

Socio-Economic Impact of Behna Hydroelectric Power Project in Mandi District, Himachal Pradesh

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Abstract

In today's contemporary era, electricity plays a crucial role in a nation's development, by contributing directly and indirectly to its GDP. Generally, electric energy can be produced from hydro, thermal, solar and nuclear sources but hydroelectric power recognized as the most economical, clean and sustainable energy source. As so hydroelectricity is widely acknowledged as the most prevalent form of electricity globally, being that hydroelectricity is an essential requirement in today's world. In this paper researcher wants to know about socio economic impacts of hydro power generation. Several hydroelectricity projects have been established worldwide frequently give rise to various socio-economic issues such as: displacement of land for local inhabitant, issues of immigration, low compensation for their land and several other consequences. It is essential to the government and project authority to take into consideration these socio-economics impacts and also the perceptions of local inhabitant of the region regarding the specific issue arise from the execution of hydro power projects. So long term benefits of project can be achieved. This paper focus on the people perceptions regarding the socio-economic impact of Behna Hydroelectric power project.

Key words: *Hydro Power Projects, Socio-Economic impacts, Sustain Execution of power projects.*

I. Introduction

Energy plays a significant role for overall development of any country. Of several sources hydroelectric power stands out as a widely embraced global concept due to its utilization of renewable energy source. Renewable energy source are characterized by their affordability and unlimited availability. Every nation aim to adopt this hydroelectricity concept, India will not exclude itself from this trend. According to population statistics, India ranks third globally in electricity consumption due to its high usage. Additionally, its abundant river resources place it as the fifth-largest country in terms of installed hydroelectric power capacity. Despite having an estimated hydro power potential of 148,700 MW, only 46,000 MW is currently tapped through large dams, along with 6780 MW from small hydro power projects, indicating a substantial untapped capacity for future development. (Central Electricity Authority, 2023)

During the twentieth century, significant advancements and transformations occurred in the field of hydropower. In the latter decades of this era, Brazil and China emerged as prominent leaders in hydropower development. The Itaipu Dam, situated between Brazil and Paraguay, commenced operations in 1984 with a capacity of 12,600MW. Subsequently, it has undergone expansions and enhancements, now boasting a capacity of 14,000MW. However, it is now surpassed in magnitude only by China's Three Gorges Dam, which has a capacity of 22,500MW. As of 2019, the total global installed capacity for hydropower reached 1,308GW, with China standing as the foremost nation in electricity production. (IHPA, Hydropower Status Report, Landon, 2020)

Himachal Pradesh is extremely rich in its hydro electrical resources because nature has gifted such favorable topography here. State has about 25 percent of the national potential, about 27,436 MW of hydroelectric power can be generated by the construction of various hydro projects on the five perennial river basins (Economic survey by Economics and Statistics department of Himachal Pradesh, 2017-18). In northern region Himachal Pradesh is the leading state with identified capacity 18470 MW and capacity in operation is 10263 MW. (CEA, 2023). There are some of the relevant studies on the topic under investigation, Large-scale development projects that involve land acquisition without consultation with landowners have resulted in agitation and public protests. (Dubey 2011) To mitigate the negative social effects, planning agencies,

particularly international aid organizations, stress the need for conducting advance assessments to identify potential harmful consequences of development interventions. This allows for timely implementation of corrective measures. (Mathur 2011) The government ought to embrace a policy of developing small-scale hydroelectric power not only to supply much-needed energy to rural communities but also to contribute to environmental preservation. (Umar and Hussain, 2015)

Objectives

The present study focus to explore the socio-economic and environmental impacts of the Behna Hydro Power Project in Mandi District of Himachal Pradesh. Some specific objectives of the study are as follows:-

- 1) To study the perceptions of individuals regarding the implementation of the project.
- 2) To study the socio-economic impact of hydro power generation;

Features of Behna Hydro Power Project

The Behna Hydro Power project is established on Behna Khad, a tributary of Satluj River, constructed by Himadri Hydro Power Project Pvt. Ltd. in Karsog valley of District Mandi in Himachal Pradesh. The construction work of this hydro power project started in 2003 and is completed by the year 2009. The water of Behna Khad was diverted with help of an underground tunnel over a distance of 6 KM from Nagan to Behna. The power generation is supplied to HPSEB substation Nagan near Anni Tehsil of District Kullu, HPSEB sub station Kumarsain Tehsil of District Shimla and some part of Karsog Valley.

