Scholarly Research Journal for Humanity Science & English Language,
Online ISSN 2348-3083, SJ IMPACT FACTOR 2016 = 4.44, www.srjis.com
UGC Approved Sr. No.48612, FEB-MAR 2018, VOL- 6/26

SOCIO-ECONOMIC IMPACTS OF HYDROELECTRIC POWER GENERATION- A SOCIOLOGICAL STUDY OF CHAMERA-I IN CHAMBA DISTRICT OF HIMACHAL PRADESH

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Abstract

Hydro-power generation is considered one of the most important renewable resource of energy and being required to meet-out growing energy requirement of the country. Being a sine-quo of any developmental project, hydroelectric power is being generated mostly in the Himalayan slopes and heavily targeted Himalayan rivers. Since fifth five-year plan, hundreds of such energy projects are being planned and most of them start generating electricity. These developments are not free of cost, there is huge socio-economic, environmental, psychological cost attached and presently, dam building industry, is one of most promising industry of the world and India is one of the top-10 dam builders of the world. This industry is impacting existing habitat, stream hydrology, stream chemistry, sediment transport, and migratory patterns, disturbance in social bonds, economic turmoil etc. and most importantly environmentally dams fragment river ecosystems, degrading the ecosystem upstream and downstream from the dam.

The present paper is based on primary research conducted in one of NHPC owned power project in Ravi basin in Chamba district by using exploratory research design on 300 respondents. To see the impact of hydro power generation, both situations, i.e. before the dam and present has been analysed by applying suitable statistical tools.

***Keywords**: Hydro-power Generation, Chamera-I, Social Impact, Economic Impact, Cost of Development*

Introduction

Optimizing use of limited resources is one of the biggest challenges facing any decision-maker. Economic assessment is therefore a vital tool. It can enumerate the potential costs and value the anticipated benefits of a proposed programme, policy or regulatory initiative, and reflect trade-offs inherent in alternatives. There is increasing recognition that environment and health impacts often require valuation in economic terms in order to receive adequate consideration in policy. An integrated economic analysis of such impacts can

capture the hidden costs and benefits of policy options, as well as the synergies and institutional economies of scale that may be achieved through complementary policies that support sustainable development.

Without the proper assessment of the belongings it is impossible to calculate the loss and profit of any developmental project. By economic here means the interacting web of social relationship which is determining the way of earning as well as way of living of the people who are living in the vicinity of this developmental mill i.e. Chamera-I Hydroelectric Power Project.

Hydro power Generation- Global to Local

Hydropower has been used since ancient times to grind flour and perform other tasks. In the mid-1770s, French engineer Bernard-Forest-de-Belidor published Architecture Hydraulique which described vertical- and horizontal-axis hydraulic machines. By the late 19th century, the electrical generator was developed and could now be coupled with hydraulics. The growing demand for the Industrial Revolution would drive development as well. In 1878 the world's first hydroelectric power scheme was developed at Crag side in Northumberland, England by William George Armstrong. It was used to power a single arc lamp in his art gallery. The first Edison hydroelectric power station, the Vulcan Street Plant, began operating September 30, 1882, in Appleton, Wisconsin, with an output of about 12.5 kilowatts.

At the beginning of the 20th century, many small hydroelectric power stations were being constructed by commercial companies in mountains near metropolitan areas. By 1920 as 40 percent of the power produced in the United States was hydroelectric. Hoover Dam's initial 1,345 MW power station was the world's largest hydroelectric power station in 1936.

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As far as hydropower generation in India is concerned, At the time of independence (1947), the installation capacity of hydropower projects was just 508 MW, which was about 37% of the total installation capacity at that time. But with the taking up of five-year plans, work began on many multi-purpose river valley projects, the so called *'temples of modern India'*. Bhakra dam was the notable showcase for a long time to come. At the end of

1998, the installed hydropower capacity was about 22,000 MW which was 24.85 % (lowest % so far) of the total installation capacity of 88,543 MW. In the year 1962-63, the hydro: thermal ratio was the maximum at 50.62 However, over the years, the share of hydropower has continuously come down. It may be noted that a thermal-hydro mix in the ratio of 60:40 is considered as ideal.

