ZAMBEZI RIVER AUTHORITY

Corporate Brochure

Water! Today, Tomorrow

OVERVIEW OF THE ZAMBEZI RIVER AUTHORITY

ABOUT ZRA

The Zambezi River Authority *(the Authority)* is a bilateral organisation mandated to contribute to the economic, industrial, and social development of the Republics of Zambia and Zimbabwe. Its mission is to obtain the maximum possible benefits from the natural advantages offered by the Zambezi River, using cost-effective methods for water provision for electricity generation and other purposes as decided by both nations.

Established on 1st October 1987 by parallel legislation in Zambia and Zimbabwe (Zambezi River Authority Acts No. 17 & 19), the Authority manages the Zambezi River section flowing between their borders (Kazungula to Luangwa in Zambia and Kazungula to Kanyemba in Zimbabwe). It is responsible for the maintenance of the Kariba Dam complex and any future infrastructure on the river bordering the two countries.

OUR VISION

To be the leading organisation in sustainable water resources and dam management.

OUR MISSION

To manage the Kariba Dam and sustainably harness the Zambezi River's shared water resources for industrial and socio-economic development for the benefit of the people of Zambia and Zimbabwe.

KEY STRATEGIC FUNCTIONS

The following are the key statutory functions of the Authority .

a. The operation, monitoring and maintenance of the Kariba Dam.

b. In consultation with the national electricity undertakings, investigate the desirability of constructing new dams on the Zambezi River and make recommendations thereon to the Council of Ministers (COM).

c. To construct, operate, monitor and maintain any other dams on the Zambezi River.

d. To collect, accumulate and process hydrological and environmental data of the Zambezi River for the better performance of its functions and for any other purpose beneficial to the Contracting States.

e. Regulate the water level in the Kariba reservoir and any other reservoirs owned by the Authority.

f. Submit development plans and programmes to COM for approval.

KARIBA DAM OPERATIONS

The management of the Kariba Dam reservoir is guided by several key factors to ensure efficient operations and sustainability while meeting power generation demands:

a. Rainfall Patterns: Seasonal rainfall across the Zambezi Basin directly impacts water availability and reservoir capacity, influencing electricity generation and water level management.

b. **River Inflows**: Contributions from Zambezi River's tributaries are continuously monitored to support informed decisions on water allocation.

c. **Outflows**: Regulated water releases through turbines and spillway gates ensure downstream ecological and agricultural needs are met.

d. **Water Quality**: Regular monitoring ensures water remains suitable for ecological balance, hydropower generation, and consumption by managing temperature, turbidity, and nutrients.

e. **Environmental Considerations**: Efforts to minimise environmental impacts include protecting biodiversity, managing sedimentation, and maintaining ecological integrity.

f. **Gauging Stations**: Thirteen gauging stations (11 in the Upper Zambezi and 2 in the Lower Zambezi) are crucial for inflow forecasting, flood management, and hydrological trend analysis.

g. **Kariba Forecasting System**: A state-of-the-art forecasting system uses real-time data and advanced algorithms to enhance inflow predictions, ensuring optimal reservoir management and power generation.

h. **Regional Collaboration**: Close coordination with neighbouring countries facilitates shared water resource management, data sharing, and ecological preservation.

i. **Forecasting and Modelling**: Advanced hydrological models predict inflows and assess climate variability impacts, enabling proactive water management strategies.

KARIBA DAM REHABILITATION PROJECT (KDRP)

After more than 60 years of operation, routine monitoring of the Kariba Dam identified the need for comprehensive rehabilitation to ensure that the dam continues to contribute to energy security and economic growth for both Zambia and Zimbabwe, as well as the region. This rehabilitation project has an estimated total cost of USD 294 million and is funded through contributions from the World Bank, African Development Bank, Swedish Government, and the European Union (the latter providing €72 million specifically for the plunge pool reshaping). Managed by the Zambezi River Authority on behalf of the Governments of Zambia and Zimbabwe, the project's overarching objective is to enhance the dam's performance and reliability, safeguarding its capacity for many years to come.

The KDRP includes two primary components:

1. Reshaping of the Plunge Pool

The plunge pool downstream of Kariba Dam underwent significant erosion over time due to the impact of floodwaters, especially during the dam's early years. To address this, the plunge pool reshaping project was undertaken to protect the dam's foundations, particularly in the weak fault zone.

