The British Dam Society

EVENING MEETING

Monday 22nd November 2021 at 6:00pm

One Great George Street, London (Nearest tube: Westminster)

Hydropower Extension Projects at Tarbela Dam, Pakistan

Applying learning from the 4th Extension Project and meeting other challenges arising from the 5th Extension Project

Brian B Darling BSc MSc CEng MICE
Mark D Gill MBA BSc DIS CEng FICE MAPM
Gonzalo Montilla Castro BSc MSc Chartered Engineer (Venezuela)

For brief presenter biography see overleaf | Admission free | Teas available from 5.30pm

This meeting will be streamed live on the internet. For details please visit the meetings page on the BDS website: www.britishdams.org
For more information please contact the ICE on 020 7665 2147 or email: societyevents@ice.org.uk

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Synopsis

Tarbela Dam on the River Indus was commissioned in the mid-1970s primarily as a water resource reservoir for irrigation and was at that time the largest rock and earth-fill dam in the world. During Tarbela's subsequent operation, its role in providing hydropower generation has become more significant. As a result, successive hydropower stations have been added to the water release tunnels over the last few decades. Power stations on tunnels 1 to 3 provide 3,478MW of installed capacity with the 1410MW 4th hydropower extension recently being completed on the 4th tunnel bring this to 4,888MW. These power plants utilise tunnels through the right abutment of the dam which can discharge directly to the Ghazi Barotha headpond – a headpond formed by the downstream hydropower scheme which effectively forms a constant tailwater level for the 4 right-bank power stations.

Unlike the other tunnels, the fifth release tunnel (T5) is situated within the left abutment of the dam (see photograph) and was never envisaged for power generation. Thus, it was situated at a higher level than the other tunnels and discharges into the Dal Dara channel. This channel also receives the discharge from Tarbela's two spillways (with a combined design flow of 47,000m3/s) and conveys this water, along with any T5 release, back to the Ghazi Barotha headpond, to join the rest of the Indus flow.

Construction of a hydropower station on the end of T5, so that it would discharge directly into the Dal Dara channel, would effectively reduce the scheme's net head by around 10% when compared to the other right-bank power schemes due to the raised tailwater level in the Dal Dara channel. It is not possible to reduce the Dal Dara channel water levels, since this would impact the spillway plunge pool water depths. An innovative solution has been adopted that provides a tailwater culvert and canal system which allows lower tailwater levels – similar to the other right-bank schemes - giving the T5 project an installed capacity of 1530MW.

The presenters will discuss:

- The arrangement for the 5th Extension Hydropower Project
- Ongoing sediment management and how raised intakes are being adopted to extend the life of the reservoir
- Construction and commissioning of the T3 and T4 raised intakes plus the plans for the T5 raised intake
- Construction challenges and lessons learned from the 4th Extension Project and how these are being applied to the 5th Extension Project.
- How Physical and CFD models of the Dal Dara channel have been used conjunctively to confirm the operability of the tailrace culvert and canal system whilst ensuring the safety of the existing spillway plunge pools
- Recent photos from site showing the construction stage of the 5th Extension Project and comparing these to the 4th Extension Project

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Presenter Biography

Brian Darling is a chartered civil engineer with 33 years' experience in the renewable energy, water and environment sectors. This experience comprises the study, detailed design and site supervision of various civil engineering works; including hydropower, river engineering, dams, water supply, irrigation and roads. Particular responsibility for leading multi-disciplinary teams undertaking feasibility and other studies related to defining hydropower scheme arrangements, optimisation and maximising benefits, both from a commercial, environmental and social perspective.

Mark Gill is a chartered civil engineer with over 40 years' experience in hydro, development and structural steel sectors. He has worked overseas for over 30 of those years in Nepal, Albania and Pakistan constructing and supervising hydro and other development related projects such as hospitals, schools, water supply, roads. Establishing construction sites and leading teams has been a key experience in delivering successful projects especially in hydro including supervision of large and small dams, high head (700m) and low head (2m) schemes, horizontal and inclined tunnels, remote area construction (only walking access) and leading multi-disciplinary teams to 'make things happen'. Mark is curator of the Mott MacDonald FIDIC network and has taught MA in Management and Organisations.

Gonzalo Montilla Castro is a Mechanical Engineer and Master of Science in Hydraulic Engineering with 20 years of experience in hydro and hydraulic projects, CFD and physical scale modelling and operational monitoring. Experience includes working on design and modelling of infrastructure projects such as large pumping stations, hydrodynamic forces in gates and trashracks, resident time distribution and water age, energy dissipation, large river diversion schemes and river closure, load rejection and load acceptance. Gonzalo is a Mechanical Engineer in the Hydromechanical Team in Mott MacDonald in Cambridge UK.