The Central Electricity Authority (CEA) undertook reassessment of the hydropower resources of the country in 1980s. In this survey, theoretical and the economic hydro potential of the rivers was worked out. The potential was assessed by identifying specific suitable sites and water availability corresponding to a 90% dependable year. CEA had identified 845 economically feasible schemes in various river basin of the country. On this basis, the total theoretical potential at 60% load factor was assessed as 301,117 MW and the economic potential at 84,044 MW. In 1932, two major hydropower projects, namely 48 MW Joginder Nagar station (Himachal Pradesh), and 14 MW Pykara hydro plants were taken up and completed by the then provincial governments of Punjab and Madras, respectively. Further notable developments in Madras state were Mettur dam hydro station (40 MW) in 1937 and Papanasam (14 MW initial) in 1944.

A project with capacity of 130 kW installed at Sidrapong (Darjeeling) in the year 1897 was the first hydropower installation in India. A few old installations, e.g., Shiva Samundram in Mysore (2,000 kW), Chamba (40 kW) in 1904, Gagoi in Mussoorie (3,000 kW) in 1907, Jubbal (50 kW) in 1911, Chhaba (1,750 kW) in Shimla in 1913, are the known hydro-power stations that are still working.

Hydropower Development in Himachal Pradesh

Himachal Pradesh is extremely rich in its hydroelectricity resources. The state is having about twenty-five percent of the national potential in this aspect. It has been estimated that about 27,436 MW of hydel power can be generated in the state by the construction of various hydel projects on the five perennial river basins no matter they are major, medium or small. Out of total hydel potential of the state, 8,418 MW is harnessed so far, out of which only 7.6% is under the control of Himachal Pradesh Government while the rest being exploited by the Central Government. The state government has been giving the highest priority for its development, since hydel generation can meet the growing need of power for industry, agriculture and rural electrification. It is also the biggest source of income to the state as it provides electricity to the other states also.

Himachal has enough resources to generate surplus power but, sometimes this is a misconception as in winters the power shortage overshoots ten lakh units per day due to less flow of water in rivers and at the same time increase in lighting and heating load. Due to increased industrialization and rural electrification this figure is expected to rise even further. The first hydropower in Himachal Pradesh is in Chamba named as *Bhuri Singh power plant* was built in May 1904. Himachal Pradesh is extremely rich in its hydroelectricity resources. The state is having about twenty-five percent of the national potential in this aspect. It has been estimated that about 27,436 MW of hydel power can be generated in the state by the construction of various hydel projects on the five perennial river basins no matter they are major, medium or small. Out of total hydel potential of the state, 8,418MW is harnessed so far, out of which only 7.6% is under the control of Himachal Pradesh Government while the rest being exploited by the Central Government. The state government has been giving the highest priority for its development, since hydel generation can meet the growing need of power for industry, agriculture and rural electrification. At present in Himachal Pradesh, there are 70 mega projects in different stages; some are producing electricity, some are in installation stage totally aiming to produce 18499.75 MW power expect mini and micro potential power projects (www.hpseb.in).

Rationale Behind the Study

The paper aims to analyse relationship with the lives and livelihood of the respondent and to assess the amount of loss or gain out of this project. And how what they lost or gain become a trauma or a matter of happiness or prosperity. To achieve the target, variables such as; category of respondents; economic characteristics of the respondents; occupation; cropping pattern; possession of land; income level of the respondents and habitation pattern have been included in the study sample.

Data on these variables have been collected, tabulated and analysed in the paper. To analyse the real picture of the problems, two conditions have been taken i.e. prior and after the installation of power project and a comparative analysis between both conditions has been made. For this comparative analysis 06 villages situated in the vicinity of reservoir have been taken. The main thrust of the study is to analyse the conditions which are responsible to bring economic deprivations or change in the economic condition due to the installation of power project.

With rising hydro power generation and improving efficiencies in distribution of electricity, Himachal Pradesh can offer energy at stable prices for eco-friendly industrial development. Thus, there is an urgent need to develop its huge untapped hydro power potential capacity with the purpose of harnessing hydro-power resources in the state for economic well-being and growth of the people in the whole region.

