

The Neckartal dam in the Karas region of southern Namibia will be the largest storage dam in the country when completed

While South Africa is still the driving commercial force in the southern part of the African continent, its neighbours are waking up to the potential in their natural resources.

Mike Hayes reports.

Waking giants

IMAGE COURTESY SALINI IMPREGILO



According to a Deloitte report from 2016, Southern Africa – which includes Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe – plays host to 29.7% of all significant projects in Africa.

Deloitte also calculated that, with a figure of \$93.4 billion, it represented 28.9% of the continent's industry in terms of value.

Yet, with the vast natural gas deposits to the north and a wealth of latent hydro power, things could be set to change.

Of course, South Africa continues to account for the largest amount of infrastructure and capital project activity in Southern Africa, with 48.2%, followed by Angola with 12.9% and Mozambique and Zambia with 10.6% each.

It also has the most projects, by country, in Africa with 41 projects.

One of the most significant South African projects moving forward at the moment is in Modderfontein, where an \$8 billion mini city – and a smart city at that – is planned in a location some 20 km from Johannesburg's central business district.

Chinese developer Shanghai Zendai bought a 1,600 hectare parcel of land from explosives and chemicals firm AECL, and is moving forward with an ambitious plan to create the 'New York of Africa'.

Dai Zhikang, the chairman of Shanghai Zendai, said the importance of the project could not be underestimated, as the continent was in need of more financial and business districts, such as Sandton in Johannesburg, which is possibly the most important business regions in sub-Saharan Africa.

Within the masterplan for the new city, Zendai expects to build major north-south and east-west connecting roads, as well as maximising connections to the nearby OR Tambo airport. A hospital will be delivered and the design of a major railway station will be undertaken. Also within the first five years, Zendai says some 5,300 new homes will be built, and 7,000 new jobs will be created.

The masterplan is expected to take some 45 years to complete, but looking ahead to the next 15 years, the company says around 50,000 jobs will be created, many of which will go to locals.

Record breakers

Almost directly west of Modderfontein, across the border in Namibia, another huge project is underway, but this is of a more traditional construction nature.

In the Karas region, along the Fish River in the south of Namibia, Italian construction firm Salini Impregilo is building the Neckartal dam.

When completed, Neckartal will stand at 80 m high. Made from a little over 1 million m³ of concrete – and including 7,000 tonnes of steel reinforcement – it will be by far the largest water storage dam in the country.

At the outset of the \$250 million

Chinese developer Zendai's masterplan for an \$8 billion smart city on the outskirts of Johannesburg

MODDERFONTEIN NEW CITY MASTER PLAN





IMAGE COURTESY SALINI IMPREGILO

Reclamation

Over 2,600 km north of the Fish River, in Angola, the government has recently contracted work with an estimated value of \$1.3 billion dollars to rehabilitate and expand the Marginal de Corimba, in the city of Luanda.

Delivering on its commitment to ease traffic congestion and improve access to the city, the government has awarded a design and build contract within the project, to a consortium comprising Van Oord and Urbinveste-Promoção e Projectos Imobiliários.

The consortium will undertake reclamation work on an area of 400 hectares, which will be protected by various rock revetments and breakwaters.

Once this phase of the project has been completed, construction work will begin on the Marginal de Corimba highway, a fishery port, marina and a real estate development.

The work to be undertaken by Van Oord is expected to be completed by mid-2019, and is valued at around \$400 million.

Salini Impregilo will use more than 1 million m³ of concrete will be used in the construction of the Neckartal dam

Traffic congestion in the city of Luanda in Angola, will be eased by the expansion work planned on the Marginal de Corimba highway

Natural resources

On the other side of the continent, in Mozambique, the potential for exporting natural gas is driving forward a number of construction projects, including one in Cabo Delgado province, in the north of the country.

Anadarko and Eni, two firms independently drilling for natural gas offshore, have agreed to jointly develop the Mozambique Liquefied Natural Gas (LNG) Park, to process the gas they source.

Phase one of the 7,000-hectare park's development includes the installation of two LNG trains, each of which will have the capacity to transport 6 m tonnes of gas per year.

