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International Conference on
**HYDROPOWER AND DAMS DEVELOPMENT FOR WATER AND
ENERGY SECURITY – UNDER CHANGING CLIMATE**



New Delhi
Central Board of
Irrigation & Power



Indian National Committee
on Large Dams

Bhakra Nangal Project – Harbinger of prosperity in Northern India

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ABSTRACT

After independence of India, most of the irrigated area went to Pakistan and food grain shortages started after World War-II became very acute. In 1950s, India started importing food grains. This situation was further aggravated by the wars of 1962 and 1965 with neighbouring countries. Failure of monsoon in 1965 and 1966 forced India to heavily import food grains. Reliable irrigation provided by Bhakra Nangal project of Bhakra Beas Management Board (BBMB) led to massive gains in production of food grains in Punjab and Haryana as well as increase in productivity which was much higher than the country as a whole.



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Bhakra Nangal Project has been a major source of green revolution in this part of the region. In addition, it is also a source of drinking water to all major towns in the states of Punjab, Haryana, Chandigarh, Delhi and parts of Rajasthan.

It also supplies electricity to the northern States of the country. This paper deals with food, water and energy security, flood control, rural electrification and other benefits from Bhakra Nangal project.



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Introduction

Bhakra dam a 225.55m high, 518.16m long concrete gravity dam located on the river Satluj in the foot hills of western Himalayas/lower Shiwaliks in Himachal Pradesh ,is a multipurpose hydroelectric project.

The Gobind Sagar reservoir, created by construction of Bhakra Dam, is one of the largest reservoirs in India having gross storage capacity of 9867.86 MCM (million cum), live storage of 7436.03 MCM and dead storage capacity of 2431.83 MCM.

The average annual energy generated from two power houses located on the left and right banks of Bhakra dam is 5400 MU.



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The Scenario Before Bhakra Nangal

Water sustains life and hence is a basic need and right. From ancient times, the provision of water for domestic use has been considered to be an essential duty of the ruler.

Unfortunately, large parts of the project region completely lacked this basic amenity till the Bhakra Nangal Project was taken up and completed.

In particular, the areas in Rajasthan and the adjoining parts of Haryana and Punjab suffered severely due to this problem.



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It was a typical sight in this area to watch women and children walking miles to fetch potable water for domestic use, deftly balancing a number of pots on their heads and in their hands.

Similarly, at many places the men folk used to go for miles in camel-drawn vehicles to fetch water from far-off sources. The Irrigation Commission pointed out that in some places in Rajasthan, ‘even drinking water is not available and we are of the opinion that drinking water should be made available without considerations of cost.’



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South-west Punjab and the adjoining areas of Rajasthan had suffered from many devastating famines as a result of severe drought till India's independence.

Records speak of Emperor Akbar ordaining in 1568 that 'this jungle (Hisar district in then Punjab) in which subsistence is obtained with thirst, be converted into a place of comfort'. Something was perhaps done but obviously that did not stop famines from recurring.

The Government of India appointed three successive Famine Commissions in the last three decades of the nineteenth century to report on the dimensions of the droughts, their causes and on the relief to the affected people. Detailed codes for providing relief were drawn up.



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However, the Hisar district featured repeatedly in famine distress records. The District gazettes of Hisar states that the first such case for which authentic accounts existed relates to the year 1783. Many thousands died as a result.

Similar accounts are narrated about the famines of 1860-61, 1868-69, 1876-78, 1899-1900, 1918, 1929-30, 1932-33 and 1938-40.

Likewise, accounts are available in the District gazettes relating to the other districts of Punjab (for example, Ferozpur, Amritsar) and Rajputana (for example, Sriganaganagar).



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The Report of the Famine Commission (1860-61) discussed the famine tract south of the Sutlej (particularly Ambala, Patiala, and Bhatinda) as follows: It is black, wretched, and without water, a mere sterile land. The wells are so deep that artificial irrigation from them is impossible; the water is so brackish and impure that no one except natives of the area can drink it with impunity; rains are scanty and precarious.