Study Area

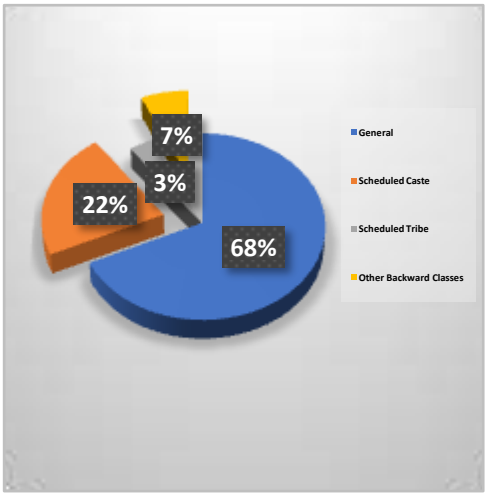
Study is aiming to understand socio-ecological impacts of hydroelectric power projects as a case study of Chamera-I power project in Ravi basin in Chamba district of Himachal Pradesh. It is an attempt to understand different dimensions of hydro-electric power generation with a particular focus on human dimensions of development and also attempt to highlights socio-ecological and economic impacts of hydro power generation. To achieve this objective out of three commissioned power projects in Ravi basin i.e. BairaSuil, Chamera-I and Chamera-II, Chamera-I power project has been selected for the in-depth study. People living in both sides (left and right) of 29 kms reservoir of Chamera-I have been selected for minute analysis. For minute analysis people who are living in the first line nearer to reservoir have been focused and the focus has also been on the people living on second line of the impact to see comparative impact of the dam on the lives of people.

Result and Interpretations

Data collected from 300 respondents from the villages situated in the vicinity of Chamera-I power project by using semi-structured interview schedule and simple random sampling method to select the respondents from upstream of the dam. The collected data tabulated and interpreted as follows to drive the conclusion:

Social Segment of the Respondents:

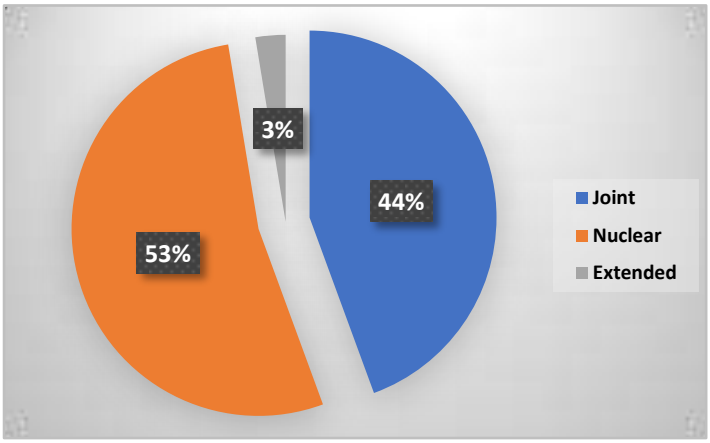
Through social segments one can divide the society in sub parts. One's social segment is his identity. In Indian caste system the person which is born in one social segment, dies in the same segment. There is no upward or downward mobility in Indian Caste System. In this research social segments on the basis of constitution are taken. As it is easy to ask once constitutional segment as compared to caste. Generally lower caste people



feel ashamed to tell their caste straight away. It has been noticed in the study that some people refused to give their social segment, the reason may be that they belong to lower segments of society. It is shown in the following table:

Social Segment	No. of Responses	Percentage
General	204	68.00
Scheduled Caste	066	22.00
Scheduled Tribe	010	03.33
Other Backward Classes	020	06.67
Total	**300**	**100.00**

As shown in table and figure, 71.3% of respondents belonged to General category. The martial castes prefer to live alongside river. It was followed by 28.7% Scheduled caste. There was no Scheduled Tribe or Other Backward Classes in the study area. People seemed to be living peacefully with each other without any caste conflicts. General and Scheduled caste respondents had houses next to each other.



Family is a fundamental institution of society. Without family the continuation of society is impossible. Type of family defines the distribution of income and resources among its members. As the family size increases, share of each family member on facilities decreases. All three types of family have been taken in the research.

