

THESIS

**STUDY OF KURRAM TANGI HYDROPOWER SYSTEM OPERATION AS
CONTINUOUS VERSUS PEAKING FACILITY**



6537

Submitted By

SYED SHAFQAT HUSSAIN
2003-PG-HPE-46

For the Degree of:

MASTER OF SCIENCE
IN
HYDROPOWER ENGINEERING

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology Lahore

2005

ABSTRACT

Electricity is the basic need for a developing country like Pakistan. It can be generated through various means. Some being expensive while others somewhat cheap. Hydropower may be referred to as the economical and flexible source of energy. The electricity demand varies considerably throughout the day. Mostly, evening demand is very high as compared to other times of day. Thermal energy is used to meet the peak hour demand at a much higher cost. If this demand could be met through hydropower, it will cut down expenses considerably. Currently, Ghazi Barotha, Mangla and Tarbela are being operated as peaking hydropower plants.

The Kurram Tangi Dam has presently been planned to operate as continuous power producing plant. The project incorporates three powerhouses to operate in cascade form to generate annually about 305 GWh. This study was focused to evaluate the prospects of operating the system as a peaking plant thus supplying energy in the evening and ensuring the irrigation water requirements as well. Downstream of second powerhouse, a storage space of about 20 T_hAF (Zarwam Reservoir) is available that may be utilized for storing excess water released from powerhouse 1 and 2 during peak hours operation. This study is based on the consideration to supply maximum power in peak hours through the system ensuring irrigation water requirements and that the extra water released during peak hours stored at Zarwam not to create any operation difficulties for powerhouse 3.

All units of powerhouses 1 and 2 were operated during peak hours throughout the year. The volume available after peaking operation according to target releases was

discharged during offpeak hours resulting in operation of fewer numbers of units according to the unit rating for offpeak power production.

The study yields that powerhouse 1 and 2 can be run as peaking plants with powerhouse 3 to be used as continuous power production plant so as to release irrigation water according to requirements. The additional water released in peak hours from powerhouse 1 and 2 can be stored easily at Zarwam (additional storage requirement of 333 AF) and it does not create any large head changes (about 0.33 ft). If storage of 333 AF can be made available downstream of powerhouse 3, then powerhouse 3 can also be operated as peaking plant.

Under time based tariff system (i.e. different unit rates in peak and offpeak hours) and considering a unit rate of 4.2 rupees/kWh in peak hours and 1.8 rupees/kWh for offpeak, the electricity revenue of 671.22 Million Rupees ($50.85 \times 4.2 + 254.25 \times 1.8$) under continuous operation could be enhanced to 700.35 Million Rupees ($63.37 \times 4.2 + 241.22 \times 1.8$) under peaking operation giving additional 29.13 Million Rupees revenue annually,

The Kurram Tangi Hydropower System can generate 305.1 GWh energy annually (peak hours energy = 50.85 GWh and offpeak hours energy = 254.25 GWh) as continuous system operation and 304.59 GWh energy annually (peak hours energy = 63.37 GWh and offpeak hours energy = 241.22 GWh) as peaking system operation. Thus peak hours energy generation can be increased by 12.52 GWh annually (24.62%) through peaking system operation.