

## Construction

- » Main Dam
- » Power House
- » Spillway
- » Transmission Facilities
- » Permanent Bridge



» Civil Work of Main Dam 95% Completed



» Upstream View of the Bui Dam after impoundment as of July 2012 showing the three intakes (left) and the five spill gates (m) under construction

## PROJECT MILESTONES AND COMPLETION SCHEDULE

### PHASE I (Actual)

October 2007	Commenced Field Investigations
January 2008	Commenced Preparatory Works
December 2008	River Diversion Completed

### PHASE II (Actual)

Jan - November 2009	River bed excavation & foundation
December 2009	Commenced Main RCC Dam
June 2011	Commenced Reservoir Filling

### PHASE II (Expected)

First Quarter of 2013	Commissioning of First Unit
Second Quarter of 2013	Completion & Commissioning

## RESETTLEMENT & COMMUNITY SUPPORT PROGRAM

The development of the Bui dam will create a reservoir that will involve the inundation, at its full supply level, of about 444km<sup>2</sup> of land, including parts of the Bui National Park. The area of permanent inundation includes six communities which need to be resettled.

Although another community, Dokokyina, will not be inundated, it will need to be relocated because the community will be surrounded on three sides by the reservoir (south, east and west), and large parts of their land, which is used for cultivation, grazing, hunting and collection of forest products, will also be submerged. It is also intended to relocate the Bui Camp, the current residence of Game and Wildlife Officers assigned to protect the Bui National Park.

The project therefore involves the resettlement of eight (8) communities with a total population of 1,216 people. Implementation of the resettlement programme has been divided into three (3) parts as follow:

**Part A:** Covering four (4) communities living at the construction site

**Part B:** Covering 3 communities living in the area to be inundated

**Part C:** Covering the personnel of Game and Wildlife Division living at the old and dilapidated Bui Camp

The initial resettlement under Part A was undertaken in May 2008 with the resettling of Brewohodi, Dam Site Village, Agbegikuro, and Lucene. Facilities completed at the Resettlement Part B Township include 170 housing units, communal facilities (school, community centre, health post and places of convenience) and water supply systems. Yet to be completed are places of worship (church, mosque), and police station.

The details of the affected communities are as below:

Affected Communities	No. of Households	No. of People	Status
Brewohodi	10	48	Resettled
Dam Site	6	36	Resettled
Agbegikuro	22	107	Resettled
Lucene	4	26	Resettled
Bui Village	42	297	Resettled
Bator Akanyakrom	63	437	Resettled
Dokokyina	36	165	Resettled
Bui Camp	36	100	Not Yet
<b>Total</b>	<b>219</b>	<b>1,216</b>	

The main elements of the Resettlement & Community Support Program include:

- » New resettlement townships with following Communal Facilities: Community Centre, Nursery, Place of worship, Boreholes, KVIPs.
- » Houses: (Room for Room+kitchen+bath+living room).
- » Compensation for loss of economic trees at LVB rates.
- » Grants: GHS100 as Resettlement Grant & GHS50 to till new farm land.
- » Income support: GHS100/month/household for 1 year.
- » Livelihood Enhancement Program: To restore Lost Economic Activities and improve Living Standards in Project Affected Areas.