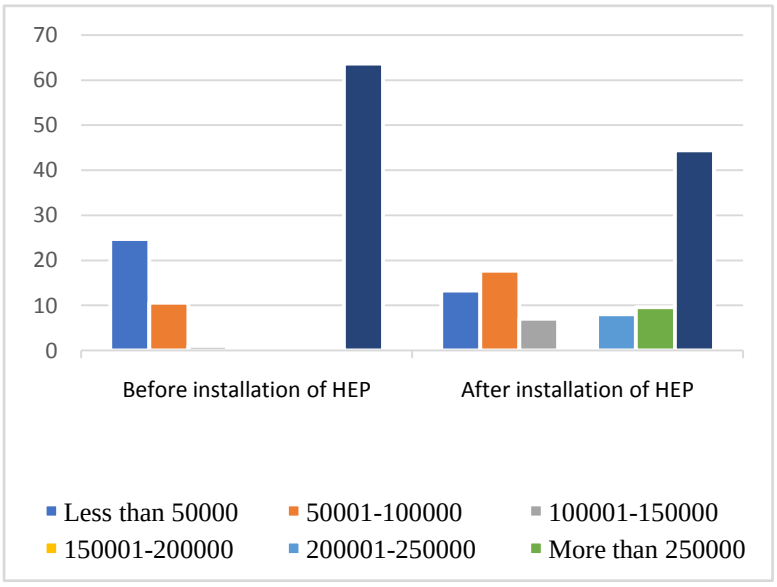
As depicted in the Figure, in the study, 53% of respondents belongs to Nuclear family, followed by 44.4% respondents from Joint family. Most of families have broken due to power project or marriage. After the installation of power project, many people decided to leave the area and shift to uplands leaving other family members behind. Like if a son got job due to power project so he decides to shift to upland leaving his brother behind. Also after marriage brothers got separated because it is very difficult now-a-days to fulfil all needs of a big family. It has also noticed that only 2.6% of respondents belong to extended families.

Comparison of Income of the Respondents Before and After Installation of Power Project

Income earned through different occupation has a detrimental impact of the livelihood and living conditions of any body. Income defines the standard of living. A family spend money on its need according to the income. Before the installation of power project, the needs of family were less so less income was required for its fulfilment but after the installation of power project the needs and cost to fulfil those needs has increased many folds. The comparison of both situations is being shown as follow:

Level of Income	**Before installation of HEP**		**After installation of HEP**	
	No. of Responses	**Percentage**	**No. of Responses**	**Percentage**
Less than 50000	074	24.70	040	13.30
50001-100000	032	10.60	053	17.70
100001-150000	003	01.00	021	07.00
150001-200000	000	00.00	000	00.00
200001-250000	000	00.00	024	08.00
More than 250000	000	00.00	029	09.60
No Response	191	63.70	133	44.40
Total	**300**	**100.00**	**300**	**100.00**

As depicted in table and figure, there is a positive trend in income from before the installation of project to after the installation of project. Before the installation of power project majority of respondents were earning less than 50,000 rupees per annum. There were only 1% respondents who earns near about 1 lakh rupees per annum. But with the installation of power project the income of respondents has increased many folds and majority of respondents started to earn near about 1 lakh rupees per annum. They are those people who have not got any compensation. The reason may also be different as there may be shift in occupation and once those were students not got employment. It is also noted that the percentage of respondents

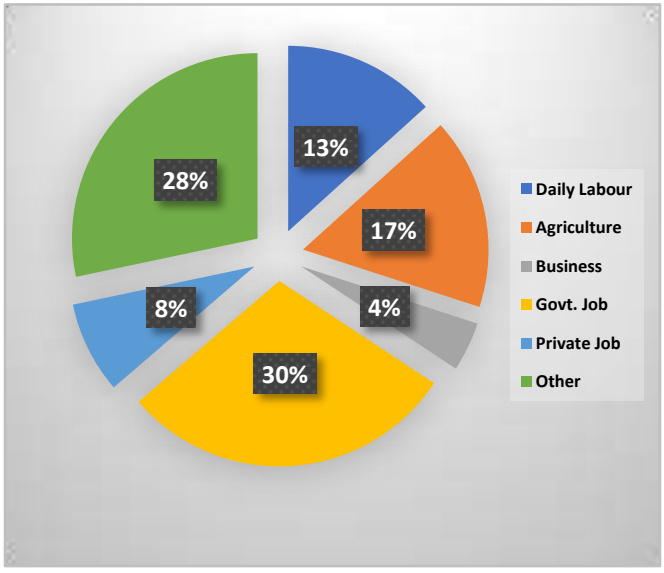


who had not given any response is as high as 63.7% and 44.4% before and after the installation of power project respectively. The reason for being much non-responsive to this question, respondents were afraid of income tax and not willing to disclose their real income.

