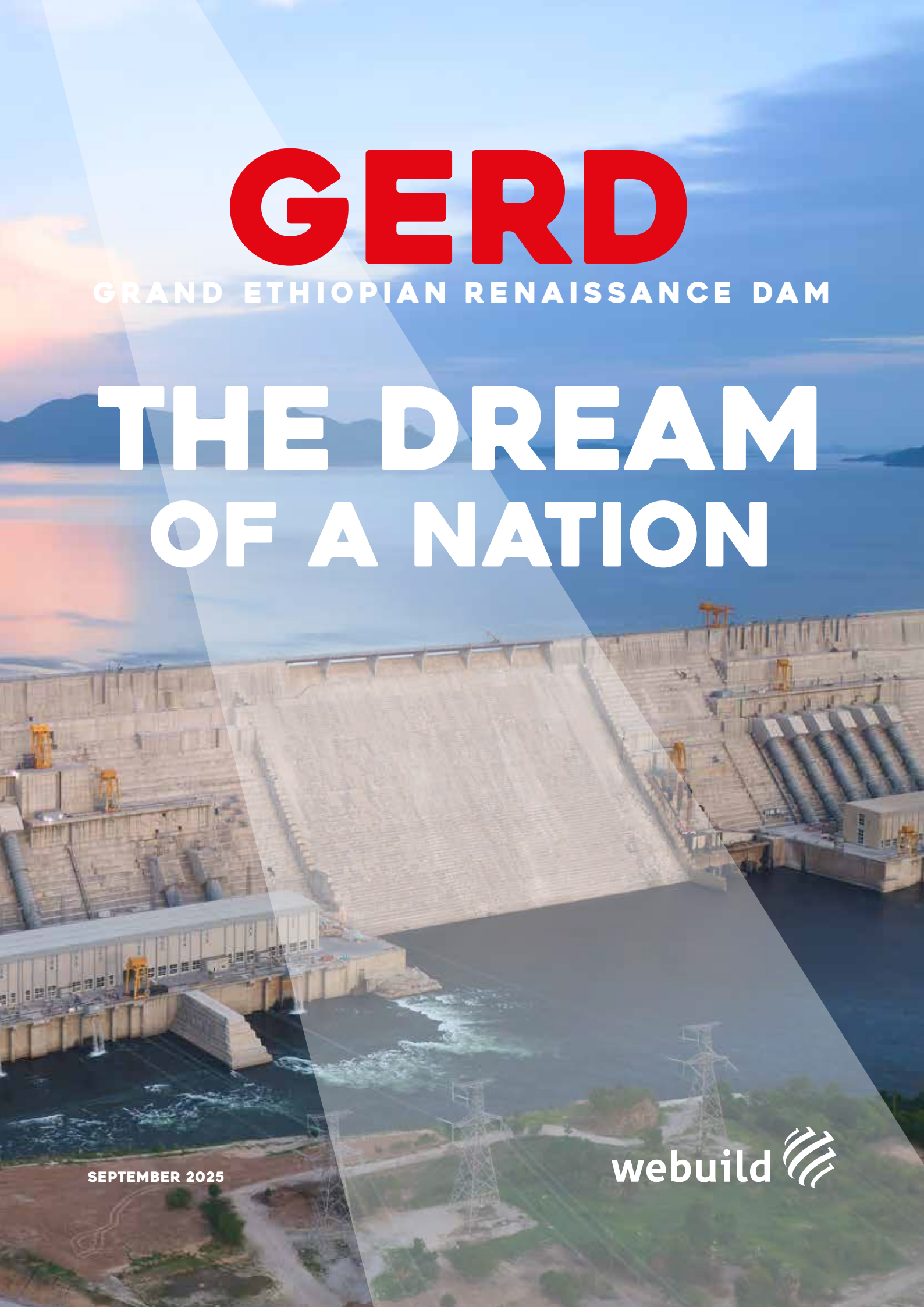

GERD

GRAND ETHIOPIAN RENAISSANCE DAM

THE DREAM OF A NATION

SEPTEMBER 2025

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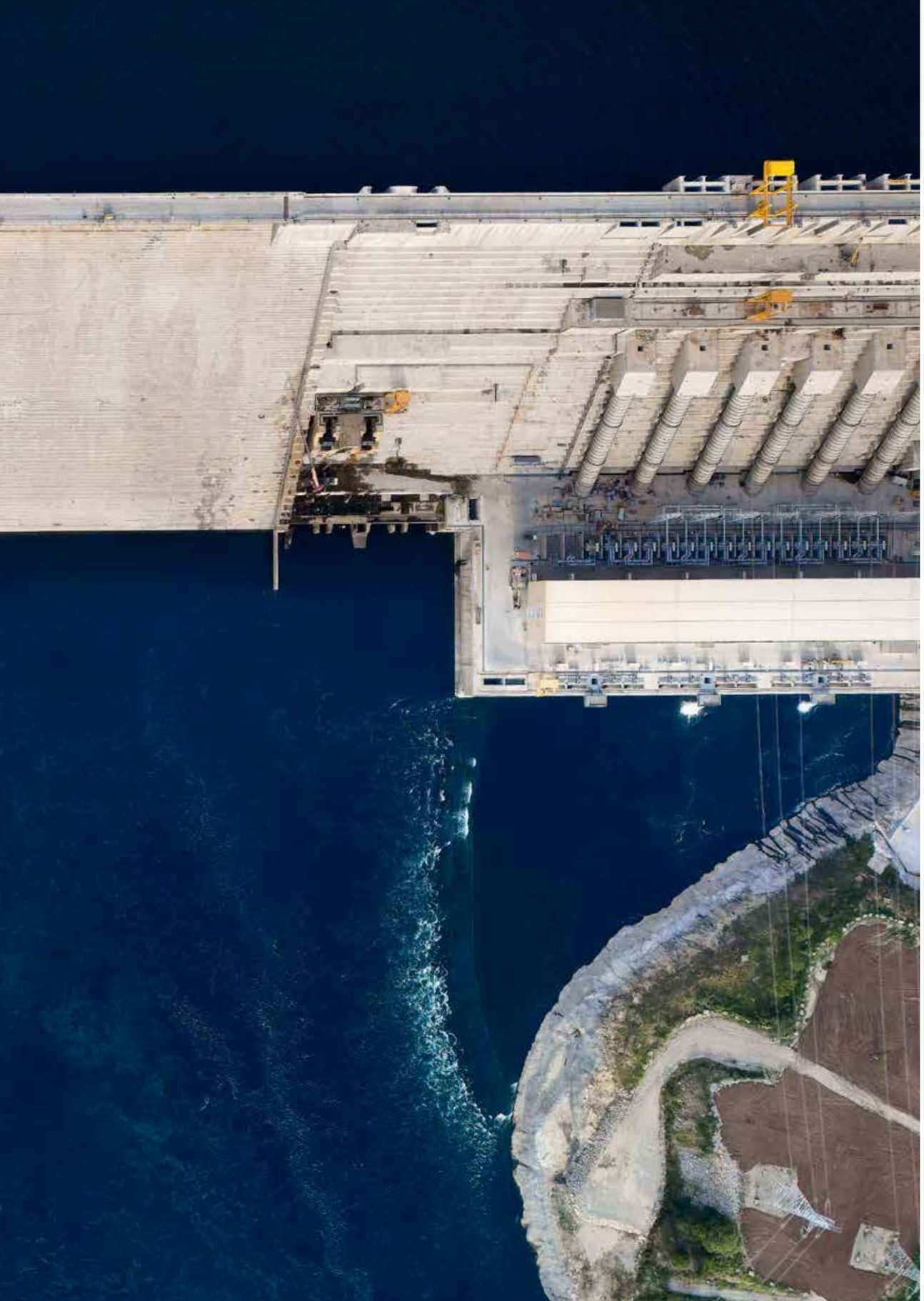

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Main dam and gated spillway

The medium-term goal of the Ethiopian Electric Power (EEP) is to reach 17,000 MW by 2037

One of the two bridges spanning the Blue Nile, with the main dam in the background

1. THE HYDROELECTRIC CHALLENGE OF ETHIOPIA

Ethiopia's development runs parallel to the valorization of its water resources and their use to meet the country's energy needs. With an estimated hydroelectric potential of over 45,000 MW and one of the most extensive river networks in the continent, Ethiopia has launched a multi-decade plan aimed at producing reliable, renewable, and exportable energy.

This transition, integrating engineering expertise and political vision, has already generated significant increases in installed capacity and access to electricity.

The cornerstone of this transformation is large hydroelectric infrastructure: highly complex technological projects designed to meet two strategic objectives. On one hand, ensuring energy supply for a growing population, now nearing 130 million inhabitants; on the other, positioning Ethiopia as a reference energy hub for East Africa.

