

Assiut Barrage in Egypt: Past, Present and Future

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Water Resources is becoming increasingly scarce due to unsustainable consumption and use behavior such as overexploitation and pollution in Egypt. In Irrigation sector, the extraction and use of water by landowners is not sufficiently regulated to protect nation and local communities from the depletion and pollution of the water resources. In practice, groundwater can be extracted and Nile river water can be diverted to irrigate fields at will. The impact of climate change also poses a further threat to food security. Assiut Barrage plays a key role in both Egypt's food self sufficiency and secures the livelihood of nearly 6.0 million people.

Assiut Barrage was constructed between 1892 and 1902 to sustain a water level difference of about 4 m in order to feed the Ibrahimia Canal. Since its completing in 1902, Assiut Barrage, along with the old Aswan Dam, remains in service as the oldest Barrage on the Nile in Upper Egypt. The two other old Barrages (Naga Hamadi and Isna Barrages) were replaced with new Barrages in the 1990s. Assiut Barrage supplies up to 440 m³/s of Nile water. With total length about 350 km, Ibrahimia Canal irrigates an area of almost 690,000 ha of Nile valley land in Upper Egypt. The barrage was remodeled by 1938 to increase the permissible headpond level difference to 4.2 m and thereby increasing the capacity of the Ibrahimia Canal. After construction of High Aswan Dam in 1960s, and during 1970s and 1980s, structural stability of Assiut Barrage has been reduced due to subsequent change in flow regime of the Nile and accelerated riverbed degradation downstream the barrages, so higher heads and higher hydraulic forces across the barrage structure and the civil works have been affected by age and also by tail water erosion as a consequence of a modified river regime.

On the Nile River, as a milestone of a National Program of rehabilitation and upgrading barrages, Egypt intends to replace the existing Nile barrage in Assiut with a new one. New Assiut Barrage would provide an increase in the allowed head, allowing more water discharges into the Ibrahimiya Canal and will improve navigation conditions. The new Barrage will also include a low head hydropower plant providing about 40 Megawatts. Egypt has investigated the options of rehabilitation of the existing Assiut Barrage and the Ibrahimiya head regulator against reconstruction of a new barrage with a hydro-power plant. Two alternatives at the same level for correct evaluation have been analyzed, the first option "New Assiut Barrage 200-300 m downstream of the existing one with hydropower plant" and the other alternative is "Rehabilitation with hydropower". The most economic option is constructing a new Barrage 200 m downstream of the existing barrage with power generating capabilities. There is a concern that the new maximum pool level will increase the groundwater levels in Assiut city and in some areas in the upstream. Dealing with this situation, different layouts of the project have been studied and some mitigation measures have been suggested. The corresponding measures would cover an increase of the headpond level for improvement of waterintake to Ibrahimia Canal, improvement of navigation conditions as well as optimization hydropower output, without serious environmental impacts.

The proposed Barrage is multipurpose Project: irrigation, navigation, and hydropower. New Assiut Barrage Project consists of an embankment dam, a gated spillway, a river hydropower plant and a navigation lock in the river Nile. The project scope of works: the

construction of 2 navigation locks of 150m x 17m according to the latest international technologies to accommodate the increase in the river and tourism transport units; the construction of a 4-lanes upper bridge over the new barrage with capacity 70 tons to link the East and West banks of the River Nile in Assiut. The Barrage Project components are: Sluiceway with 8 radial gates 17 m wide and Road Bridge; Hydropower plant: Low-head hydropower plant with 4 bulb units of 8 MW, total capacity 32 MW; new navigation lock: 120 x 17m chamber in addition to the refurbished 80 x 16 m existing navigation lock; Closure dam: embankment type, 11m high; Rehabilitation of the existing navigation lock; Replacement and Rehabilitation of the existing Ibrahimiya canal head regulator; and Transmission line.

The Barrage Project study's components are included: Physical and mathematical hydraulic modeling of the Barrage and river course, groundwater/seepage and foundation analysis; Determination of design parameters; feasibility level designs for technical alternatives of the chosen option; preliminary design of the new barrage; Environmental and socio-economic study; capacity building and institutional development; economic and technical feasibility of providing hydropower generation at the barrage site; Comparison of rehabilitation option with the new barrage option by economic, technical, environmental analysis; Demonstration of the viability of the chosen option by carrying out a full assessment of the technical, economic and environmental issues; Tender Design, Tender documents and assistance in tendering procedures; Construction supervision; Preparation and implementation of an environmental management plan; and Training and integration of counterpart personnel, seminars and presentations.

Egypt laid the foundation stone of New Assiut Barrage. The barrage aims at modifying the irrigation of 1.65 million feddan, about 20% of the cultivated land in middle Egypt including 5 governorates: Assiut, Menia, Bani Suief, Fayoum and Giza. The barrage executed works with total cost value EGP 2.4 billion (475 M€) will be achieved by a consortium comprising of international and local Contractors. New Assiut Barrage Study showed the technical and economical feasibility of the rehabilitation of the existing barrage including the installation of a hydropower plant. The New Assiut Barrage Project has very promising positive aspects in relation to sustainable development, poverty alleviation, social and economic development in Egypt.

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Received June 14, 2012; Accepted June 14, 2012; Published June 18, 2012

Citation: Batisha AF (2012) Assiut Barrage in Egypt: Past, Present and Future. Irrigat Drainage Sys Eng 1:e104. doi:10.4172/2168-9768.1000e104

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