The installation of four further such trains is planned for later stages of the park's development.

With completion of the first phase of development – and the first LNG sales – scheduled for 2018, there is the prospect of some 15,000 jobs being created directly by the project.

With an expectation of 50 million tonnes of gas a year being produced – potentially making Mozambique the third largest



project, some 800,000 m³ of earth and rock had to be excavated, before the foundation of the dam could be built.

Before this, the river had to be diverted in two phases: firstly using a cofferdam on the left side of the river, which allowed the early stages of foundation construction to begin at below water levels, as well as the construction of a diversion culvert. Once completed, the river was diverted through the culvert, allowing foundation work to continue on the right-hand side of the river.

On completion of the dam – as well as a pumping station, to be located some 13 km downstream – water will flow almost 9 km through a 1,100 mm steel pipe, to reach a reservoir with a capacity of 857 million m³. Once the water starts to flow, it is expected to take around two years to fill the reservoir, which will have a surface area of close to 40 km².



Competing energy companies, Anadarko and Eni, have jointly agreed to develop a LNG Park in northern Mozambique

Natural gas from Anadarko and Eni's offshore operations in the Rovuma basin, will be processed at the planned LNG Park



Completion of the Maputo Bay bridge – set to be the longest suspension bridge in Africa – will be in late 2018

LNG exporter on the planet, after Qatar and Australia – there is a further prospect of 685,000 indirect jobs being created in the country.

High and wide

Within the Maputo province of Mozambique, one of the major hurdles holding back development is the lack of a well-developed transportation network between the capital city of Maputo and the southernmost portion of the country. A trade route dubbed the East3route - connecting Maputo to Kwazulu Natal in South Africa – has been identified as a precursor to economic development and is being jointly developed by the governments of South Africa, Mozambique and Swaziland, respectively.

As part of the initiative, it was decided to build a bridge across Maputo Bay, to support tourism, thus generating jobs and further economic growth.

After its completion at the end of 2018, the Maputo Bridge will be the longest suspension bridge in Africa, with a main span



An impression of the Maputo Bridge and Link Roads Project in Mozambique, the largest suspension bridge in Africa

of 680 m and total length of 1,225 m.

Construction of the bridge started in 2014 with a total project value, including the southern link roads, of approx. \$700 million. Design and execution is being carried out by China Road & Bridge Corporation and is based on FIDIC's Silver book EPC contract. German consultant GAUFF Engineering is responsible for quality supervision as well as design verification against Eurocode.

The bridge consists of two reinforced concrete approach viaducts from the north and south banks, which connect to the main span, a suspension bridge made up of a segmental steel box girder deck, held up by two large subterranean RC anchor blocks filled with sand and concrete. The bridge will carry four lanes of traffic, two in each direction, with a design speed of 80km/h.

Due to adverse soil conditions and a high groundwater level, construction required several different foundation engineering solutions: diaphragm walls for the anchorage shafts; bored piles up to a diameter of 2.2 m drilled with a slurry suspension; subsoil stabilisation using cement-stabilised earth piles; high-

Material gains

Analysis of Vögele's PowerFeeder operation proves its worth

Work on a 4 km stretch of the N14 highway near Johannesburg in South Africa could prove significant in the advancement of best road construction practices in the country.

In simple terms, the road was rehabilitated with the help of a VÖGELE MT 3000-2 Offset PowerFeeder from German company Joseph Vögele, as opposed to a conventional material feeder.

The work was carried out by the South African firm Power Construction, and was supported by researcher from the University of Twente. Their job was to monitor the quality of the binder and surface courses paved and report on whether the PowerFeeder improved the quality of the repair.

Following the positive results of the research, Vögele said, "Diverse and compelling reasons support the use of material feeders, above all quality and cost-efficiency. It is in the interests of construction companies, for example, to separate the material feed process from paving: While the road paver concentrates entirely on paving, the material feeder takes care of transferring mix from the lorries. This increases both quality and productivity."