II. Research Methodology

The purpose of this paper is to study the socio-economic impact of hydro power generation in Himachal Pradesh. For this purpose out of 12 districts of Himachal Pradesh, Mandi and Kullu have been selected randomly for the study of socio-economic and environmental impact of hydro power projects. Behna hydro power project is located at the boundary of district Mandi and Kullu has a catchment area corresponding to 2 Panchayats of Karsog Block and 2 Panchayats of Anni Block. Out of those 4 Panchayats, 2 panchayats 1 from Karsog and 1 from Anni were selected purposively. Single village were selected from both the panchayats named Firnu and Behna. In village Firnu 44 households were selected whereas in village Behna 46 households were selected for the study. Primary data has been collected through a well-structured schedule questions relating to the socio-economic aspects of hydro power projects. The data of present study has been analyzed with the help of tabular analysis, simple statistical techniques such as percentage and average.

III. Result and Discussion

(1) Perceptions of Local People in Execution of Power Project

In present study, perceptions of local people in the execution of power project was assessed separately in the both selected villages through primary investigation carried out from local affected households. After the survey it can be said that initially the people of surrounding area support the execution of power project with the hope of getting lots of opportunities but after establishment of power project people faces lots of problem and now they are not in favor of this project. Below table show the people perceptions before and after the execution of project:

Perceptions of People in Execution of Power Project

Table.1

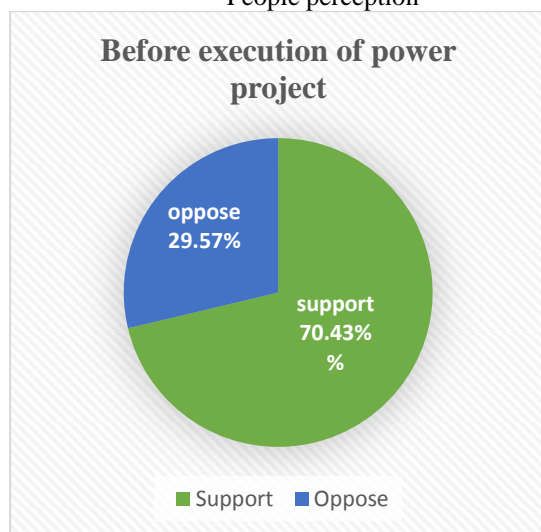
Location	Respondents who said that People supported the execution of project		Respondents who said that People opposed the execution of project	
	Before Execution of power project	After execution of power project	Before Execution of power project	After execution of power project
	% of the households	% of the households	% of the households	% of the households
Firnu	68.54	26.42	31.46	73.58
Behna	72.32	30.34	27.68	69.66
Total Panchayats =2	70.43	28.38	29.57	71.62

Source: Field Survey

The above table show that the people of In both the Panchayat Behna and Firnu there was 70.43 percent households, reported that Panchayats supported the power project before its execution and the remaining 29.57 percent households reported that Panchayats oppose the power project before its execution. In both the Panchayats, there were 28.38 per cent households who said that the Panchayats supported the power project