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Unfortunately, it appears that a fatalistic view was taken by the administration that droughts and famines would be unavoidable and all that could be done was to save human lives to the extent possible.

It is, however, noted that even then, many voices were raised in favour of drought-proofing these regions. Some follow-up actions in providing canal irrigation in Punjab and Bikaner followed but not in the region that we are concerned with here.

It was almost at the dawn of Independence that this long overdue action was initiated. It is indeed ironical that this part of India had to suffer for such a long period due to the loss of agricultural production and consequent famines.



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The total extent of cultivable area in post-Partition Punjab (excluding Shimla and Kangra districts) in the early 1950s was around 8.5 million ha. The net area sown was around 6.6 million ha. The net irrigated area was about 43 per cent. There were problems with the type and quality of irrigation provided.

The canal irrigated area accounted for just one-fourth of the net area sown. Tube-wells were yet to appear in any significant manner. There was neither electricity nor diesel for running the pumps. Well irrigation, which accounted for a third of the irrigated area, was practiced with the aid of bullock-driven Persian wheels or water buckets lifted with camel power.



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The intensity of irrigation and water allowance were very low. In the absence of storage, the canal system was dependent upon the flow of the river.

In most years, during the non-monsoon months, the delivery at the canal heads dwindled. In drought years, it became impossible to deliver 'authorized' full supply discharge, even during the rainy season.

The delivery of water was unsteady and unreliable. Thus even with the 'available irrigation' agriculture and food production remained a gamble with the rain.



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The people of South-West Punjab resorted to jawar, bajra etc. for food grains, as the level of wheat production was low. While undivided Punjab ranked as the granary for India, but after partition, Punjab became deficient in food grains as most of the irrigated areas of undivided Punjab went to Pakistan.



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The Post-Project Scene

The partition in 1947 brought only 20% of the canal system of undivided Punjab to India's share with 50% population. The "Upper Bari Doab Canal" between the Ravi and the Beas (1859) and the "Sirhind Canal" in southern Punjab (1872) only came to India's share. Bhakra-Nangal Project was taken up as a Joint Venture of States of erstwhile Punjab and Rajasthan immediately after independence. Construction of Bhakra-Nangal Project was started in the year 1948 and completed in 1963.



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Bhakra Dam, Downstream View



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Benefits from The Project

- Immense contribution to economy by increase in agro and farm production.
- A Study commissioned by World Bank and published in 2008 shows the following impact on Different crops - with and without Bhakra Dam:-
 - Without Bhakra the production of rice would have been about one half of what was being produced in 1979-80 with Bhakra.
 - Production of wheat would have been between 54 and 65 per cent of the currently produced quantity of wheat.



