

Role of Mega Hydro Power Projects: A Case Study of Ranjit Sagar Dam, Pathankot, India

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Abstract

Thein Dam in Pathankot is known as Ranjit Sagar Dam which is a component of a mega hydro power plant built by Punjab Government across the Ravi River at the boundary of Jammu, Himachal Pradesh and Punjab, the three states of India. The power plant is located in Pathankot district of Punjab and this project site is in tehsil Basholi, district Kathua, Jammu, India. The case study was done in November, 2019. Only one unit was found in operation, out of four installed at this Hydel Power Project. Total installed capacity of this project is 600 MW. This paper features the significance of mega Hydel Projects with a Case investigation of Ranjit Sagar Dam Project and will push a great deal to the future scientists in the zone of sustainable power source generation which is a critical need of the day.

Keywords: Mega, reservoir, installed capacity, sustainable etc.

1. Introduction

India has a plenty of water resource and this water can be utilized for many purposes. Hydropower plants ranges from small size systems for a small villages to large projects producing electricity according to the utilities. Hydroelectric power generation is the most efficient method for producing large scale of electric power generation. Hydropower plants are characterized in four types of technology; Dammed Reservoir, Run-off River, Pumped Storage, In Stream and Gravitational Vortex Plant [3]. Software is also created, utilizing MATLAB to find out the discharge rate, total head, kind of turbine for the small scale hydro power plants, when the limit is known [1]. Ranjit Sagar dam reservoir has been constructed for the purpose of supplying water for irrigation, navigation, hydroelectric generation and flood control measures. Ranjit Sagar reservoir was constructed started in the year of 1981 and completed in March 2001. It is the highest earth core with gravel shell type dam in India; Reservoir remains fed by Ravi River and spreading in an area of 87.00 sqkm. Total capacity of the project is 600 MW having 2 penstock headers, 4 penstock branches with internal diameter of each penstock branch 5.17M and penstock header 8.5M. Dam has maximum height above river bed is 135m, and level at the top is 540m. Gate of the reservoir is to be closed by its own self-weight. It lies in between three states of Indian Republic; Himachal Pradesh, Jammu and Punjab, This project is situated close to Pathankot city, Punjab and Basholi tehsil of Kathua region in Jammu. 20% of produced energy is delivered to Jammu and 4.6% produced energy is provided free of cost to Himanchal Pradesh at the generated cost. Some of the objectives of this study were Knowledge enhancement, to spread awareness, promotion of renewable, sustainable and flood control measures and to understand significance and utility of Reservoirs.

2. Literature Review

Hydro power has a great potential to create power. Hydro power plant is ordered in smaller scale hydel having the capacity less than 100 KW and mega hydro plant which store water and produce electricity. Researchers in this paper examined on the improvement and reasonable structure of a miniaturized scale hydro power plant [1].

Small Hydro Power (SHP) are having more economical than mega hydropower (MHP). In this research development and financial investigation of a small hydro power project (SHP) has been studied [2].

This paper gives a survey of hydropower advances and turbines; it is concentrating on the performance and categories of hydro power project and the best and appropriate turbines which can be utilized [3].

In a thrust area of India having a potential greater than 20,000 MW hydro power generations. The Ministry of Non-conventional Energy Resource Energy (MNRE) is promoting MHPs and SHPs both in public and private sectors [4].

In this literature it state that India has boundless potential of Hydro power production to serve in the hilly areas where providing normal electric transmission is a tough jobs. Its control over exploitation of natural resources and GHG emission to hydropower is more efficient than other source of energy [5].

Similar to Myanmar India is having multi hydro energy resources in mountains areas, hence there is opportunity to install such kind hydro projects to get sustainable vitality at low cost [6]. Shekhar and Sharma investigated various types of earthen and Gravity dams failures being used for hydroelectric generation and other purposes simultaneously [7].

3. History and Background

Ranjit Sagar dam or the Thein Dam is constructed by the Punjab government, Punjab irrigation department on the Ravi River which is situated at the border of the three Punjab, Himanchal and Jammu states of India. This site is located near the township of Shah Pur kandi in Pathankot district of Punjab. Volume capacity of the dam is 21,920,000 m³. This reservoir spreading in the area of 87.00 sq km. It was inaugurated in the year of March 2001.

4. Layouts plan

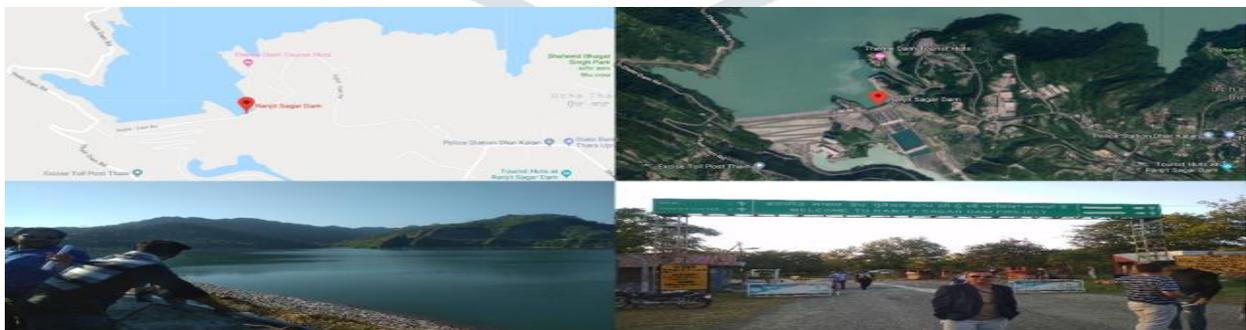


Figure 1. Layout plan and Google map of Ranjit Sagar Hydropower Project

5. Study Data

During the study months November 2019 various studies regarding hydel installation, power generation and consumption, previous year monthly production were recorded in tabular form as shown in Table-1, 2 and 3 below.

