NEELUM JHELUM HYDRO POWER PROJECT
TECHNICAL VISIT BY A DELEGATION OF PAKISTAN ENGINEERING CONGRESS ON 25-27 NOVEMBER, 2011

A 15 - Members delegation of Pakistan Engineering Congress paid an extensive visit to the under-construction mega Neelum Jhelum Hydro Power Project, Muzaffarabad (AJK) from 25th - 27th November 2011. The visiting team was given detailed briefing by the project authorities on the technical aspects and vital significance of the project for the economy of the country as well as taken round the project site. Salient features of the project are given below.

INTRODUCTION

Energy is the basic ingredient of development of a country. The fast-growing energy requirements in Pakistan need to be met in order to achieve full economic and social development. Currently, most of the energy demands are being met through thermal Power Projects. Although thermal projects offer benefit of comparatively less time for completion, however, their dependence on fossil fuel which is mostly imported through foreign exchange and their higher power generation cost is causing difficulty for general public and the industrial products to compete in the world.

The Government of Pakistan is focusing on the development of indigenous domestic hydropower resources. Pakistan has huge hydropower generation potential, which can be exploited on a long-term basis for provision of power at much lower costs. The hydropower project, through their initial cost is high and is relatively difficult to develop, should be given preference because of their low recurring expenses for provision of inexpensive energy

THE PROJECT

The Neelum Jhelum Hydropower Project (NJHPP) is the largest project undertaken in the country since the completion of Mangla and Tarbela Dam projects. On completion, it would generate 5.15 billion units annually, green energy fetching total revenue of Rs. 50 billion to WAPDA annually. Timely completion of the Project will help to establish rights on the waters of River Neelum, as Pakistanis competing with India which is also executing a similar Project (Kishanganga Hydroelectric Project) on the same River in Indian Occupied Kashmir It is worth mentioning that Progress of the Project has been increased tremendously since last year and accordingly financing requirements also increased.

The Neelum River is one of the main tributaries of the River Jhelum and has a catchment area of 6,682 km^2 above the intake at Nauseri with greater portion situated within state of AJ&K. the majority of catchment is mountains. Bulk of catchment of River Jhelum lies within the range of 3,000-4,500 m altitude. The Northern boundary of catchment reaches toward the Nanga Parbat massif with the highest part of the catchment at Sarwali. The Southern boundary is formed by the Kajir range, which forms divide between Neelum and Jhelum catchments. The river is characterized as a glacial fed river and rises from permanent snow field surrounding Kaobal Gali (5,665 m) in Kashmir. The river is fed by numerous tributaries which include; Burzali, Balam Kasi, Salemul, Matsil, Baral, Gumot, and Jagran. These tributaries have high sediment outputs resulted in braided channels. The Average Annual flow of the Neelum River at Muzaffarabad and Nauseri are about 269.5 and 335.16 m^3/s respectively.

NJHPP is located in the vicinity of Muzaffarabad in the State of Azad Jammu & Kashmir. It envisages the diversion of Neelum river water through a tunnel out-falling into Jhelum River. The tunnel intake is at Nauseri 41 Km North East of Muzaffarabad. The Powerhouse will be constructed at Chatter Kalas, 22 Km South of Muzaffarabad. After passing through the turbines, the water will be released into Jhelum River about, 4 Km South of Chatter Kalas. Neelum Jhelum Hydroelectric Project has installed capacity of 969 MW. The Project will produce 5.15 Billion units of electricity annually.