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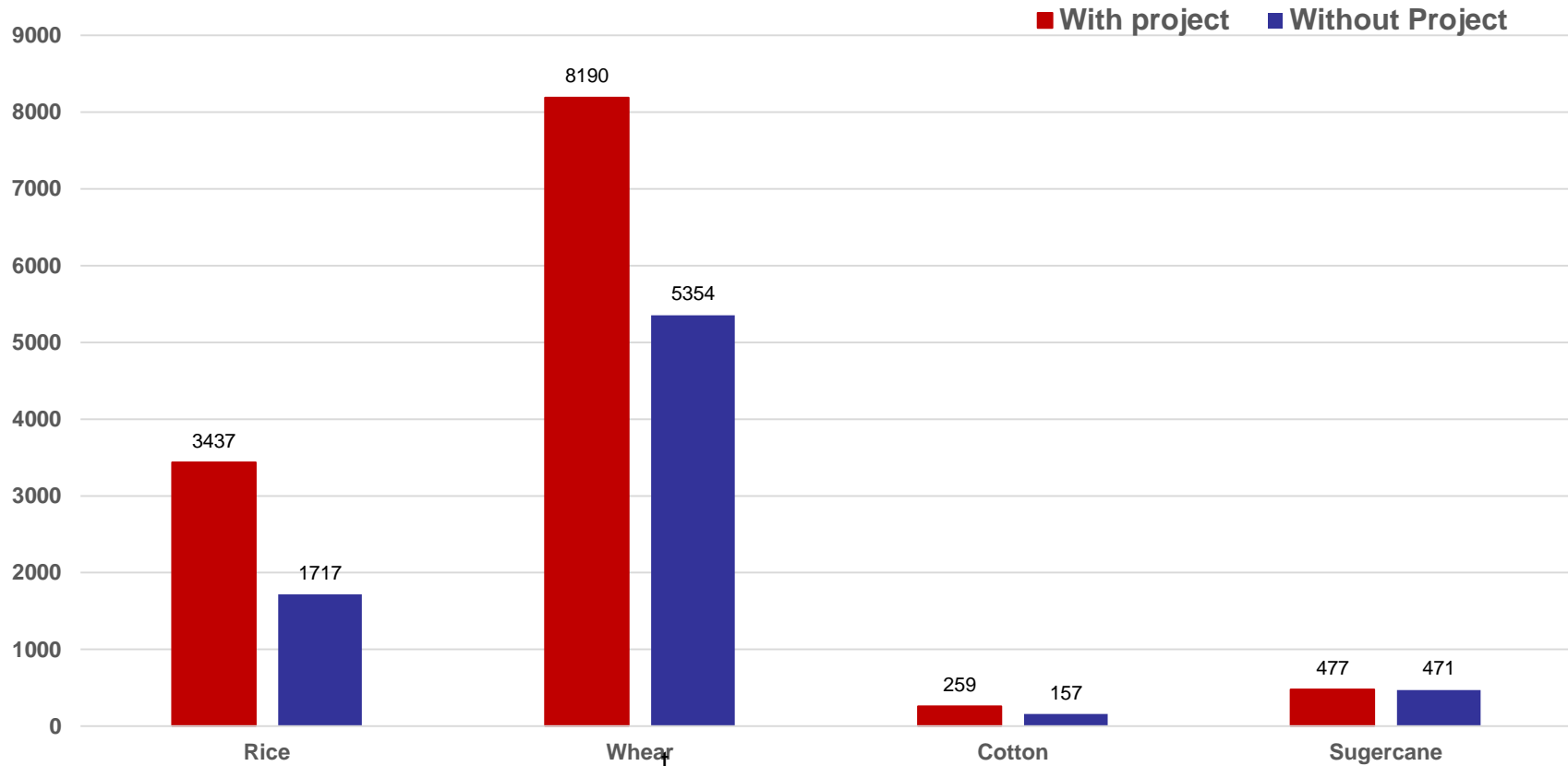


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Production of Different Crops with and Without Bhakra Dam - Thousand Tonnes/Year