According to data from the Ethiopian Electric Power (EEP), in 2024, the country surpassed 5,300 MW of installed capacity, doubling the values of 2014. The medium-term goal is to reach 17,000 MW by 2037 through the construction of new plants and the optimization of existing infrastructure. This development serves as a driver for industrial growth, poverty reduction, and increased employment, strengthening the country's energy autonomy and regional competitiveness.

Ethiopia's river network has an estimated hydroelectric potential of 45,000 MW

2. THE STRATEGIC ROLE OF GERD IN THE COUNTRY'S ENERGY FUTURE

GERD, the Grand Ethiopian Renaissance Dam, represents one of the cornerstones of Ethiopia's national energy strategy. The project, commissioned by Ethiopian Electric Power (EEP) and inaugurated in September 2025, is a complex infrastructural system that, by harnessing the waters of the Blue Nile, achieves an installed capacity of 5,150 MW, equivalent to three medium-sized nuclear power plants.

The plant is capable of doubling national energy production

GERD is a complex infrastructural system with an installed capacity equivalent to that of three medium-sized nuclear power plants

The main dam with a view of the powerhouses

The plant consists of two dams (a Main Dam and a Saddle Dam) and two powerhouses, at the base of the Main Dam, one on the right bank and one on the left bank of the river, designed to double national energy production and generate a surplus for export to neighboring countries, including Sudan, Kenya, Djibouti, and Tanzania.

Beyond its technical significance, GERD also holds strong strategic and institutional value. The construction was entirely funded by domestic resources, supplemented by funds raised through a government bond program subscribed to by the population and local institutions, without resorting to multilateral financing. This approach reinforces the project's value: a global-scale infrastructure that consolidates Ethiopia's energy autonomy and its ability to position itself as a regional energy hub.

3. THE PROJECT

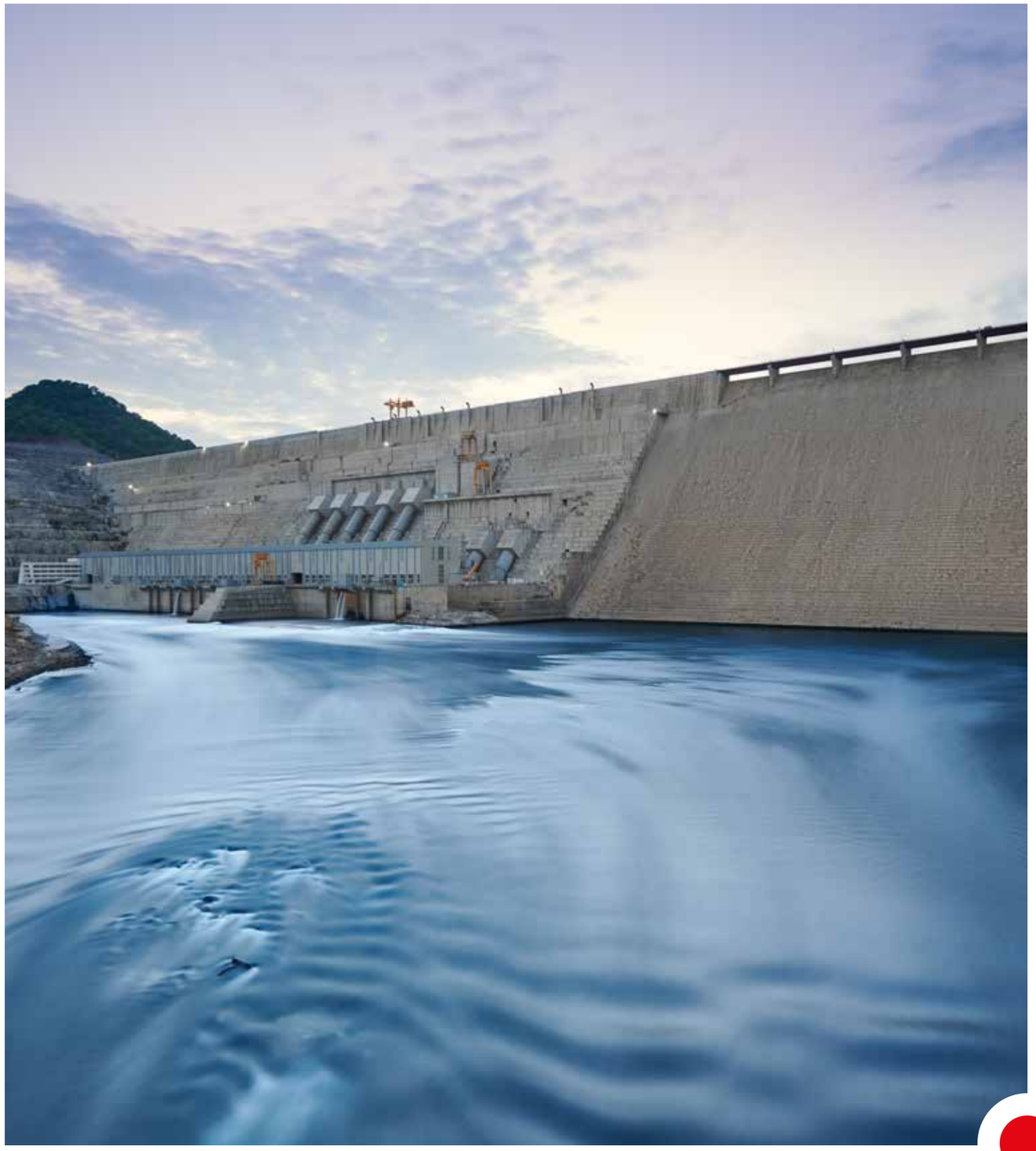
The Grand Ethiopian Renaissance Dam is a globally significant engineering project and a strategic infrastructure for Ethiopia's energy independence. The plant is developed along the course of the Blue Nile with a configuration consisting of two main structures:

The Grand Ethiopian Renaissance Dam is the largest hydropower project in Africa

- **The Main Dam**, the primary dam that blocks the river's waters to produce electricity, is one of the most complex and grandiose infrastructural works built in recent years worldwide. It is a roller-compacted concrete (RCC) dam, 170 m high and 1,800 m long, for which 10.7 million m^3 of RCC were placed.

- **The Saddle Dam** is the secondary dam. An arched dam with a concrete facing, 5 km long and 50 m high, with a volume of 15.3 million m^3, designed to close a natural depression and contain the reservoir.

Together, the two dams create an artificial reservoir with a linear length of 172 km, an area of 1,875 km^2, and a capacity of 74 billion m^3 of water. The average annual downstream outflow of the Nile's waters is estimated at 50 billion m^3, with regulated management to ensure water continuity to Sudan and Egypt.



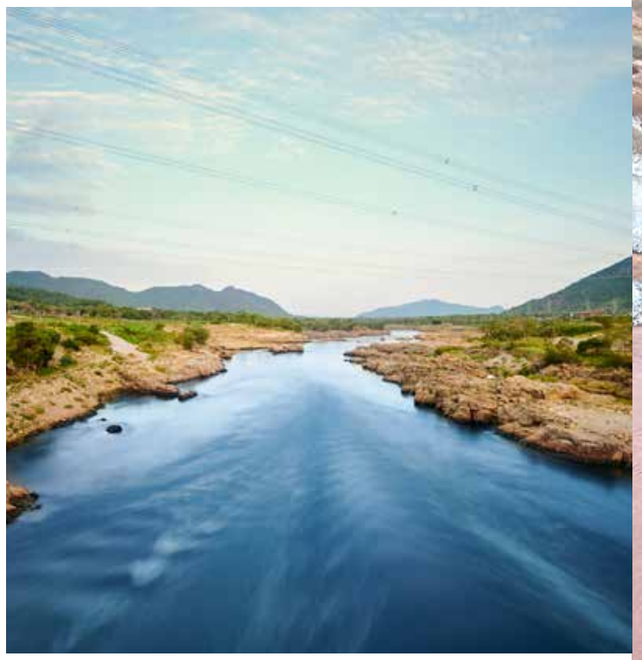
Downstream view of the main dam and the powerhouse on the right bank

ENERGY GENERATION SYSTEM

Energy production is entrusted to the two powerhouses, located on both banks of the river at the base of the Main Dam, equipped with 13 Francis turbines. The total installed capacity is 5,150 MW, with an expected production of approximately 15,700 GWh/year. Energy production began in 2022, thanks to a progressive activation system that allowed production to start before the reservoir was fully filled.