The project involved:

a. Controlled blasting and excavation of approximately 300,000 m^3 of rock from the downstream face and both the north and south bank sides of the pool.

b. Creation of a new stepped profile to reduce water pressure on the rock floor, enhance energy dissipation, and redirect water flow downstream, away from the dam's foundations.

c. Application of high-performance, abrasion-resistant reinforced concrete lining in critical areas to prevent further scouring near the foundation.

d. The reshaped plunge pool ensures improved stability and operational safety for the Kariba Dam. The project was successfully completed in September 2024.

2. Refurbishment of the Spillway Gates

The Kariba Dam's six spillway gates, responsible for controlling water discharge, have faced operational challenges caused by Alkali Aggregate Reaction (AAR). This condition leads to swelling in the concrete, impeding smooth gate movement.
To resolve these issues, an ongoing spillway refurbishment project includes:

a. Replacing built-in parts for stop-beams across all water passages.
b. Installing a new emergency gate capable of closing sluices under flow conditions.
c. Introducing a new gantry crane to handle the emergency gate, ensuring safe and reliable spillway operations.
d. Upgrading the hoist system for opening and closing the downstream gates.

These upgrades will align the spillway system with international dam safety standards, securing the dam's long-term operability and preventing potential failure. Phase 1 of the refurbishment is expected to be completed in the third quarter of 2025, with phase 2 concluding in the third quarter of 2026.

The plunge pool reshaping and spillway refurbishment works collectively form the core of the KDRP, addressing critical aspects of dam safety and infrastructure resilience. The KDRP's timely completion is expected to extend the operational lifespan of the Kariba Dam, reinforcing its role in sustainable energy generation and flood management for Zambia, Zimbabwe, and the Southern African Region.

BATOKA GORGE HYDRO-ELECTRIC SCHEME (BGHES)

Project Site Location

The Batoka Gorge Hydro-Electric Scheme (BGHES) is positioned on the Zambezi River, about 47 km downstream of Victoria Falls, a UNESCO World Heritage Site. Located along the Zambia-Zimbabwe border, the site integrates natural beauty with strategic bi-national significance.

Background

The Batoka Gorge HES concept originated in 1972 from a study by the Central African Power Corporation, the Zambezi River Authority's predecessor. Identified for its high hydroelectric potential on the Zambezi, the project has evolved to incorporate sustainability and modern engineering standards. Beyond meeting Zambia and Zimbabwe's power needs, Batoka Gorge HES aims to promote regional economic growth, job creation, and clean energy access in Southern Africa.

Project Description

a. The Batoka Gorge Hydro-Electric Scheme (HES) will represent an advanced hydroelectric project, optimally designed for high-capacity power generation and efficient water management. Its reservoir will span a catchment area of 508,000 square kilometres, holding up to 1.38 billion cubic metres at a Full Supply Level of 762 metres.

b. The dam will stand as a robust 175-metre RCC Gravity Arch, built with 4.08 million cubic metres of roller-compacted concrete to ensure durability. An overflow crest spillway equipped with 11 radial gates (each 14 by 13 metres) will provide a design capacity of 20,000 cubic metres per second, enabling safe overflow management.

c. Power will be generated through two surface power stations on the north and south banks of the Zambezi, with a combined installed capacity of up to 2,400 MW (1,200 MW each), securing a significant and stable energy supply for Zambia and Zimbabwe. This strategic setup will align the project with regional energy needs while maintaining environmental stewardship.

Project Benefits:

a. Will reduce power system operation costs when managed alongside Kariba Dam.
b. Will increase the renewable energy share in Zambia and Zimbabwe, aligning with carbon emission reduction goals.
c. Will avoid displacement as the reservoir will remain fully contained within the gorge.

Mission 300:

Transforming Access to Energy

BGHES contributes directly to the Mission 300 initiative, which aims to connect 300 million people in Sub-Saharan Africa to electricity by 2030. It will significantly increase access to power in Zambia, Zimbabwe, and the wider SADC region, catalysing economic growth and enhancing livelihoods.