Production of crops with and without Bhakra Dam

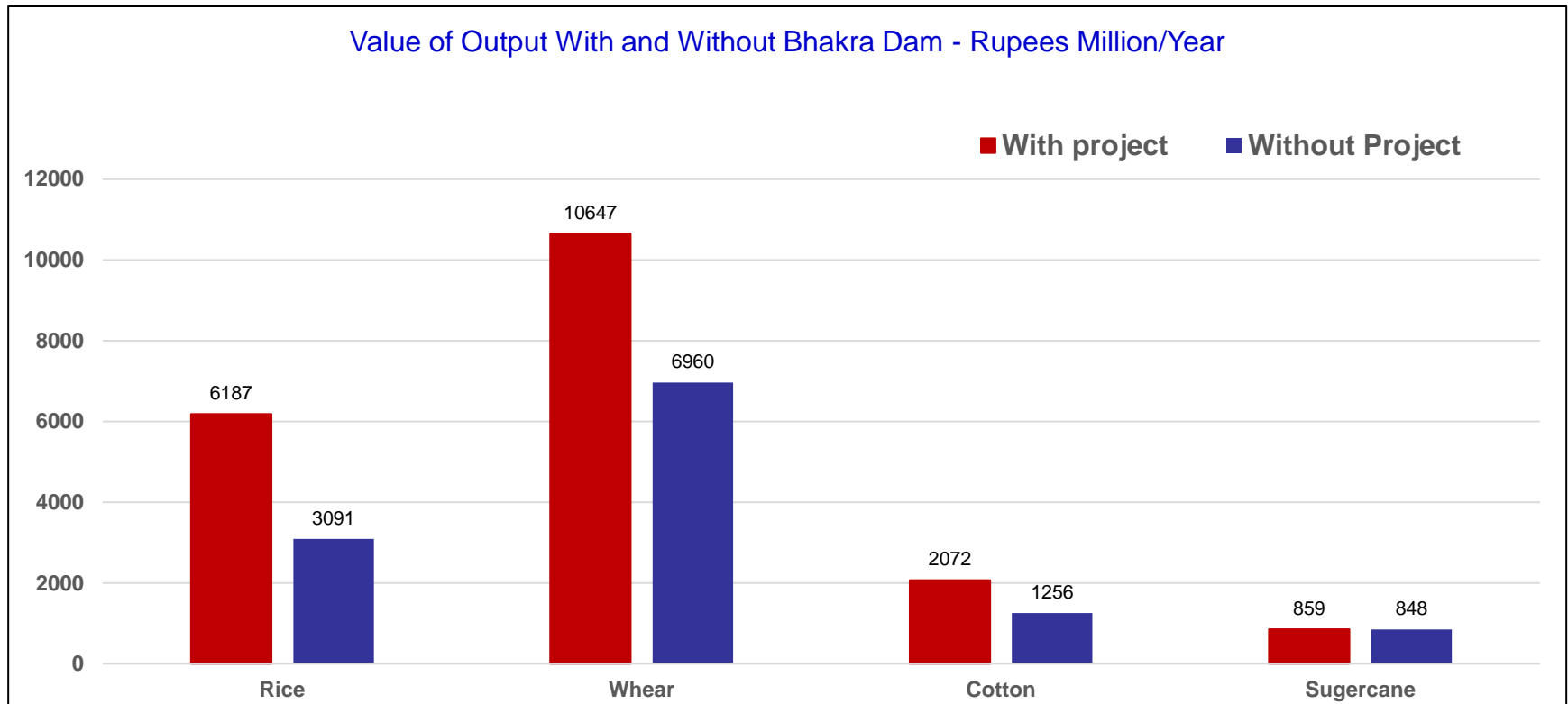


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The total value of these four major crops would have been between 52 and 61 per cent of the value currently obtainable.