Change in Occupational Profile of the Respondents

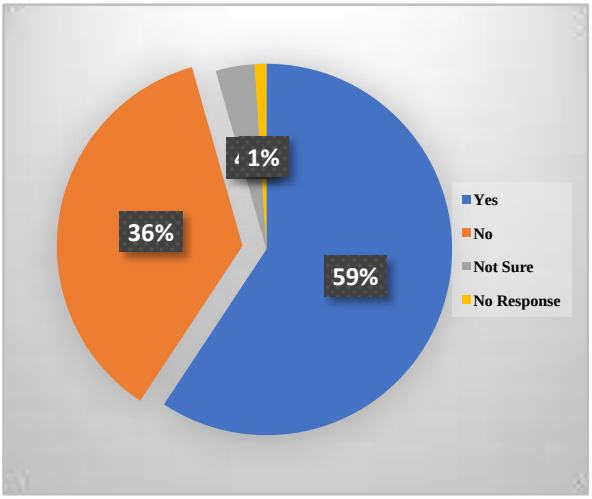
Occupation is the process by which someone can earns a living. In this table occupation of the respondents in two conditions i.e. prior to the installation of power project and after the installation of power project has been recorded. Main occupations like agriculture, labourer, service including job in NHPC, central or state government, trading, and fishing have been included. The responses recorded on these variables describes that the traditional occupation of agriculture has received a major jolt and transmitted to the labourer which increased after the installation of Chamera-I. Trading and service sectors have experienced a positive trend and more respondents have responded that they have got more jobs and trading opportunities with the installation of Chamera-I. It is shown as follows:

Occupation	**No. of Responses**	**Percentage**	**Occupation Change**	**No. of Responses**	**Percentage**
Daily Labour	040	13.30	Yes	178	59.30
Agriculture	050	16.70	No	109	36.30
Business	013	04.30	Not Sure	010	03.40
Govt. Job	088	29.40	No Response	003	01.00
Private Job	024	08.00	**Total**	**300**	**100.00**
Other	085	28.30			
Total	**300**	**100.00**			



In the research it has been found that 29.4% respondents have government job including jobs from NHPC. It is followed by 28.3% others which mostly were housewives. 16.7% of the respondents were engaged in agriculture. The share of agriculture has decreased significantly due to submergance of land in dam. 13.3% of respondents were working as daily labour. All daily labourers were illiterate. 8% of respondents were in

private job followed by 4.3% business men. These business men are marginal shopkeepers.



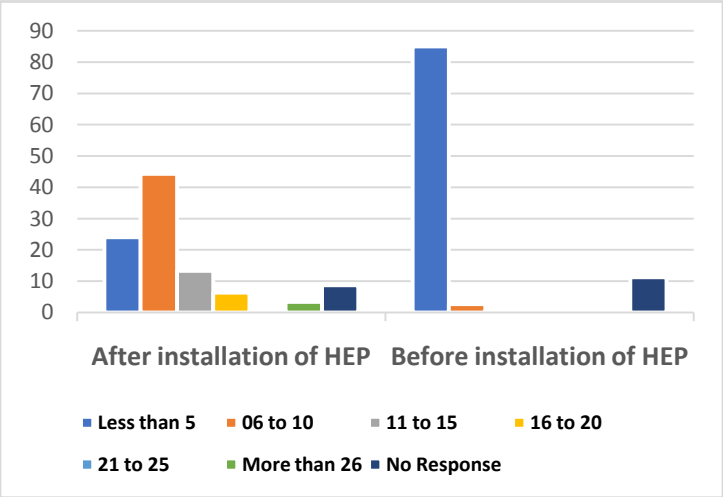
With the coming-up of Chamera-I, there is a drastic change in the occupational profile of the respondents and respondents expressed their views that people of whole area experienced a major shift in their occupational profile. This signifies the status and prestige of a family. The education level of people in the study area is not very high because of which the occupations are general. There was not a single person from Class-I or Class-II jobs. Main focus of occupation is either business or job. Majority of jobs were given by power project to affected people. The number of people who has other job is very less.