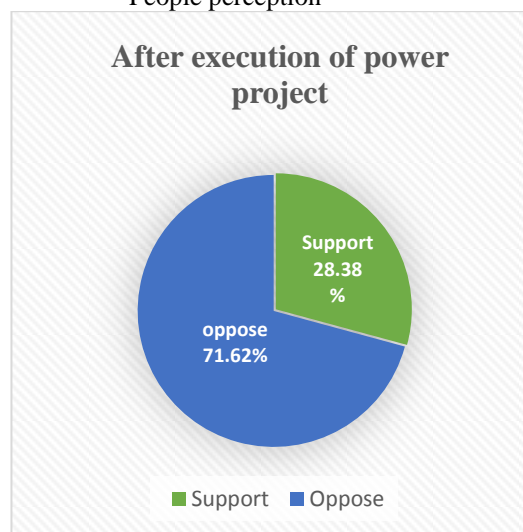
after its execution and 71.62 percent households said that Panchayats oppose the power project after its execution. Below two fig. shows the people perceptions regarding Hydro Projects execution before and after:

Fig.1 before execution of project
People perception



Source: Field Survey

Fig.2 after execution of project
People perception



Source: Field Survey

Above fig.1 show that the 70.43 percent people are in favor of project before it was established, because they have some expectation like: project provide employment to the local people, infrastructural development, irrigation facility, low price for electricity etc. But after the execution of power project 71.62 percent people are opposing on the basis of several social and economic problem like low payments for their lands, lack of infrastructural development, employment is temporary in nature, other social economic issues.

(2) Socio-Economic impacts of the Hydro Power Projects:

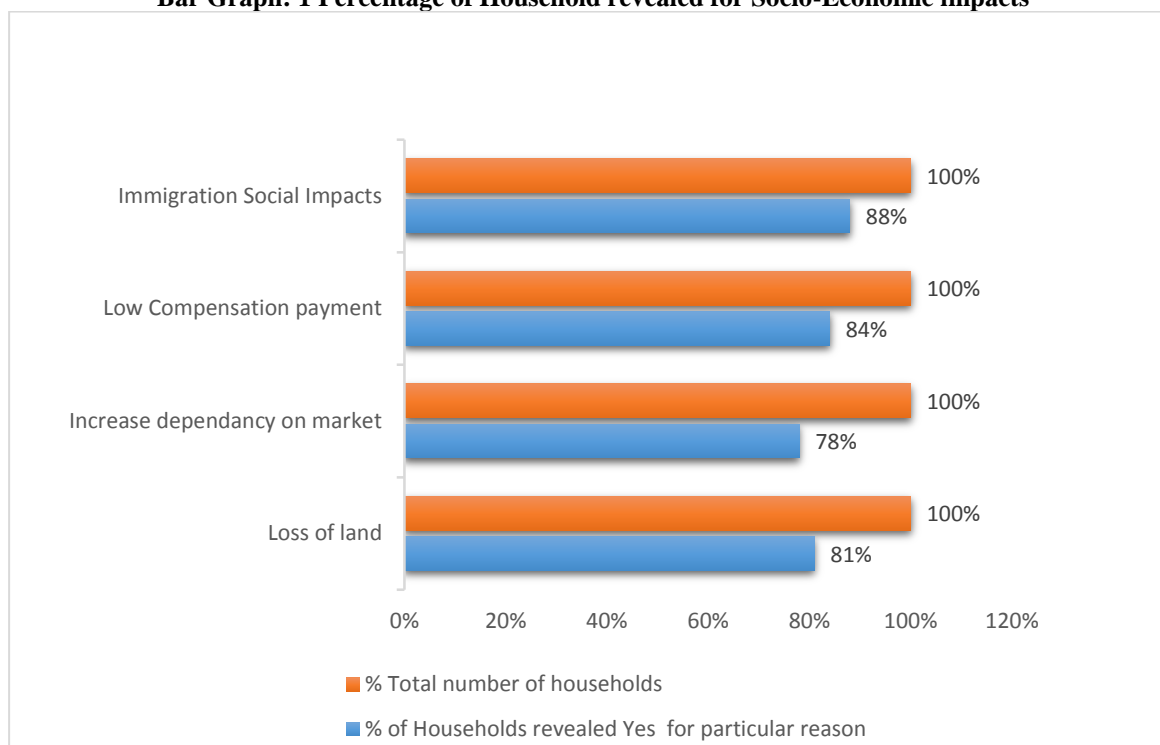
The Behna Hydro Power Project has both positive and negative effects on the surrounding households and the environment. Therefore, the socio-economic impacts have been categorized into two types as follows:

- a) *Adverse socio-economic impacts*
- b) *Positive socio economics impacts.*

a) Adverse Socio-Economic impact of the Behna Power Project:

Study has evidenced that the power project has caused adverse socio-economic impact on the local inhabitant. Some indicators are select to study these adverse impact such as- loss of land, increased dependence on market, low compensation payment for their land and impact of immigration on local habitant.

Bar Graph: 1 Percentage of Household revealed for Socio-Economic impacts



Source: Field Survey

The project authority acquired land from local residents for the power project construction. 81 percent of the population expressed that, according to Himachal Pradesh's customs and beliefs, selling their land was seen as a sign of disrespect to their families. 78 percent of households stated that the loss of land resulted in smaller plots insufficient for cultivating food grains and sustaining livelihoods. Consequently, they diversified into growing commercial crops like vegetables and fruits, leading to a reliance on the market for food grains. This study underscores the dependency on the market among those whose land has been acquired by the project authority. The compensation provided to local households whose land was acquired by the project authority was significantly below expectations. According to 84 percent of households, the initial valuation by the project authority was based on the land's fertility, but they expressed dissatisfaction with the compensation amount. They argued that the present value of the land is much higher than what was offered when they sold it to the project authority. Immigration refers to the process of individuals settling in a different area. In the current investigation, 88 percent households reported that when the Behna hydro power project was developed, a majority of the workers came from other states, making them immigrants in the local area. This arrival of immigrants has various negative effects on the local communities, including the demonstration effect, market expansion, traffic congestion, social tension, and lower wages for local residents.

The research zone exhibits negative socio-economic repercussions such as diminished land ownership, inadequate compensation, and an influx of immigrants. The implementation of a power project has both detrimental and beneficial effects on the local community's socio-economic status. The forthcoming discussion will focus on the positive outcomes.

b) Positive Socio-Economic Impacts of Power Project

The evaluation of the project's favorable influence on the selected households has been conducted by analyzing factors like asset ownership, housing pattern, infrastructure enhancement, and employment opportunities. This evaluation specifically targets households affected by the project's implementation, primarily within the neighboring villages of Firnu and Behna. The significant socio-economic benefits resulting from the power projects are explained below.

b.1) Housing Pattern

The housing pattern within the study area felt notable changes after the execution of power project, encompassing shifts in housing pattern, roofing styles, toilet facilities, and kitchen availability. As depicted in Table 2, there was a substantial shift observed, with 57.78 percent of households transitioning to modern (pacha) houses, up from the previous 8.89 percent. Prior to the project, 75.56 percent of households resided in traditional (kacha) houses, a figure that decreased to 28.89 percent post-project. 28.89 percent respondents cited the

suitability of these houses for the winter season and the high cost of constructing modern homes due to transportation expenses as reasons for this choice. Similarly the roofing styles of the houses transitioned from slate roofs to concrete and tin roofs. Initially, 74.45 percent of people's houses had slate roofs, but after the project was completed and their income increased, they shifted to concrete and tin roofs. Specifically, 57.78 percent transitioned to concrete roofs and 17.77 percent to tin roofs. Following the project's execution, there was a significant increase in the percentage of households with in-house toilet facilities, rising from 25 percent to approximately 95 percent.