Value of crops with and without Bhakra Dam



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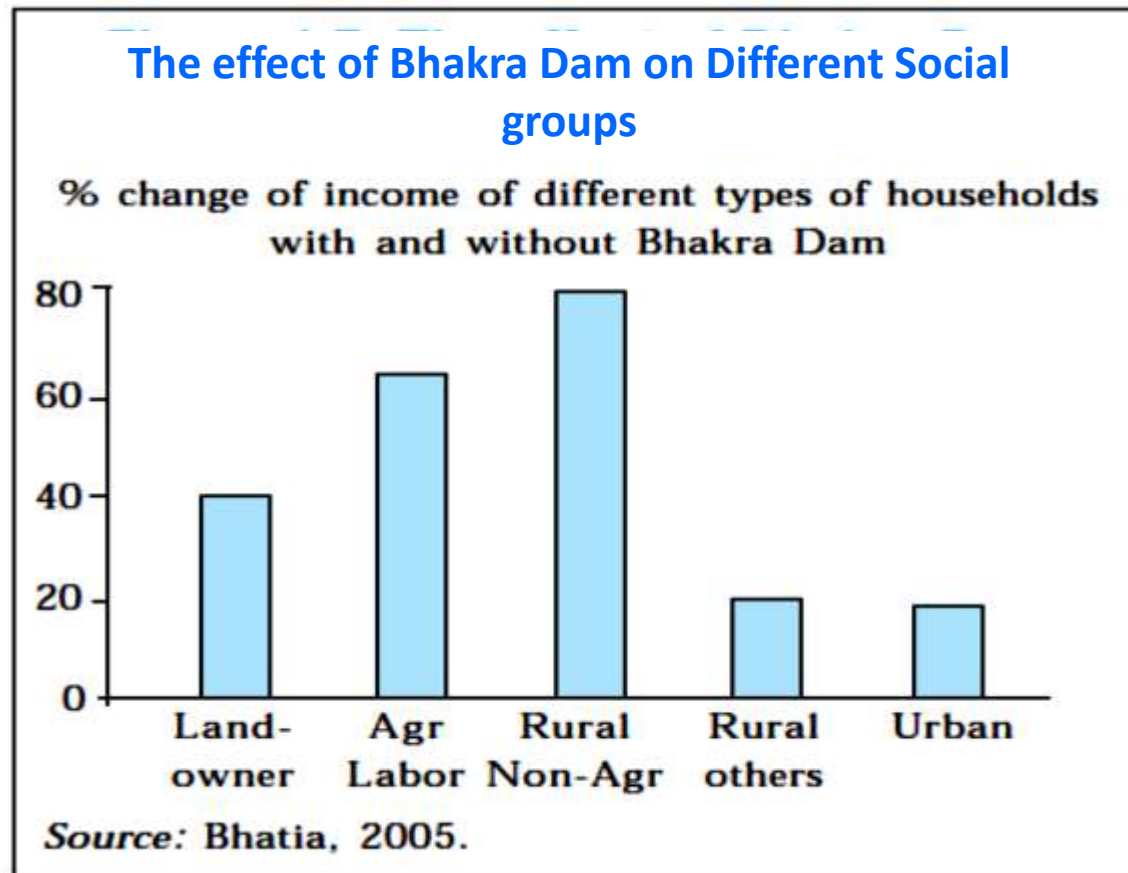


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- Rural poor and agricultural labour benefited hugely from the project. Their income increased by 80% and by more than 60% respectively.





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- **Millions of very poor seasonal migrants from the Bihar and the urban poor benefitted from lower food prices.**
- **The major impact on urban areas had indirect effect and therefore on urban poverty reduction.**
- **The flood control by this project has made huge difference in the lives of people living in the plains.**
- **This project is a harbinger of Green, White revolutions and rapid industrialization in Northern Region, providing food, water & energy security.**



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Annual Food Grain Production

Growth rate of food grain production between 1960-61 and 1978-79, on an all India basis was 2.77%, but varied from state to state. Punjab and Haryana led with average growth rates of 8% and 5.3% per year respectively.

Jawaharlal Nehru University (JNU) and the Planning Commission jointly made an analysis of growth at district level.

Forty-eight districts recorded a high growth rate of over 4.0% annually during 1962-65 to 1971-74.



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Punjab, Rajasthan, Haryana and western Uttar Pradesh accounted for three-fourths of these districts.

Similarly, milk production in these states witnessed huge jump due to better irrigation facilities & water availability.

*	Food Grains	240.00	lakh tonne
*	Cotton	18.42	lakh tonne
*	Pulses, Oil Seeds etc.	33.11	lakh tonne
*	Sugar Cane	25.65	lakh tonne
*	Milk	107.05	lakh tonne



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Irrigation & Drinking Water Supply

- **Bhakra-Nangal Project has been a major source of green revolution in this part of the region.**
- **In addition, it is also a source of drinking water to all major towns in the states of Punjab & Haryana, Chandigarh, Delhi and parts of Rajasthan.**

- **Area irrigated** **54 lakh hectares(135 lakh acres)**
- **Supply of water to Partner States** **34000 million cubic metre**

(for irrigation & drinking)



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Hydel Power

- **Bhakra plays the most important role of supplying ‘Black Start Power’ in the event of Grid Collapse. Following a Grid Collapse, the first Bhakra machine is synchronized within five to ten minutes followed by the other machines and start up power is extended to Thermal Power Stations in Punjab, Haryana and Delhi.**
- **Supply is also extended to important installations like Railways tractions, airports and hospitals.**