As depicted in table and figure, 59.3% of respondents were of the view that Chamera-I has change their occupation. This change can be negative or positive. Project has snatched work from respondents. Prior to the installation of project everyone has some kind of work to do. But with coming of project many has lost their land and work. 36.3% of respondents said that there was no change in occupation due to dam. 3.4% of respondents were not sure about the change and 1% have not responded.

Change in Possession of Land of the Respondents

Himachal Pradesh is an agricultural dominated state and Chamba district in general and study area in particular is not exception. Even today maximum residents of study area are mostly dependent on agriculture as their primary occupation. For agriculture, land is a major asset when it comes to people who are totally dependent on it. Whole population of the study area was dependent on land for living. The education was available to high class so poor people don't have option of job. The land holding of the respondents was small but with the coming-up of project, maximum land of the people living in low-lying area were submerged and now they are without land. The description of land profile of the respondents and change therein is being mentioned as below:

Land (in bighas)	**Before installation of HEP**		**After installation of HEP**	
	No. of Responses	**Percentage**	**No. of Responses**	**Percentage**
Less than 5	072	24.00	255	85.00
6-10	133	44.30	008	02.70
11-15	040	13.30	003	01.00
16-20	019	06.30	000	00.00
21-25	000	00.00	000	00.00
More than 26	010	03.40	000	00.00
No Response	026	08.70	034	11.30
Total	**300**	**100.00**	**300**	**100.00**



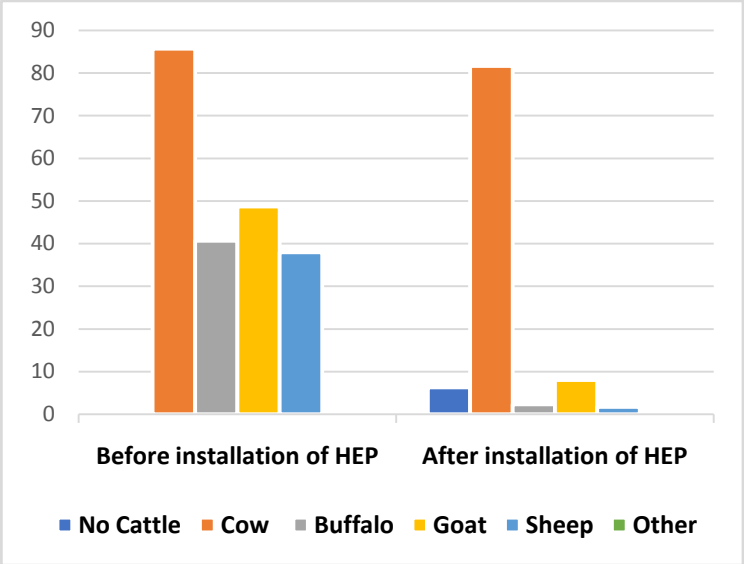
As shown in table and figure, before the installation of power project 24% of respondents had land less than 5 bighas. Now, after the installation of power project this percentage has shifted to 85%. This means due to power project the land holding has decreased significantly. Percentage of respondents having land between 6-10 bighas has decreased from 44.3 to 2.7. Respondents who had 11-15 bighas of land before the installation of power project has decreased from 13.3% to 1%. Respondents who had 16-20 bighas of land has decreased from 6.3% to 0%. There were 3.4% of respondents who had land more than 26 bighas, but now no one had land even above 15 bighas.

Type and Number of Possession of Livestock by the Respondents

It can be said that cattle rearing is hobby of the people of area and people use to rear almost all kinds of cattle. Every household has cattle but their number vary from one household to another. Cattle were used for milk, ploughing and also their waste is used as manure into fields. People use to rear large number of goats and sheep for their milk, meat and wool. But with the installation of power project the pasture land has submerged/decreased significantly due to which people cannot afford to rear cattle.