Table 2 Housing Pattern

Housing Pattern		Number of households before project execution	% of Households	Number of Households after project Execution	% of Households	
1.	Type of house					
	A	Kacha (traditional house)	68	75.56	26	28.89
	B	Pacca (modern house)	8	8.89	52	57.78
	C	Semi Pucca	14	15.55	12	13.33
2.	Roofing Pattern					
	A	Concrete Roof	8	8.89	52	57.78
	B	Slate Roof	67	74.45	22	24.45
	C	Tin Roof	15	16.66	16	17.77
3.	Toilet Availability		23	25.56	86	95.56

Source: Field Surve

b.2) Employment Structure

It is evidenced that the implementation of the power project necessitated a considerable workforce for its operation. The authority overseeing the power project enlisted a substantial number of workers from other states like Haryana, Bihar, Uttarakhand, J&K, among others. Nevertheless, there were also local individuals employed in the power project. Employment opportunities were provided exclusively to households whose lands were acquired by the power project.

Fig.3 Percentage of Households Benefiting from Employment Opportunities

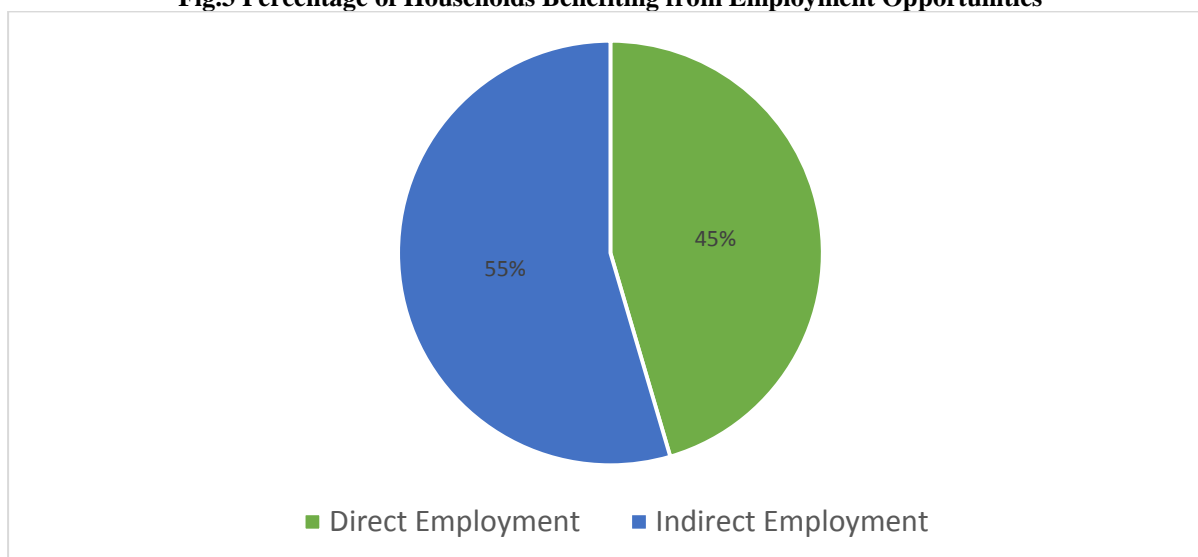


Table: 3 Employment Generation

Providing Employment		Number of households	Percentage Households
Direct Employment		10	45.45
Indirect Employment			
A	Hotel/Dhabas	2	09.09
B	General Store	4	18.18
c	Vehicles hiring out to project	6	27.28

Source: Field Survey

Among these affected households, 80 percent were offered employment by project authority, while the remaining 20 percent expressed a willingness to work but were not provided with any employment opportunities. In table 3, 45.45 percent of households secured direct employment in the operation of the project, while the remaining 54.55 percent found indirect employment opportunities such as working in hotels/ dhabas, daily need shops, and providing vehicles for project-related tasks.

b.3) Infrastructural Development

The fundamental necessity for the socio-economic progress of any nation is infrastructural development. In this particular study, the primary criteria for evaluating infrastructural development were identified as educational institutions, healthcare facilities, transportation networks, and banking services.

