam projects in development across the continent.

Grand Ethiopian Renaissance Dam

The biggest dam in Africa is currently under construction in Ethiopia. The 1.8km long, 170m high Grand Ethiopian Renaissance Dam is being built on the River Abbay (the Blue Nile) and will feature 16 x 375MW turbines, giving the project a total capacity of 6000MW.

Preparatory works for construction started in December 2010. By October 2014, developers Ethiopia Electric Power announced that the dam was 40% complete. The project involves the construction of a main dam in Roller Compacted Concrete (RCC), with two power stations installed at the foot of the dam. It is completed by a 15,000m³/sec capacity concrete spillway and a rockfill saddle dam, 5km long and 50m high, both located on the left bank. Works are being led by Salini Impregilo.

Since the idea of such a large dam on the Blue Nile was put forward, it has been the subject of some intense debate, and protest. Environmental groups are concerned about the impact of the dam, with International Rivers one group that has been vocal about its opposition to the project. In a statement on its website, it says: "Although it is Africa's biggest dam project and will have lasting impacts on its longest river, the GERD has been developed under a veil of secrecy. The dam will impact Ethiopians and downstream neighbors, yet its planning process has been top-down and unilateral. The public and dam-affected people have not been given a meaningful opportunity to critique the project or process."

After construction began, Ethiopia agreed to the formation of an international Panel of Experts, with members from Egypt and Sudan, to review the GERD's social and environmental impacts on downstream nations. The 10-member panel submitted its report to the governments in June 2013.

The final report suggested that project was being undertaken in line with international design criteria and standards. It said that the dam would significantly benefit all three countries, and would not result in significant adverse impacts downstream of the project site. Benefits noted include: improving access to energy and jobs in Ethiopia; address shortage of energy in the region; cost effective electricity; improve siltation issues in Sudan and Egypt; solve flooding issues in Sudan and improve flood control in Egypt.

Regular meetings have been held between the three countries, and in the 4th round of tripartite talks held in August 2014, the countries agreed to further assess the hydrological modeling, social and environment impact of the project – with four experts from each country participating.

Ethiopian Ministry Spokesperson Ambassador Dina Mufti said that based on scientific study the dam will not pose any significant harm either on the environment or the downstream countries. He said that he was confident the assessment would not identify impacts which have not been studied previously.

Back in April last year, the Ethiopian Embassy in London said it expected the dam to start generating electricity from two of its 16 turbines by the end of 2015. With the new round of studies having been agreed its unclear how this will affect scheduling, but it is certainly a project to watch!

Inga 3

The 4800MW Inga 3 project is the planned first phase of the 40,000MW Grand Inga project on the Congo River in the Democratic Republic of Congo (DRC).

Inga 3 work is being split into two phases. The first, expected to start late this year, is the Inga 3 Low-Head project, which will not involve damming the river. Construction work here is expected to cost US$8.5B. The second phase – Inga 3 High-Head – will involve construction of a dam and will add 3000MW of capacity. Followng these, a further five plants will be installed to take the Grand Inga project capacity to 40,000MW.

In March 2014, the World Bank approved a US$73.1M grant for development of the Inga 3 project Flooding in Hatton November 2000. The funding will be used to support DRC with technical assistance for preparation of the project, and will help establish an autonomous and transparent Inga Development Authority, which will follow best international practice in selecting the private concessionaire and negotiating power purchase agreements, the World Bank said. The project will also finance technical, environmental, and social studies to develop the Inga 3 BC and selected mid-size hydropower projects sustainably.

"Inga 3 BC is undoubtedly the most transformative project for Africa in the 21st century. It is one of the strategic pillars of development for the DRC, that needs energy to expand growth and reduce poverty in a sustainable way," said H.E. Matata Ponyo Mapon, Prime Minister of the Democratic Republic of Congo. "The World Bank Group's involvement in this project reinforces its mission to fight poverty, and its ongoing commitment to help the Congolese government in its goal to move the country along the path to a strong development future."

The Inga 3 development would divert about one sixth of the flow of the Congo River into the Bundi Valley. A dam on the Bundi River would create a 15.5km² reservoir. Inga 3 does not include a dam on the Congo River itself. A preliminary environmental and social assessment concluded that the Inga 3 development has a smaller footprint compared to hydropower projects of the same capacity. The land area to be flooded per megawatt of electricity generated will be among the smallest in the world, said the World Bank in a statement.

As part of the project, 1000MW of electricity produced is to be sold to the national utility SNEL, which in turn would sell it to households and small businesses in greater Kinshasa. A further 1300MW is expected to be sold to mining companies in DRC's Katanga Province and an additional 2500MW would be sold to South Africa. At the same time, the mid-size hydropower projects would help to increase energy access for people living in the rest of DRC.

"By being involved in the development of Inga 3 BC from an early stage we can help ensure that its development is done right so it can be a game changer by providing electricity to millions of people and powering commerce and industry," said Makhtar Diop, World Bank Vice President for Africa. "Supporting transformative projects that expand people's access to electricity is central to achieving the World Bank Group's twin goals of helping to end extreme poverty and boosting shared prosperity."

The TA project does not include any construction or operational activities and no decision has been taken on whether the

World Bank Group will support the eventual construction of Inga 3 BC. The TA project will finance a number of environmental and social assessments to shape the development of Inga 3 BC, including a cumulative impact assessment.

Gibe III

Gibe III is the third plant of the Gibe-Omo cascade comprising Gilgel Gibe (IP=200MW) and Gibe II (IP=420MW), both operating, and Gibe IV and V (planned).

At the end of 2014, Ethiopia Electric Power announced that 88% of the Gibe III hydropower dam on the Omo River has been completed. Once finished, the project's ten 187MW turbine units will increase the country's energy coverage by 94%. Two of the units are expected to begin generating electricity by Spring 2015.

