

ELECTRICITY

Power House

Pumped-storage scheme on track to supply sustainable electricity

TRACY HANCOCK | STAFF WRITER

State-owned power utility Eskom's Ingula pumped-storage scheme is about 40% complete and on schedule to be fully operational by the end of 2014, reports South Africa-based engineering company Gibb, which led the project's design.

The R21.4-billion project is in line with meeting government's sustainability commitments, says Gibb divisional manager for dams, hydropower and underground works **Colin Logan**.

Located in the Drakensberg mountain range, on the border between the Free State and KwaZulu-Natal, Ingula includes technology that enables sustainability and environmental targets to be met, particularly where carbon emissions are concerned.

Being a closed system, it reuses water used in the upper dam (Bedford) and a lower dam (Braamhoek); therefore, little additional water is required to supplement power generation. While there is a continuous inflow of freshwater from the Braamhoek Spruit and Wilge rivers, a contingency allowance is made for evaporation.

Once Ingula is commissioned, the first three years will see the dams being filled.

The 1 332 MW pumped-storage scheme, which is designed to meet South Africa's power demand using maximum power-generation efficiency, will be the largest hydroelectric power source in South Africa and provide the water-challenged country with a sustainable resource.

"The power supply crisis has accelerated the need to diversify Eskom's energy mix and its move towards alternative energy sources such as nuclear power and natural gas, and alternatives to fossil fuel-based energy sources. In a national response to South Africa's electricity shortages, government and Eskom are working to bring the country's electricity supply and distribution system back into balance.

"The plan includes work on the country's electricity distribution structure, and the fast-tracking of electricity projects by independent power producers," says Logan.

Gibb has experience in designing and developing major infrastructure projects in South Africa and, increasingly, beyond its borders, such as the recently signed \$100-million Metolong dam project, in Lesotho.



WATER RESERVOIR

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Given the scale of Ingula, Gibb sourced additional partners to design components of the overall design of the pumped-storage scheme.

A combined turbine-pump system enables water to be released from the upper dam to the lower dam through the turbines to generate power. When the demand cycle falls, water is pumped back through the system in reverse to the upper dam.

"We decided to go with this option in our design because the demand cycle can be better tracked with a minimal loss in power-generation efficiency. Coal-fired power stations, on the other hand, cannot simply be switched off and on again to meet demand when the cycle peaks. With the pumped-storage scheme, we have this flexibility," explains Logan.

This creates a battery for power storage when the electricity demand decreases.

The largest caverns in mud rock in the world have been dug to accommodate the transformer hall and machine hall, which will house four turbine pumps that will generate 333 MW each.

South Africa currently produces 40 000 MW from its existing assets and needs to increase energy generation capacity to meet demand.

"While demand for power is part and parcel of a larger economy that is developing, demand has been bolstered by a successful electrification programme. Areas throughout South Africa previously without access to electricity now have it," concludes Logan.