Table. 4 Infrastructural Development (in both villages)

Sr. No.	Infrastructure		Before Project Execution				After Project Execution			
			Ownerships Pattern				Ownerships Pattern			
			Public Sector	%	Private Sector	%	Public Sector	%	Private Sector	%
1.	Education Institutes									
	A	Primary Schools	2	100	-	-	4	100	-	-
	B	Middle Schools	-	-	-	-	2	100	-	-
	C	High Schools	2	100	-	-	2	100	-	-
	D	Sr. Sec. Schools	2	100	-	-	3	100	-	-
2.	Transportation									
	A	School Buses	-	-	-	-	1	100	-	-
	B	Local Buses	17	70.84	7	29.16	26	63.41	15	36.59
	C	Taxi	-	-	6	100	-	-	24	100
3.	Health Services									
	A	Health Centers	2	66.66	1	33.34	3	42.85	4	57.15
	B	Ambulances	1	-	-	-	2	100	-	-
	C	Veterinary	1	-	-	-	2	100	-	-
4.	Banking Services									
	A	Banks	2	100	-	-	4	66.66	2	33.34
	B	Post offices	1	100	-	-	3	100	-	-

Source: Field Survey

b.3.1) Educational Facilities and Transportation

After the implementation of the power project in the study area, there has been a noticeable increase in educational institutions. The number of schools has risen from 6 to 11. Initially, only 6 schools were present, with 2 primary schools, 2 high schools, and 2 senior secondary schools situated near villages Firnu and Behna. However, after the execution of the power project, the total count of schools has reached 11, comprising 4 primary schools, 2 middle schools, 2 high schools, and 3 senior secondary schools, all of which are operated by the public sector. Furthermore, the connectivity of roads and bridges has been enhanced post the power project implementation. There has been an increase in the number of local route buses, and school buses are now being provided by HRTC.

b.3.2) Health facilities and Banking Services

An enhancement was noted in the health facilities and ambulance services within the study area. Following the implementation of Project, three new private health clinics were established, along with two veterinary centers aimed at improving animal health. Additionally, there was an observed increase in access to banking services in both villages subsequent to the execution of the power project, indicating a rise in the income levels of local residents.

The execution of such projects, various benefits become apparent, as seen in the current study. These benefits encompass infrastructure development, including road construction, an increase in educational institutions, enhanced banking facilities, improvements in the standard of living, increased asset ownership, and expanded employment opportunities.

IV. Key Findings

The implementation of the Behna hydro power project has yielded both positive as well as negative consequences in the area under study. A thorough examination of the project's impacts revealed several significant findings.

Negatively, the project involved the acquisition of land, which held sentimental value as ancestral property for local inhabitants. This acquisition, viewed as disrespectful by the hilly people, led to dissatisfaction with the compensation provided by the project authority, which fell short of the land's present value. Consequently, locals experienced a reduction in land holdings, transform their cultivation from traditional crops to cash crops. While cultivating cash crops initially seemed advantageous, the limited land holdings hindered further expansion, forcing increased reliance on the market for agricultural needs. Furthermore, the immigration of external labor worsened socio-economic tensions, resulting in the overutilization of local resources, a demonstration effect, and diminished employment opportunities for locals.

However, among these challenges, there were distinguished positive impacts. While direct employment opportunities decreased, indirect employment rose, enhancing overall income and economic conditions for many. Additionally, infrastructure development flourished, remarkably in education, health, transportation sectors. The establishment of the project facilitated an increase in educational institutes, road construction, ultimately improving accessibility and fostering agricultural competitiveness. Widening of existing roads, in particular, positively impacted agriculture and horticulture activities, streamlining transportation to markets and boosting farmers' incomes.

V. Conclusion

Hydroelectric power plays a vital role in the progress of a nation, as the implementation of hydroelectric projects brings about significant socio-economic effects on the local people. The Behna hydro power project introduced challenges such as land acquisition disputes and other socio-economic strains, it also brought about significant improvements in living standards, infrastructure, employment opportunities and market accessibility, which highlighting a complex interplay of positive and negative consequences. The government and project authority must carefully consider these socio-economic impacts, as well as the perceptions of local inhabitants regarding the issues arising from hydro power project execution. By doing so, they can ensure the realization of long-term benefits from the project.

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