The research analysis identified that the PowerFeeder contributed to the homogeneity of the mix, improving the paving quality. In the MT 3000-2, the conical augers in the receiving hopper ensure uniform material transfer and homogenise colder and warmer areas of mix. In combination with a trough-shaped conveyor, the Vögele design prevents both mechanical and thermal segregation.

The MT 3000-2 Offset PowerFeeder at work on national route N14





Addressing the infrastructure 'gap' – Zimbabwe's finance minister Patrick Chinamasa

"It is a very important project which seeks to address the infrastructure gap in the power generation sector," Chinamasa said.

In recent years, the Zimbabwean government has ramped up its budget for power generation projects, in an effort to effectively deal with its significant deficit. This includes funding for a \$1.5 billion joint project with China to build units at the Hawange thermal power station, and a \$533 million expansion of the Kariba hydro-power station.

World's biggest dam

One southern African nation that receives little press in construction circles is the Democratic Republic of Congo.

Yet, of all the projects either planned or ongoing in this part of the continent, the project planned in DR Congo is the largest, most ambitious and most expensive.

The Grand Inga hydropower project is being fast-tracked by the government, although there are complications surrounding both funding and its adherence to international guidelines.

This is nevertheless a priority project for a number of Africa development organizations, including the New Partnership for Africa's Development (NEPAD), the Southern Africa Development Community (SADC), East African Power Pool (EAPP) and ESKOM, Africa's largest power utility, among others.

Currently, construction of Inga 3 – the first phase of the project – is set to start at the end of this year. This will see a \$14 billion dam spanning one channel of the river Congo at Inga Falls and a 4,800 MW hydro-electric plant.

The cost of this and the five subsequent phases of the project are set to total \$100 billion, with the dam spanning the entire river. Once completed, the plant would have an electricity-generating capacity of almost 40,000 MW – equal to twice that of the Three Gorges dam in China (currently the world's largest).

It is reported that, when fully operational, the Grand Inga dams will have the capacity to provide 40% of all of Africa's electricity.

There are many hurdles to overcome before South Africa's neighbours in the region can compete on the same commercial stage, but they are clearly realising their potential – and their power. **IC**

pressure grouting below the diaphragm walls; lowering of the groundwater; pile loading tests with embedded hydraulic cylinders; large-scale tests to determine friction of the shaft; driven reinforced-concrete piles and sheet piling. These foundation solutions all required a highly workable fluid concrete, so that casting at extreme depths could be achieved with self-compaction over a long period of time during these procedures.

As there was no comparable project in Mozambique for the design of the bridge foundation piles, the design was based on the findings of a geotechnical investigation, which started two years ahead of the actual construction work.

The final height of the tower on the north, Maputo side, will be 135 m, while on the south, Katembe side, just 1 m higher.

The concrete used in the bridge's construction contained up to 40% fly ash or pulverised fuel ash (PFA), sourced from South Africa. Apart from offering immediate cost savings, the PFA allows the concrete to achieve much higher long-term strength gains.

According to GAUFF Engineering, the bridge's concrete was tested by the University of Cape Town's Concrete Materials & Structural Integrity Unit, which confirmed that the samples constituted the best site concrete ever tested at the facility.

Purchasing power

In neighbouring Zimbabwe, the first of four phases of a huge coal-fired power plant is being constructed on the shores of Lake Kariba on the country's northern border with Zambia.

Zimbabwean company PER Lusulu Power signed an agreement in 2015, with the China State Engineering Corporation (CSEEC), to build the first phase of the project – a 600 MW thermal power plant.

Stuart Perry, chairman of PER Lusulu, said, "It's the first of four phases so it's a huge project for Zimbabwe. One of the biggest projects Zimbabwe has ever done."

On completion of the fourth phase of the project, the Lusulu plant will have the capacity to produce 2,000 MW of power, which is expected to greatly reduce Zimbabwe's the long-running issue of power cuts.

When Zimbabwe's finance minister, Patrick Chinamasa, spoke about the project, he stressed that the power project, which is also funded by China, will ease the current electricity woes of a country in which blackouts of up to eight hours a day are a common occurrence.

Dams of the Grand Inga hydroelectric project will span the river Congo, the world's second largest by volume