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- **Maximum Power generated by Bhakra Left Bank Power House consisting five no. units is 594 MW.**
- **Maximum Power generated by Bhakra Right Bank Power House consisting five no. units is 785 MW.**
- **Total installed capacity of Bhakra Project = 1379 MW.**
- **The average annual energy generated from power houses of Bhakra is about 5400 MU.**



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Flood Control

- **Flood is the single largest natural calamity for humanity.**
- **Bhakra dam has largely eliminated the occurrence of floods in the plains of Satluj river.**
- **A record flood of more than 600000 cusecs was absorbed in the Gobind Sagar Reservoir.**
- **Bhakra dam has also eliminated the occurrence of Famines of yore in the region.**



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- **Water of Satluj, which earlier was going waste in the Arabian Sea and causing floods during monsoons, became boon for agricultural and industrial development after Bhakra Dam came up.**
- **The people of areas influenced by the Dam are harvesting fruits of hard labour of thousands of known and unknown workmen, technicians and engineers.**
- **Every effort is made to avoid wastage of water going downstream of international border by regulation of dam supplies as per decision taken in the monthly meetings of the Technical Committee comprising Chief Engineers of Partner States as well as Power Utilities to meet out their irrigation requirements and by using the gains in downstream areas during rainy season.**



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Piscicultural

Bhakra reservoir is important source for raising fish in the region. During 2020-21, huge quantity of high quality fish i.e. 314.58 MT amounting to Rs. 399.76 lakh was harvested from the Bhakra reservoir. HP Fisheries Department has acknowledged the contribution of Bhakra Reservoir as the classic example of the large reservoirs for job generation & production of high quality animal protein i.e. fish.



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Fishing in Gobind Sagar Reservoir



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Rural Electrification

In 1951, only 42 out of 11,947 villages in Punjab had electricity.

With the help of power generation from Bhakra, Punjab and

Haryana were the first States in India to provide electricity to every

village in the year 1975-76.



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Industrial Development

- **With the help of reliable and low cost power generation from BBMB Projects, the region also saw a large scale industrialization which had tremendous impact on the economy of the region.**
- **The Fertilizer Factory at Nangal (of National Fertilizers limited) is a direct result of the power generation from Bhakra. Agriculture-based industries have also flourished in the command of Bhakra Project. Large industrial towns were developed subsequently at Ludhiana and Jalandhar in Punjab and Panipat & Faridabad in Haryana.**



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Nangal Fertilizer Factory



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Water Security From Bhakra Reservoir

The inflows of Bhakra Reservoir is given below which shows that in general, there is no much variation in inflows of Bhakra Reservoir during lean season from average of last 10 years. Thus, no shrinkage of water level has been experienced, especially in lean season.



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Levels of Bhakra Dam and inflows during depletion period in the last 10 years

Year	Level on 21 st Sep. (Start of Lean Season)	Level on ending 20 th May (End of Lean Season)	Inflows of Depletion period in MAF (lean season)
2011-12	1680.51	1541.04	4.631
2012-13	1655.83	1559.15	4.691
2013-14	1678.19	1575.56	4.672
2014-15	1678.34	1598.23	4.687
2015-16	1676.72	1561.88	4.330
2016-17	1650.38	1539.71	4.659
2017-18	1668.78	1501.36	3.907
2018-19	1651.25	1615.88	5.776
2019-20	1675.34	1563.80	5.014
2020-21	1659.61	1512.52	4.144

Average inflows into Bhakra Reservoir of depletion period is 4.651 MAF



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Conclusion

Multi purpose projects like Bhakra Dam provide benefits for longer duration and have more far reaching impacts and benefits as compared to number of small projects having similar installed capacity.

Bhakra Nangal Project provides affordable access to clean water for drinking, agricultural, industrial and household usage as India is facing a serious water resource problem and trends suggest, it is expected to become 'water stressed' by 2025 and 'water scarce' by 2050.



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Water along with food and energy forms a critical part of the 'new security agenda' and redefines the understanding of security as a basis for policy-response and long-term planning.

Multipurpose storage projects provide immense benefits. Storage projects like Bhakra can turn flood and drought prone areas into food bowl of the country.



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Jai Hind