The project contains some 5.9Mm^3 of roller compacted concrete (RCC) and when completed will be the current tallest RCC dam in the world. The RCC placement operations started in late December 2011, pre impoundment started in August 2014, with early impoundment starting in early 2015.

In the January 2015 issue, IWP&DC provided a detailed look at project's construction, including the many obstacles overcome. The is little doubt the project is a major challenge for all involved. There are expat staff from 26 countries working collectively with Ethiopian Engineers to obtain the best product that can be achieved. The project has even claimed a world record – on December 11th through December 12th 2014 the Salini-Impregilo team working on the dam placed 18,519m^3 in a single 24 hour period breaking the world record held previously by Longtan dam in China for the most RCC placed in a single 24 hr period for any RCC dam structure worldwide to date.

The dam has however been the subject of protest from environmental groups. International Rivers has run a campaign against the dam stating that it threatens food security and local economies.

Ingula pumped storage

The Eskom owned Ingula pumped storage project is located between Ladysmith and Harrismith in the Little Drakensberg, and will have a generating capacity of 1332MW available during periods of peak demand and to supplement base load when necessary.

Development of the pumped storage scheme was proposed in 2002 and was initially called the Braamhoek scheme, named after a tributary of the Klip River. In March 2007, the scheme was renamed Ingula, meaning 'the cream on the surface of milk'. The basic design of the scheme began in 2004, when it was given environmental clearance.

The project involved construction of two dams – the upper and lower reservoirs; a powerhouse, two tunnels, access roads and transmission lines.

The dams are designed for a water capacity of 22Mm^3 and have underground waterways.

The upper dam of Ingula, named Bedford Dam, is located in the secondary of Wilge River that flows into the Vaal River system. The dam is 810m long and 40.9m high. It also has a 100m-long emergency spillway, a dam crest with elevation of 1740.6m and 8m crest width.

The lower dam, named Braamhoek Dam, is situated in the secondary of Klip River that flows into the Thukela River. The length and crest width of the dam are 331m and 5m. The dam is 38.6m high and has a 40m long crest. The 0.5m dam wall height holds flood inflows to avoid 1:200-year flood dam spill.

Construction progressed well at the site until a fatal incident occurred in October 2014, which led to the deaths of six workers. The site was closed while investigations were undertaken.

Since then, undergound work has proceeded with the concrete lining in the tailrace and headrace tunnels completed. Cavity and consolidation tunnel grouting are are over ¾ complete, while concrete slip forming at one of two 91m high Surge Chambers commenced in mid 2014. All civil works in the transformer hall have been completed and the machine hall and underground control room are almost complete.

The dam is expected to fill to capacity during 2015 for the first time, two years later than originally planned. Anticipated completion and operation of the first of the four pump / turbines is expected by May 2015 with the remaining units coming on stream over the following 12 months.

Concerns about the dam have been raised over the years, including fears of depleting water resources in the region, and impacts on local wildlife. In 2004, Eskom partnered with BirdLife South Africa (BLSA) and Middlepunt Wetland Trust (MWT) to mitigate the adverse impact of Ingula on the environment. The partnership monitors the effect of the construction on birds, veld management, eradication of alien plants, wetlands monitoring and community upliftment. The partners have also taken measures to protect birds – especially threatened birds.

More than 275 bird species have been sighted at Ingula including all three crane species that although rare, are regularly seen there. The endangered Southern Bald Ibis is another resident of the conservation area and thirty breeding pairs have been counted. However, construction of the upper Bedford Dam, completed in 2011, robbed them of their historic nesting ledges, causing Eskom to construct a massive artificial nesting site to compensate for the loss of their originals. Before the project is complete it is hoped the birds will discover the new nesting site themselves. Several dummies have been placed in the new site to entice them to relocate. The change in habitat due to the construction of the dams is being monitored by conservation staff and already new species are moving into the area such as spoonbill and flamingo.

Lesotho Highlands Water Project – phase II

The Lesotho Highlands Water Project (LHWP) is a multi-phased project to provide water to the Gauteng region of South Africa and to generate hydro-electricity for Lesotho. It was established by the 1986 Treaty signed by the governments of the Kingdom of Lesotho and the Republic of South Africa. The project entails harnessing the waters of the Senqu/ Orange River in the Lesotho highlands through the construction of a series of dams for the mutual benefit of the two countries. The first phase (Phase I) of the four-phased project was completed in 2003 and inaugurated in 2004, and the second phase (Phase II) is currently underway, with the project launched back in March 2014.

Phase II is expected to ensure a reliable water supply to South Africa by 2022 that will meet the demands of the Gauteng region, increasing the current supply rate of 780Mm^3 per annum from the LHWP to the Vaal System by approximately 465Mm^3 to make a total of 1255Mm^3 per annum. Phase II is equally significant for Lesotho as Phase I. The existing 72MW 'Muela hydropower station was built under Phase I of the project. Under Phase II the hydropower generation capacity of the scheme will be increased.

In addition the 1200MW Kobong Pumped Storage Scheme is part of the bi-national Phase II agreement, but this is subject to the outcome of a joint feasibility study detailed in the Phase II Agreement. The technical and the economic feasibility studies have been completed and have recommended that further studies be undertaken to include: a market study; integration study; geotechnical investigations; and legal and commercial arrangements. These studies have been funded by the World Bank.

The people of Lesotho and South Africa are already reaping the benefits of Phase I of the Lesotho Highlands Water Project. Phase II promises benefits beyond the increased water and electricity supply, the developers have said. These include economic benefits such as a growing market as a result of the expected influx of people during construction, more employment opportunities, capacity building and skills development. ■