THESIS

IMPACT OF SKARDU RESERVOIR ON DOWN STREAM HYDROPOWER PROJECTS

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ABSTRACT

Pakistan has large potential of hydropower on its main river and canals. For sustainable development of the country the hydropower needs to be exploited to maximum potential.

This study was carried out to determine the hydropower potential of the upper Indus sites including Skardu, Tangus, Yulbo and Bunji on average flow bases and evaluation of effect of Skardu reservoir on the power potential of the down stream hydropower sites of Tangus, Yulbo and Bunji. The study identified a best suitable release policy for Skardu reservoir which will ensure to generate maximum energy for all four sites.

The study was based on historic daily discharge data of the proposed sites Skardu, Tangus, Yulbo and Bunji for past 27 years (1970 - 1997). The energy generation was determined on 10 daily discharge data. Flow duration curves were developed for the hydropower sites. The data for the sites were used to develop an energy generation model using excel spread sheet for Tangus, Yulbo and Bunji. The system design discharge was selected that ensured plant operation factor of 45% or more at all sites. Fourteen alternative filling and release policies for Skardu Reservoir was evaluated and compared to identify best release policy.

The effect of Skardu reservoir filling / release pattern on Terbela was evaluated and it was concluded that the release policy for Skardu have insignificant effect on Terbela. The annual energy generation at Skardu was considered as a run-of-river scheme and weir height of 165 m was determined as 7436 Gwh. The best release policy on the bases of maximum energy generation consists of 625 cumecs discharge released during the period from 10th October to 10th of May, outflow equal to inflow for 100 days (11th

May to 20th July and 11th Sept to 10th Oct) and reservoir filling during 21st July to 10th Sept during which outflow is restricted to 1400 cumecs. With selected release policy 6928 Gwh energy can be generated at Skardu which is 6 % less than energy generated as run-of-river project. While with selected release policy 13641, 19340 and 29364 Gwh energy can be generated at Tangus, Yulbo and Bunji respectively. This means 32% more energy can be generated than the energy generated with out Skardu reservoir releases. With out Skardu reservoir releases total of 51668 Gwh was generated from all sites, while with selected Skardu release policy 69354 Gwh was generated which is 28% more than the with out Skardu. The energy of 44200 Gwh was determined by using average flow.

For design discharge for Tungas, Yulbo and Bunji as 1500 cumecs, the energy generation increases from 51668 Gwh with Skardu as run-of-river project to 63096 Gwh with Skardu as a reservoir reflecting 21.8% increase in energy for the Tungas, Yulbo and Bunji (18.5% overall increase). This also results in increase of plant factor for 44 to 56% with Skardu.

In view of substantial role of Skardu reservoir it is recommended that hydropower projects Tangus, Yulbo and Bunji should be designed keeping in view the increase in energy generation capacity at particular sites after construction of Skardu reservoir.

Since construction of Skardu reservoir is likely to lag several years, the hydropower plant at Tungas, Yulbo and Bunji are recommended to be installed for design discharge of 1500 cumecs.After completion of Skardu reservoir; one extra unit may be installed at each site to generate 5957 Gwh subject to the economic analysis for additional costs and benefits.