THESIS

HARNESSING THE HYDROPOWER POTENTIONAL OF LUTKHO RIVER

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(2010-PG-HPE-86)

For the Degree of

MASTER OF SCIENCE

IN

HYDROPOWER ENGINEERING

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING,

University of Engineering and Technology, Lahore-Pakistan

2014

ABSTRACT

To meet the power demand of Chitral city, one megawatt (1MW) hydroelectric hydropower project was constructed by WAPDA on lower part of Lutkho river, the right bank tributary of Chitral river. the catchment area of Lutkho River is about 2340 km^2. The power station has been providing electric power to Chitral city area since 1975. Existing power generation plan was designed to utilize the portion of flows from Lutkho River. No permanent weir for diversion of discharge from Lutkho River is available. The temporary weir flushed away particularly in the summer season due to high flows in Lutkho River. This study was carried out to evaluate the hydropower potential of power station at Lutkho River and to select optimized solution for power supply and to develop a suitable layout for hydropower generation. Economic and financial analysis was also carried out to evaluate the economic viability of selected alternate.

In order to carry out the proposed study, the relevant data viz. discharge data, climatological data, topographic survey and geological data was collected and analyzed. Flow duration curves of Lutkho River were prepared using the rank-ordered technique to assess the availability of flows. The power and energy have been estimated on the basis of 10 daily. The various alternatives for the project were studied before the final selection. The estimate of the construction cost used was based on unit & lump sum prices applied to quantities of major work items / components of the hydropower plant.

After finalizing the layout of the project, various components, including civil components and electromechanical components, were selected and properly designed. To divert the design discharge of 16.0 m^3/s into the power channel, a concrete weir of 3.0 m

height above the nullah bed was proposed. The channel was designed as rectangular R.C.C section with width of 4.50 m and height 2.40 m with free flow condition. From Forebay to inlet to the turbine, two penstock of diameter of 1.7 m each were proposed to be laid over the right bank slopes. The type of turbine selected for the Chitral Hydropower project is Horizontal Axis Francis Type each of 2.5 MW.

In this study, an economic comparison was made following the prevailing standard practice in WAPDA, Pakistan. According to that practice the hydel project was compared with an equivalent capacity of diesel plant. The Financial analysis was undertaken to ascertain the expected returns on investment and assess the financial viability of the project. In alternate-I with existing channel power generation is upto 1.8 MW and annual energy is 15.72 GWh with EIRR of 52.04% and FIRR of 20.92% and in alternate-II with extended channel power generation is upto 5 MW and annual energy is 42.70 GWh with EIRR of 66.91% and FIRR of 25.07%.

Lutkho River has abundant flows that can be diverted with a permanent weir towards power channel and powerhouse. Due to limitation in extension of power channel, the design discharge has been proposed as 16.0 m^3/s, available 75% time of the year. The hydrological, topographical and geological conditions favor the extension of structure and capacity enhancement for 5 MW. With high plant factor power station to meet the power requirement of remote area, the project is recommended for further studies and implementation.