CORPORATE SOCIAL RESPONSIBILITY: ZAMBEZI VALLEY DEVELOPMENT FUND (ZVDF)

The Zambezi Valley Development Fund (ZVDF), established in 1997 as the Zambezi River Authority's corporate social responsibility initiative, supports communities displaced during the construction of the Kariba Dam to access social amenities. The fund finances sustainable infrastructure projects to mitigate the long-term impact on the Tonga and KoreKore people in Zambia and Zimbabwe.

The ZVDF follows a community-driven approach, empowering residents to propose projects through their local councils in consultation with community leaders. These initiatives focus on addressing critical health and educational needs, demonstrating the fund's commitment to sustainable community development.

ZVDF Objectives

1. Financing sustainable projects to alleviate displacement impacts.
2. Supporting financing, training, and administration for community-based projects.

Some of the projects implemented under the Zambezi Valley Development Fund (ZVDF) to support communities impacted by the Kariba Dam construction.

Chabbobboma Mothers' Shelter (Gwembe District)

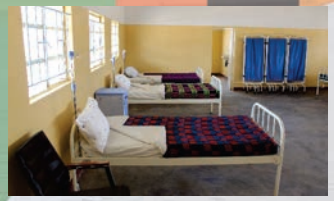
Chiyabi Health Post (Sinazongwe District)

Nkandanzovu Science Laboratory (Kalomo District)

Construction of a 1x3 lab.

Njabalombe Health Centre (Kalomo District)

Construction of a clinic and staff houses.



Chiroti Clinic (Karoi District)
Establishment of a healthcare clinic and three staff houses.


Chidyamugwamu Health Centre (Nyami Nyami District)
Construction of a clinic and three staff houses.of classroom blocks and three staff houses.


Chisipiti Primary School (Hurungwe District)
Construction of a classroom block and the school itself to enhance education access.


Chikuro Primary School (Nyami Nyami District)
Construction of classroom blocks and three staff houses.


The Zambezi River Authority operates 13 gauging stations in Zambia and Zimbabwe, providing real-time data crucial for managing water resources. These stations support hydropower forecasting, spillway operations, and safe reservoir management, enhancing flood control and downstream safety. With over 100 years of Zambezi Basin hydrological data, the Authority ensures accurate forecasting, sustainable energy generation, and effective flood risk reduction. This extensive data also aids climate adaptation by identifying water flow trends and seasonal changes, enabling responsive strategies to environmental and weather challenges.

Kariba Reservoir Features: Storage Capacity and Surface Area and Dimensions:

a. Total Storage Capacity: 181 BCM
b. Live Storage: 65 BCM
c. Dead Storage: 116 BCM
d. Spillway Capacity: 9,000 m^3/s (with 6 gates open)
e. Surface Area (Full Capacity): 5,580 km^2
f. Length: 280 km / Width: 40 km

Spillway Discharge Capacity:

Equipped with six spillway gates, the dam has a maximum spill capacity of 9,000 cubic metres per second (m^3/s). This robust discharge capability is essential for effective flood management, ensuring safe passage of extreme inflow events and maintaining structural integrity during peak hydrological periods.

ENVIRONMENTAL MONITORING PROGRAMME

The Zambezi River Authority's Environmental Monitoring Programme is an integral component of its commitment to environmental stewardship in the Zambezi Basin. The programme includes in-situ measurements and chemical analyses to monitor water quality and ecosystem health, hyacinth weed control initiatives to maintain aquatic biodiversity, and regular seasonal and regional monitoring. These measures help mitigate the impacts of human activity and climate variability on the basin's water quality and ecosystem integrity, contributing to sustainable resource use and environmental resilience.

DAM SAFETY MANAGEMENT PROGRAMME

The Dam Safety Management Programme ensures the reliability and functionality of the Kariba Dam through preventive activities. Key components include:

a. **Surveillance and Monitoring (S&M):** Daily data collection from installed instruments monitors the dam's behaviour, assessing factors like water levels and maintenance impacts.

b. **Operations and Maintenance (O&M):** Routine tasks, such as floodgate testing and drainage clearing, prevent safety issues, with specialised expertise engaged for complex projects like the Kariba Dam Rehabilitation.

c. **Inspections:** Regular inspections—daily, monthly, annually, and every five years—identify potential issues, adhering to international standards like the International Commission on Large Dams (ICOLD).

d. **Risk Assessments and Reviews:** Systematic evaluations of design, operation, and risks like flooding and seismic activity guide improvements based on international safety benchmarks.

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