» Newly Resettled Household

» Original Settlement



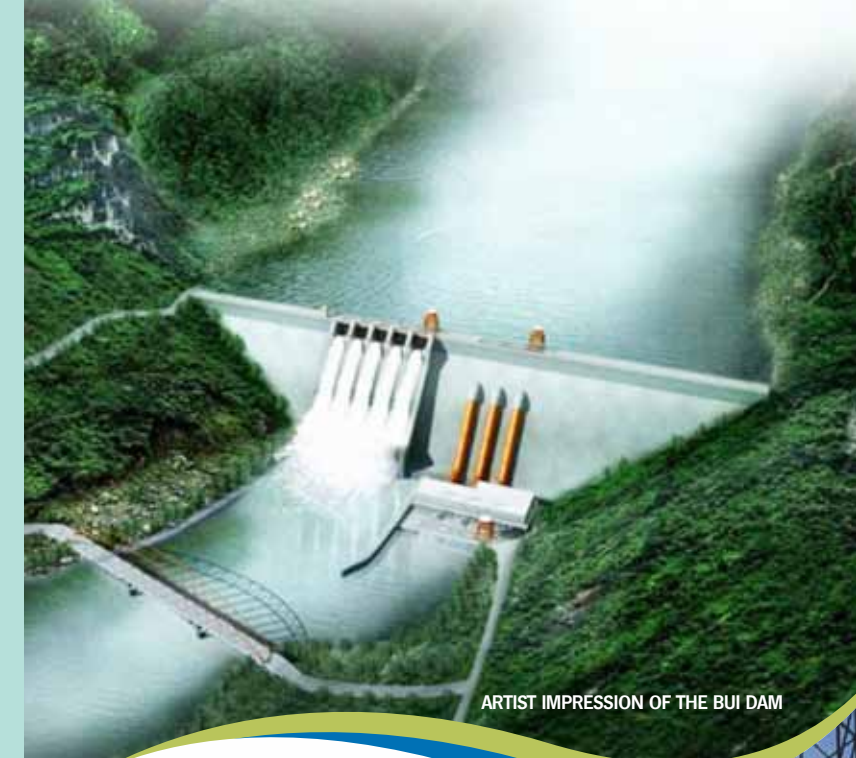
» BPA opens Information Centres to serve as platform for the Project Affected people to access information and to make their concerns known



» Six Classroom Primary School Block



» Children at the BPA Resettlement Township



ARTIST IMPRESSION OF THE BUI DAM

# BUI HYDROELECTRIC PROJECT

## BACKGROUND

The development of a hydropower scheme on the Black Volta river at the Bui Gorge had been the subject of many studies; namely, detailed studies by J.S. Zhuk Hydroprojekt of the USSR in 1966, a Feasibility Study by Snowy Mountains Eng. Corp (SMEC) of Australia in 1976 and another Feasibility Study by Coyne et Bellier of France in 1995.

The proposed 400 MW Bui hydropower scheme was considered to be the most technically and economically attractive hydropower site in Ghana after the Akosombo and Kpong hydro power plants. The feasibility study of 1995 was subsequently updated by Coyne et Bellier in October 2006 to enable the commencement of the project.

The Bui Power Authority Act, 2007 (Act 740) was enacted by the Parliament of Ghana and assented to by the President in July 2007 to establish an Authority known as the Bui Power Authority (BPA) which was to plan, execute and manage the Bui Hydroelectric Project.

The Bui Hydroelectric Project which is currently being implemented was designed primarily for hydropower generation. It however also includes the development of an irrigation scheme for agricultural development and presents an opportunity for enhanced ecotourism and fisheries. It also includes a Resettlement and Community Support Program.



Physical Address: Hse No.9 Carrots Lane, East Legon  
 Fax: +233 302 522 443, Phone: +233 302 522 444/ +233 302 522 445  
 Email: info@buipowerauthority.com, Website: buipowerauthority.com

## BENEFITS OF THE BUI HYDROELECTRIC PROJECT

### Hydro power generation and water supply

- The country's generation capacity will be increased thus enhancing power supply in the country in general and in particular the reliability and security of power supply to the Northern Sector of the country.
- Reinforcement of the Transmission Network in the Three Northern Regions of the Country.
- Provision of Auxiliary Services i.e. Peaking Power and Reactive Power
- Improved water supply for irrigation and domestic use

### Agriculture

Potential irrigable land of 30,000ha; bedrock for massive mechanized farming.

- Food and cash crops
- Fisheries
- Animal husbandry

### Socio-economic

- Job creation
- Improvement of educational, health and social facilities

## MAIN PROJECT COMPONENTS

The main components of the Bui Hydroelectric Power Project are: a **Roller Compacted Concrete (RCC)** gravity dam incorporating a 5-bay **spillway**, and 3 **penstocks** in the middle of the dam; a **powerhouse** at the toe of the dam on the left bank; **two rockfill saddle dams** on the right bank; a **switchyard**; 244km of **transmission lines**; and, a permanent **bridge** downstream of the dam.

