

# THESIS

## EVALUATION OF HYDROPOWER POTENTIAL OF SHATUNG NULLAH DIVERSION FLOW IN NORTHERN AREAS



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## ABSTRACT

The objective of Shatung Nullah Diversion is to supplement the Satpara inflows by diverting a flow of 3 cumecs ( 106 cusecs) from Shatung Nullah into Satpara Nullah through a 6.5 km long diversion tunnel. The tunnel outlet level is about 4000 m.a.s.l and the elevation where the diverted Shatung Nullah flow joins Satpara Nullah is approximately 3969 m.a.s.l. This gives a drop of about 31 m that can be utilized for power generation. The present study aimed at the evaluation of hydropower potential and development of a suitable layout for hydropower generation at the tunnel outlet.

In order to carry out the proposed study, the requisite data was collected and processed. The discharge data for Shatung Nullah was available from October 1994 to July 2001. From the available data, the flow duration curve was prepared to ascertain the availability of flow. The diverted flow of 3 cumecs is available for 33 % of the time i.e 121 days (about 4 months).

For power and energy calculations, a design discharge of 3 cumecs was taken into account. For the layout planning of the project, two alternatives were considered viz. powerhouse with penstock and powerhouse with headrace canal. Keeping in view the merits and demerits of both the alternatives; the alternative, powerhouse with headrace canal, was selected for further study. An intake structure will be constructed at the tunnel outlet portal to divert the flow into 700 m long headrace canal. At the end of the canal, a forebay will be provided. The forebay has been designed so as to serve as sand trap as well. From the forebay, the water will be conveyed to the powerhouse through 24 m long two penstocks. Two Francis type turbine units have been suggested for the powerhouse.

The unit discharge is 1.5 cumecs and the net head is 30 meter. The maximum power output is 771 kW with mean annual energy of 4.091 million kWh.

The cost estimation for the project was also carried out. The base cost has been estimated as Rs. 76.293 million. The local component of the base cost is Rs. 48.808 million which is about 64% of the total base cost while the foreign component is Rs. 27.485 million which amounts to about 36% of the total base cost.

The feasibility of the study has been assessed by carrying out economic and financial analysis. The internal economic rate of return (IERR) has been worked out to be 28.38%. The economic feasibility of the project has been assessed against 10% decrease in benefits, 20% cost over run, as well as combined impact of both the variations to see if the project remains economically viable. The results showed that the project yields economically viable rates of return. The internal financial rate of return (IFRR) for this study comes to be 12.78%. The analysis shows the generation cost of Rs. 1.85 (3.09 US cents) per kWh, while the cost per KW of installed capacity comes to Rs. 102327 (US \$ 1705). The project is economically justifiable in view of supplying low cost hydel power to Skardu Town, hence recommended for implementation.