Table-1 Hydel Installation Data

Particular	No	QTY
Francis Turbines (BHEL)	4	150 MW
RPM		166
Penstock	4	8.5 m
spillways		Chute
Generating Voltage		13.8 KV
Generated power is fed into existing Grid substation at Sarna.		220 KV
Capacity	4	600 MW
Hydraulic hoist is being used.		
Capacity of the each hoist A) Pulling B)Pushing		470 T 5T
Stroke		9.5 m
Operation pressure		150 Kg/cm ²
Working pressure		150 Kg/cm ²
Test pressure		225 Kg/cm ²

5.1 Turbine Installed.

Francis turbines has been installed in this hydro power plant. This type of turbines are the most commonly turbines that are being used today. They are being operated in a water head between 10 to 650 m of height. This type of turbines can generates power outputs ranges 10 to 750 megawatts this type of turbine can give more than 88 % of their efficiency. There is a Francis turbine used with inward flow reaction to the turbine with radial flow outlet. Water enter to the turbine runner radially then goes out from the runner axially. Water enter in the nozzle and decreases velocity, and water moves in forward direction in the turbine but decrease in the spiral casing, with the constant speed water strikes to the blade of the turbines. In long run this type of turbines are more efficient as compare to other type of turbine.

6. Advantages of Hydropower

Hydropower is an energized by water, so it's a perfect fuel source. Hydropower doesn't contaminate the air like other power plants that burn fossil energizes, for example, coal or petroleum gas. Hydro power is an eco-friendly, economically and sustainable abundant source of energy. For global energy problem it is a good solution (Wijesinghe A and Lai L.L, 2011).Hydropower depends on the water cycle, which is inexhaustible power source.Hydropower is commonly accessible as needed; It can control the progression of water, through the turbines to deliver power on demand.Hydro plant provides ease to provide clean energy. And also providing opportunities, recreational, fishing, swimming, and boating

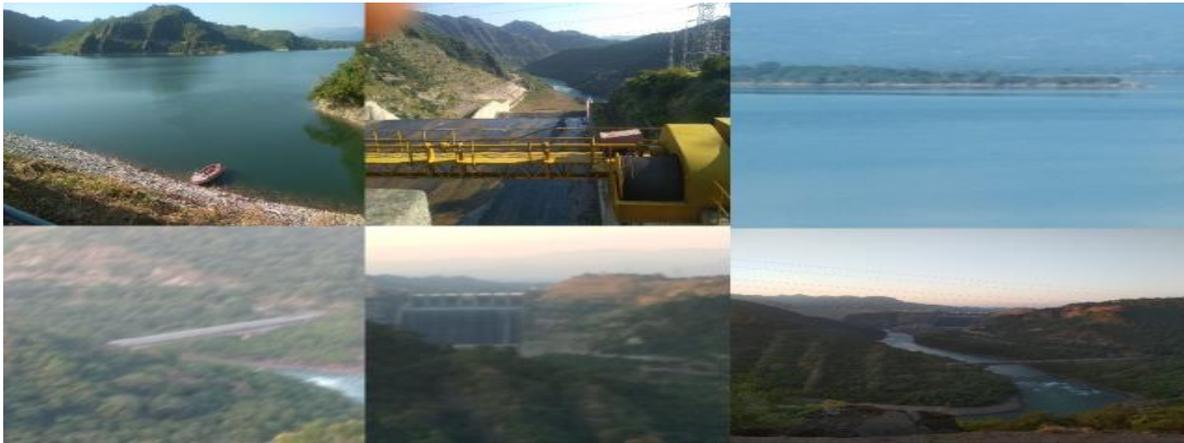


Figure 2. Different components of Ranjit Sagar hydropower project (Photograph dated 09/11/2019)

7. Disadvantages of Hydropower

Over exploitation forest land and relocation of the community from that area. Fish population can be affected if fish can't move upstream and downstream of the water bodies. The environmental changes due to Storing of water and change in the water flows. Building mega power is expensive, Electricity generation and energy price is totally depend upon the availability of the water. Time required for development of this project is very high.

8. Scope of the Study

Hydroelectric power is environment friendly. It is renewable source of energy. Not at all like thermal power plant or diesel power plant, have which required coal and diesel. Water head is the main fuel required in hydroelectric power plants. Hydropower production is through storage of seasonal run-off by rain and snow collected in various lakes, rivers and the natural streams.

9. Conclusion

This article concentrated on hydro control frameworks and in sustainable power source fields; it showed that hydro is a foundation of the electric generation power plant which is more Concern toward economic and ecological of environment. Mega hydro power plant has a great potential to generate electricity and to full fill the utility according our needs.

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