HYDRAULIC MANAGEMENT AND FLOW CONTROL

One of the main challenges of the project was a diversion system to shift the Blue Nile river course from one bank to the other as needed. The management of the river, characterized during the rainy season by flows that can reach an average of 8,000 m^3/s, was ensured through temporary diversion and redirection structures, with controlled release of turbined waters downstream. In addition to the dams, a spillway was constructed, an overflow structure that can be opened when lake levels exceed projections, allowing water to flow downstream without passing over the central part of the dam.



One of the project's challenges was a diversion system designed to shift the Blue Nile course from one bank to the other

Early stages of dam construction with the diversion of the Blue Nile

GERD in numbers

MAIN DAM

Length
1,800 m

Height
170 m

10.7 mln m^3
of concrete

RESERVOIR

Volume
74 bln m^3

Surface area
1,875 km^2
larger than the entire Greater London area

SECONDARY DAM

Length
5,000 m

15.3 mln m^3
of rockfill

2 POWERHOUSES

13 Francis turbines
Total installed capacity
of **5,150** MW
Expected production
15,700 GW h/year
enough energy to supply
6 mln households annually

PROJECT BENEFITS

CO_2 reduction
-1.3 mln
tonnes per year

equivalent to
that absorbed by
~8 mln oak trees

4. INNOVATIONS AND TECHNICAL COMPLEXITIES

The Grand Ethiopian Renaissance Dam integrates cutting-edge engineering and technological solutions to ensure performance, safety, and durability over time.

The Main Dam is equipped with an advanced monitoring system, set up in the network of galleries

HIGH-PERFORMANCE MATERIALS

The Main Dam was built placing roller-compacted concrete (RCC), a particular mix of concrete with low cement and water content, very dry. Research conducted in internal laboratories, in collaboration with international experts, led to the creation of this mix characterized by extended setting times and superior mechanical performance. This solution improved workability and structural quality increasing long-term durability.

INTEGRATED STRUCTURAL MONITORING

An advanced monitoring system was installed within the dam, set up in the network of galleries of the Main Dam. The system detects key parameters in real-time, including:

- Hydrostatic pressure and reservoir levels
- Integrity of the concrete block joints
- Millimetric structural shifts
- Turbine and mechanical component performance

The Main Dam with a view of the powerhouses

Machine hall

Monitoring is carried out through a network of sensors and precision instruments that record every variation in the structural conditions

PRECISION INSTRUMENTATION

Monitoring is carried out through a network of sensors and precision instruments, including high-sensitivity *pendula* extending from the crest to the base of the dam. These devices measure and record every variation in the structural conditions, ensuring a constant view of operational conditions.

CONTROL CENTER AND DATA MANAGEMENT

All acquired data feeds into a centralized database hosted in the control center located at the base of the dam on the right bank. Here, the data is analyzed in real-time to support predictive maintenance activities and ensure maximum operational reliability.

5. BENEFITS FOR THE TERRITORY

The Grand Ethiopian Renaissance Dam project has generated significant occupational and social impact, confirming its strategic value not only from an energy perspective but also for the development of local communities. The plant also ensures a reduction of 1.3 million tons per year of CO_2 emissions for the national power grid.

The permanent camp for the workers

The Village of Banza

EMPLOYMENT AND PROFESSIONAL DEVELOPMENT

Over the years, the construction site hosted a total of 25,000 workers, with peaks of 10,000 people at a time. More than 95% of these were from Ethiopia, largely from nearby communities. The high number of workers and the project's complexity necessitated the organization of technical and safety training programs, enhancing professional skills and ensuring high operational standards, even for those who had never worked on a construction site before.

LOGISTICAL AND RESIDENTIAL INFRASTRUCTURE

To support the workforce and operational needs, a complex logistical system was created, including:

- Three housing camps
- An extensive internal road network within the site, including the construction of two bridges over the Blue Nile
- A landing strip for rapid connections with Addis Ababa
- Numerous service facilities such as schools, canteens, recreational areas, a club, a swimming pool, and sports fields
- A central hospital and two satellite clinics, operating 24/7

Over the years, the construction site hosted a total of 25,000 workers, with peaks of 10,000 people at a time

FROM SCHOOL TO WATER

The facilities included the construction of water treatment and distribution systems for the Blue Nile, serving both the site's needs and the residences. A school was also established within the camp to ensure primary education for the workers' children.