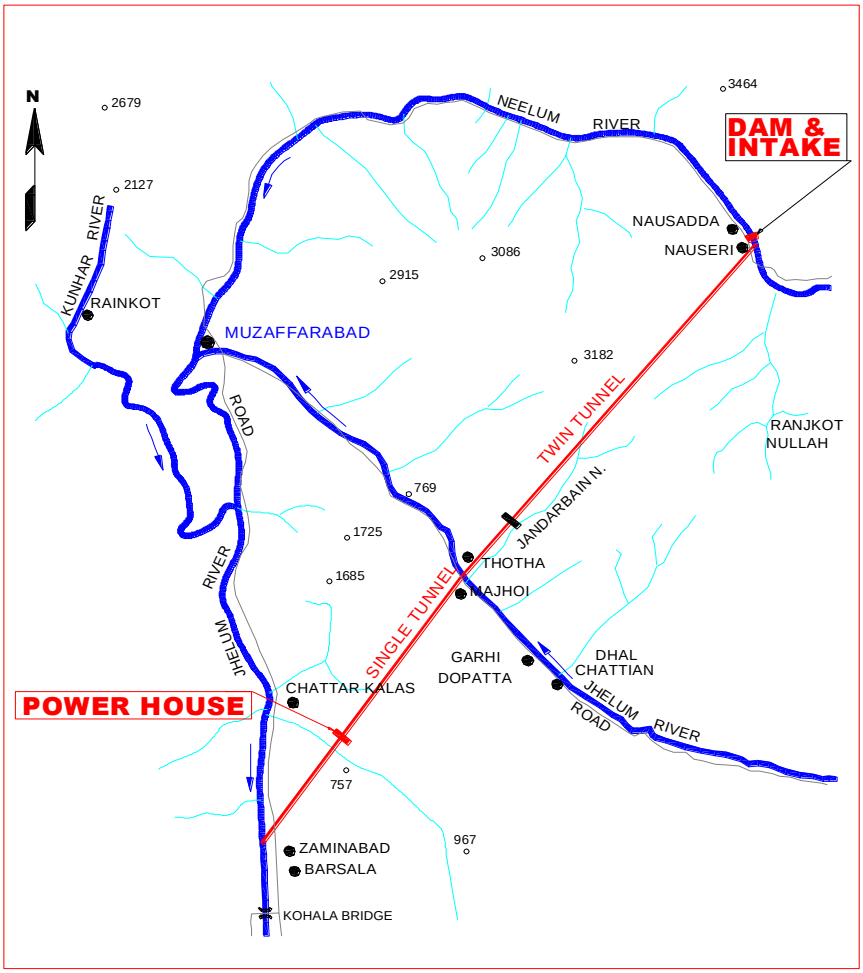

Figure 1: Project Layout

A Composite Dam (Gravity + Rockfill) 160 m long and 60 m high will be constructed on Neelum River at Nauseri. The dam will create a head pond of 10 million cubic meters, which will allow a peaking reservoir of 3.8 million cubic meters to meet daily peaking of power for more than 4-hours. A six-gate tunnel intake structure of 280 cumec capacity, will be connected with three conventional flushing surface basins installed at their end for taking sediment back into river.

The total length of head race tunnel is 28.5 Km. A 19.5 Km stretch of the tunnel from the Nauseri be constructed as a twin tunnel system each with x-section ranging from 52 to 58 m^2. The remaining headrace tunnel down to the surge chamber will be a single tunnel having x-section 104 m^2. The tunnel portion to be excavated with TBM will be shotcrete lined with a concrete invert while the drill and blast portion of the tunnel will have full face concrete lining. The tunnel crosses Jhelum River approximately 200 m below its bed. The tunnel is accessed by 7-Adits for removal of excavated spoil.

The Surge Chamber consist of 341 m high riser shaft and 820 m long surge tunnel, Four steel lined Penstock tunnels 154 m long and having 3.8 m internal diameter will also be constructed. The underground power Station will have 4-units with a total capacity of 969 MW. The Power Station will be connected with Gakhar Grid station through 500KV double circuit transmission line.

All the project components are being constructed according to the standard design parameters and guidelines. First time in Pakistan extensive tunneling is being done using world's most advanced equipments for excavation in soft rocks, which are tectonically highly disturbed and traversed by major active faults.

The economic merit of the project is established by considering its Justification as part of the development of the country's generating system, to overcome acute power storage, load shedding as well as in terms of its contribution to the country's economy.Neelum Jhelum Hydroelectric Project (NJHEP) would be the part of the least cost generation expansion plan of Pakistan. Considering the present generation capacity, the operation of NJHEP will increase the overall capacity by about 5%, whereas, the addition in Hydel generation will be about 15%.

Figure 2 : Tunnel Boring Machine (TBM) being assembled

The current power crisis in the country has dictated to accelerate the pace of progress at NJHPP and bringing 969 MW power generation on the line at the earliest. Reduction in the implementation time can be made by deploying two Tunnel Boring Machines (TBMs) for tunnel excavation. The tunnel technology has advanced tremendously since the original Project design was made in 1997.The additional cost of TBMs deployment is tentatively estimated as Rs. 19.5 Billion. The deployment of TBM for the NJHPP will reduce the implementation time by about 18-24 months. It is estimated that the benefits from the early operation of the Project will be much more than the additional cost being incurred on the deployment of TBMs. In addition, the use of TBMs on NJHPP will result in major technology transfer and the TBM can be utilized on future Hydropower Projects like Diamer Bhasha and Bunji on Indus River. Early availability of 969 MW power will help in reduction of load-shedding and enhancement of economic activity and will also help to establish Pakistan's priority rights over Neelum waters over Kishenganga Hydropower Project by India. It is worth mentioning that India has recently awarded a contract to deploy TBM for Kishenganga Project to speed up the construction after facing difficulties in conventional Drill and Blast excavation method.

PROJECT IMPLEMENTATION

A contract has been awarded to M/s CGGC-CMEC, consortium China, for implementation of the project at a cost of Rs. 90.90 Billion. The project is expected to complete in mid-2016.

SALIENT FEATURES

- Overall Project Cost Rs. 90.90 Billion (under review)
- Installed Capacity 969 MW, Four Units @ 242.25 MW each

- Dam, Type — Composite Dam (Gravity + Rock fill)
- Height / Length — 60 / 160 Meters
- Average Annual Energy — 5.150 Billion electricity Units Annually
- Average Head — 420 Meters
- Design Discharge — 280 Cumecs
- Tunneling — Twin Tunnel, Length 19.54 km each; Single Tunnel, Length 8.94 km; Tailrace Tunnel, Length 3.54 km
- EIRR — 22.5 (under review)
- Date of Commencement — 30-01-2008
- Scheduled Completion Date — October 2015
- Expected Completion Date — Mid 2016
- Implementation Period — 93 months

Overall physical progress is 33 % and overall financial progress is 48.5 %.

Figure 3: Access Tunnel for the Water Tunnel

Figure 4: Excavation of Headrace tunnel

Figure 5: River Diverted Through Diversion Tunnel On 15 October 2011

PROJECT BENEFITS

- Reduction of dependence on thermal power
- Saving in foreign exchange
- Employment opportunity during construction and operation
- Improved standard of living
- Social-economic uplift of the area
- Introduction of valuable latest technology in Pakistan in the field of Mechanical Engineering and tunneling by bringing in Tunnel Boring Machine.It can be further utilized on future Hydropower Projects like Diamer Bhasha and Bunji on Indus River.
- Timely Completion will help to establish Pakistan's priority rights over Neelum waters over Kishenganga Hydropower Project by India.