## SUMMARY OF PROJECT FEATURES

### Main Dam

- » Roller Compacted Concrete (RCC) Gravity Dam (1,000,000m<sup>3</sup>)
- » Crest length - 492.5m<sup>3</sup>
- » Dam crest elevation - 185.0masl
- » Maximum dam height - 108masl
- » Dam crest width - 7m

### Reservoir

- » Full Supply Level (FSL) - 183.0m
- » Reservoir Area at FSL - 444km<sup>2</sup>
- » Storage Volume at FSL - 12.57 x 10<sup>9</sup> m<sup>3</sup>
- » Minimum Operating Level - 168.0m
- » Active Storage - 7.72 x 10<sup>9</sup> m<sup>3</sup>

### Spillway

- » Five gated structure
- » Designed for 1 in a 10,000 year flood of 10,450m<sup>3</sup> /s
- » Weir crest elevation - 166.5masl

### Power House

- » Unit Type - 3 Francis Turbines/Generators of 133MW each
- » Guaranteed Peak Efficiency >94%
- » Installed Capacity - 400MW
- » Net Average long term energy production - 969GWh/yr



» Status of the powerhouse as of June 2012

### Transmission System

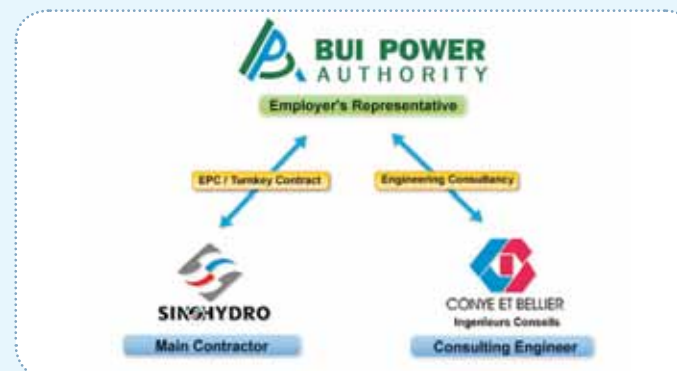
Power produced from the plant will be evacuated from the Bui Switchyard through 161 kV transmission facilities which will be operated as part of the National Interconnected Transmission System. The transmission facilities to be constructed are:

- » Bui Switchyard
- » Bui - Teselima Two (2) lines - 18km each
- » Bui - Sunyani transmission line - 138km
- » Bui - Kintampo transmission line - 70km
- » Kintampo Substation, by GRIDCo



» Erection of Transmission Lines from the Bui Switchyard

## BUI HYDROELECTRIC PROJECT PARTICIPANTS



## PROJECT COST & FUNDING

The Project, which was expected to cost about US\$622 million, was funded with a Concessional loan of US\$263.5 million, a Buyer's Credit of US\$298.5 million from the Government of the People's Republic of China and EXIM Bank respectively with a Government of Ghana contribution of US\$60 million.

## ADDITIONAL FUNDING

The Project has experienced a funding shortfall arising primarily from the unanticipated effects of global upheavals as well as unforeseen essential works. These global events resulted in the inadequacy of the budget provided for some line items in the EPC Contract and therefore a shortfall totalling USD 168 million. These are summarized under Price Contingency, Physical Contingency and Other Items.

### A. Price Contingency

The turnkey price for the Bui Hydroelectric Project was agreed in 2007 based on cost estimates submitted by the contractor.

As a result of the global financial upheavals, the escalation index has been higher than anticipated. Hence the need to re-estimate the obligations in respect of price escalation to the value of US\$ 90.7 million.

There is the additional need for an initial working capital, supplementary insurance and other incremental costs. The total additional amount of Price Contingency is US\$ 106.7m

### B. Physical Contingency

Any complex construction project, such as the Bui Hydroelectric Project which incorporates substantial levels of geological unknowns and other physical risks, needs to recognise the associated uncertainties and therefore make an appropriate budgetary provision for Physical Contingency.