CLINICS AND HOSPITAL

A comprehensive healthcare system was set up within the site, including a central hospital (20 beds, six ambulances, 71 healthcare workers) and two satellite clinics, operating 24/7. The facilities provided medical care, prevention, and vaccination campaigns, collaborating with local health authorities (over 4,200 vaccinations and more than 700,000 medical services provided throughout the entire project). The centers offered free services to both workers and residents of surrounding areas. The healthcare infrastructure was transferred to the Ethiopian Ministry of Health, ensuring service continuity and representing a tangible legacy for the community.

Among the facilities there are a school, a hospital, and a factory for producing injera, Ethiopia's national food

The school inside the camp

THE INJERA FACTORY

In addition to the three canteens set up within the site, the Webuild Group established and managed a factory for producing injera, Ethiopia's traditional food, which appears as a large, light gray crepe made from teff flour. The factory, employing 84 people, produced an average of over 6,500 injera per day, with peaks exceeding 10,000, to meet the workers' demand. Up to 3 million injera were produced annually.

The injera factory

6. WEBUILD IN ETHIOPIA: 70 YEARS OF STRATEGIC PROJECTS

Webuild's history in Ethiopia began in the late 1950s, in a context characterized by significant infrastructural needs and a political vision oriented toward the country's modernization. Since then, the Group has significantly contributed to the development of a system of water and energy infrastructure, supporting the national strategy that placed infrastructure at the core of economic and social growth. In almost 70 years of continuous presence, Webuild has completed 30 projects, mostly dams and hydroelectric power plants, consolidating Ethiopia's role as a hub for clean energy in Africa.

In 70 years, Webuild has completed 30 projects in Ethiopia, mostly dams and hydroelectric power plants

Gibe III Hydropower Project

Among the most significant projects is the Grand Ethiopian Renaissance Dam (GERD), the largest gravity dam on the continent and one of the most imposing in the world. Alongside GERD, the construction of the Koysha dam on the Omo River is underway, the second largest dam in the country by size. It is a roller-compacted concrete (RCC) dam, 190 meters high, with a crest about one kilometer long and a reservoir capacity of 6 billion cubic meters. The six 300 MW Francis turbines, for a total of 1,800 MW of installed capacity, will generate an estimated production of 6,460 GWh/year and a reduction in emissions of approximately one million tons of CO_2. Koysha is part of an integrated cascade hydroelectric system that also includes Gilgel Gibe, Gibe II and Gibe III, the latter being one of the most significant projects for increasing national electricity production, which rose by 85% upon its commissioning in 2016.

In northwestern Ethiopia, Webuild completed the Beles Multipurpose Project, the largest underground hydroelectric plant in Ethiopia at the time of its inauguration. The project, which harnesses the waters of Lake Tana and returns them to the Beles River, includes an intake, a 12-kilometer tunnel,

an underground powerhouse, and a 7-kilometer tailrace tunnel, with an installed capacity of 460 MW and an average annual production of 1,720 GWh.

Webuild's history in Ethiopia is not only about energy but also about potable water management. Between the 1960s and 1990s, the Group built critical water infrastructure for Addis Ababa, including the Legadadi dam, which, with a capacity of 40 million m^3 and a treatment plant capable of processing 50,000 m^3 of water per day, remains one of the main sources of water supply for the capital.

In addition, Webuild also built the Dire Dam, a strategic infrastructure designed to provide a concrete and sustainable response to the region's water needs. The dam is 2 km long and 46.5 meters high, designed to ensure reliability, efficiency, and long-term durability. A project of great benefits, conceived to strengthen water resilience and improve the quality of life of local communities, successfully combining engineering, sustainability, and innovation.

Today, with projects like GERD and Koysha, Webuild confirms its long-term vision. These projects are not only energy infrastructure but also tools for sustainable development, regional cooperation, and economic growth, the result of a commitment that began seventy years ago and is set to continue with new challenges and opportunities.

Webuild built also critical water infrastructures for Addis Ababa: the Legadadi dam remains one of the main sources of water supply for the capital

Addis Ababa

The main dam

The secondary rockfill dam with concrete face

GERD
GRAND ETHIOPIAN RENAISSANCE DAM

THE DREAM OF A NATION

Project coordination
Corporate Identity, Communication and Institutional Affairs, Webuild Group

Credits
Webuild Image Library

Photography
Filippo Vinardi for Webuild

Visual concept
PRC – Promozione, Ricerche, Consulenze

Print
PRC – Promozione, Ricerche, Consulenze

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