The essential items that were not foreseen include:

- » Diversion of Banda-Bongase Road and 33kV Powerline. (The Bui Reservoir will extend to cover part of this road. This was not foreseen or budgeted)
- » Reservoir Clearing. (This was not budgeted)
- » Turbinette. (This was not foreseen and not budgeted)
- » Water Supply Plants. (This was not foreseen and not budgeted)
- » Development of Fisheries in the Bui Reservoir. (This was not budgeted)
- » It is therefore proposed that the provision be revised to US\$ 47.7m.

### C. Other Items

#### i. Employer's Engineering and Administration:

A lump sum allocation of US\$ 15.0m was made in the contract budget for this item. The review has taken into consideration the negotiated costs of engineering consultancy services as well as detailed cost estimates for our other Engineering and Administration activities. The revised estimate is US\$ 25.0m.

#### ii. Others:

- » Employer's Permanent Facilities – US\$ 5.0m addition is needed
- » Workshop and Equipment for maintenance of the Facilities – US\$ 4.5m
- » Facilities for Resettlement – US\$ 1.0m extra is required

In view of all the above, additional funding totaling US \$ 168 million is required to complete the project on schedule.

#### iii. Post Construction Activities: Operation and Maintenance of Plant

## PROJECT IMPLEMENTATION

The Government of Ghana, as "Employer", entered into an Engineering Procurement and Construction (EPC)/Turnkey Project Contract for the implementation of the project in April 2007 with SINOHYDRO Corporation Limited, a major Chinese dam construction firm as the "Contractor". The role of "Employer" was subsequently assigned to Bui Power Authority to manage and supervise the project.

Coyne et Bellier an Engineering Consultant from France is providing supervision services for the construction of the Dams and the Powerhouse. BPA is responsible for the Switchyard and Transmission lines as well as all other activities such as the resettlements and agriculture.

On August 24, 2007, the sod was cut for the commencement of the Project. The implementation of the project has been divided into two phases.

**PHASE I** comprised detailed field investigations and preparatory works needed for the construction of the main works.

### Detailed Field Investigations

Detailed geological and hydro-geological investigations were carried out at the Dam site between October 2007 and March 2008. The investigations were to determine the structure of the subsurface and ascertain the geological characteristics of rock mass at the dam site. In addition, these detailed investigations were to determine the rock mass permeability, depth of underground water, scope and depth of antiseepage curtain needed for the dam foundation. The investigations also included the evaluation of the stability of rock mass at both abutments of the dam slopes, saddle dams and Powerhouse foundation.

Part of the investigations were also to determine the quantity and quality of material such as sand, gravels and aggregates for concrete works that were available from the proposed quarry and borrow areas.

The results of this phase included topographic maps, geological and hydrogeological maps, and laboratory test results of sampled core and soil materials.

### Preparatory Works

The Preparatory works which commenced in January 2008 involved the provision of support facilities and pre-constructional activities needed to facilitate the execution of the main works. The preparatory works included the following activities:

#### Construction of Contractor's temporary facilities and camp including the following:

- » Employer's offices and accommodation blocks
- » Contractor's offices and accommodation blocks
- » Recreational facilities
- » Access roads
- » Clinic
- » Steel Workshop
- » Mechanical and Electrical workshops
- » Carpentry Workshop
- » Vehicle maintenance workshop
- » Contractor's labour camp
- » Crushing plant for production of aggregates
- » Warehouse Complex

#### Construction of river diversion channel and cofferdams

The key milestone of the entire first phase was the successful diversion of the river by the construction of the diversion channel and coffer dams (upstream and downstream) in December 2008 to enable the main works to commence in January 2009.

**PHASE II** of the project includes the following activities:

### Detailed Engineering Design

- » Main and Saddle Dams
- » Spillways
- » Power house – civil and electromechanical works
- » Hydraulic Turbine Model Test
- » Transmission lines
- » Environmental & social Impact Assessment (ESIA)
- » Finalization of Transmission Line Route Selection