Livestock	**Before installation of HEP**		**After installation of HEP**	
	No. of Responses	**Percentage**	**No. of Responses**	**Percentage**
No Cattle	000	00.00	019	06.30
Cow	257	85.70	245	81.70
Buffalo	122	40.70	007	02.30
Goat	146	48.70	024	08.00
Sheep	114	38.00	005	01.70
Other	000	00.00	000	00.00
Total	**300+328***	**100.00**	**300**	**100.00**

**respondents have more than one type of cattle*

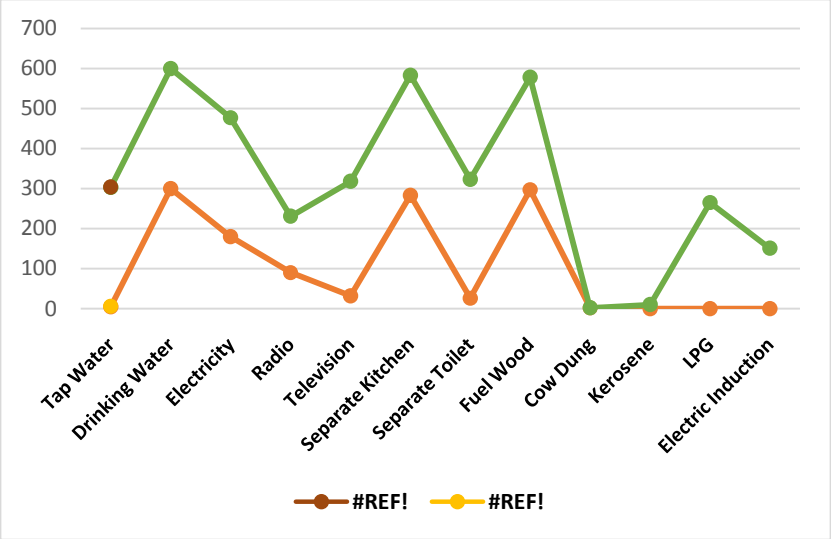


The most reared cattle were Cow because of her milk. A slight change has been seen in number of cow reared. The percentage has decreased from 85.7 to 81.7. Before installation of power project everyone has atleast one cattle but at present 6.3% of respondents don't have any cattle. Share of buffalo has decreased from 40.7% to 2.3%. Share of goat and sheep has decreased from 48.7% and 38% to 8% and 1.7% respectively.

Comparison between Availability of Amenities in the Household of the Respondents

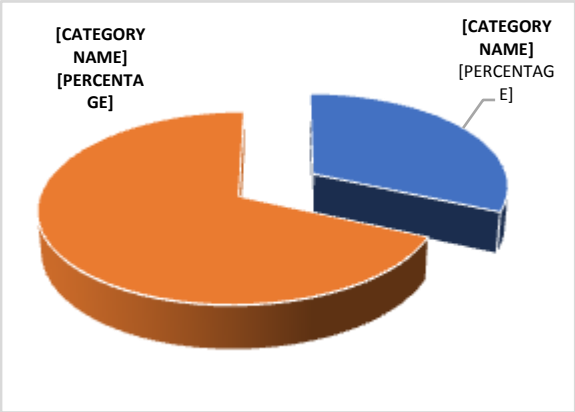
To make life more comfortable and smooth is a desire of any head of the household. It is pertinent to mention here that there may be many reasons which may be responsible for the increase or decrease in the household items. Considering a positive impact of installation of power projects, an account of amenities available with respondents to meet-out their daily needs has been generated on the basis of response of the respondents. Before the installation of power project the facilities available at households was very less. People didn't had access to basic facilities like electricity, toilet etc. Due to poverty people was not able to fulfil their basic needs. They were dependent on conventional sources of cooking. The detailed presentation of available amenities with households is as below:

Amenities	**Before Installation of HEP**		**After Installation of HEP**	
	No. of Responses	**Percentage**	**No. of Responses**	**Percentage**
Tap Water	005	001.7	297	099.1
Drinking Water	300	100.0	300	100.0
Electricity	180	060.1	297	099.1
Radio	090	030.0	141	046.9
Television	032	010.6	286	095.5
Separate Kitchen	283	094.6	300	100.0
Separate Toilet	026	008.8	297	099.1
Fuel Wood	297	099.1	281	093.8
Cow Dung	002	000.8	000	000.0
Kerosene	000	000.0	010	003.5
LPG	000	000.0	265	088.4
Electric Induction	000	000.0	151	050.4



Massive change has been witnessed before and after the installation of power project in amenities. Tap water has increased from 1.7% to 99.1% in household. Before the installation of power project 100% respondents had access to clean drinking water. The share of electricity has increased from 60.1% to 99.1%. Only one house was found without electricity. Radio was first source of entertainment in the area because of which there was 30% of respondents who had radio before the installation of power project, this has increased to 46.9%. When the television came for first time in area, it was a thing of great honour to have one. Only 10.6% of respondents had television, which has increased to 95.5% today. The percentage of separate kitchen has increased from 94.6% to 100%. Before the installation of power project, the number of toilets was very low. People use to go to open places. There were only 8.8% respondents who had toilets before the installation of power project. Only source of cooking food was fuel wood. The percentage of respondents who cook food using fuel wood has decreased from 99.1% to 93.8%. There was only one respondent who use to cook food using cow dung. Today the main source of cooking food are L.P.G. and Electric induction. The percentage of kerosene, L.P.G. and

induction has increased from 0% to 3.5%, 88.4% and 50.4% respectively. Overall, total number of amenities has been changed as under:

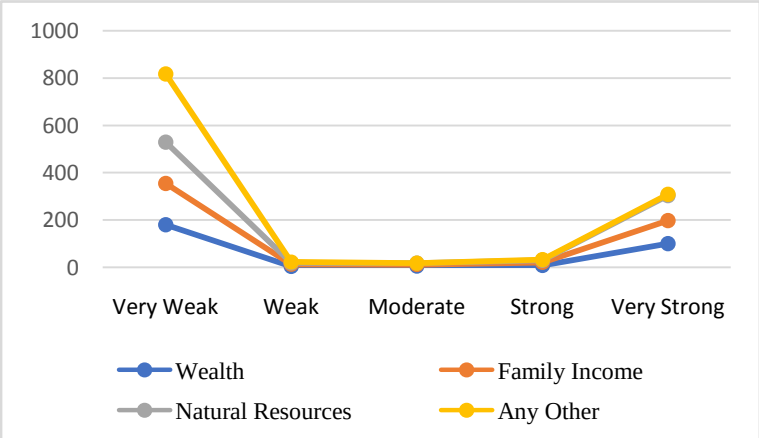


As shown in this figure the total number of amenities available to the households prior to the installation were 1215 whereas the number increased to 2625 after the installation of Chamera-I, which shows the positive trend. Though it may be because of many other reasons as with the increase in monthly household income the purchasing capacity of the respondents have increased.

Overall Impact of Chamera-I Power Project

Chamera-I has a major impact on wealth and resources of respondents. The impact can be positive or negative. Chamera-I was constructed to bring positive change in the area. It was supposed to improve the condition of people and area. Project has brought change in the life of affected people by providing money and jobs. But some people who didn't receive job due to one way or another were unhappy. The overall impact of Chamera-I is being shown as below:

Does it Affect	**Level of Impact**					
	Very Weak	**Weak**	**Moderate**	**Strong**	**Very Strong**	**Total**
Wealth	180	005	006	009	100	300
Family Income	175	009	006	012	098	300
Natural Resources	174	006	006	009	105	300
Any Other	288	003	000	003	006	300
Percentage	**68.0**	**01.9**	**01.5**	**02.7**	**25.9**	**100**
Total	**817**	**023**	**018**	**033**	**309**	**1200**



68% of respondents had very weak impact of Chamera-I on wealth and resources. These people were native of the area and didn't received sufficient compensation and job. 25.9% of respondents had very strong impact of Chamera-I on wealth

and resources. These people were displaced and now living in the upper areas. They received compensation and job. 2.7% of respondents had strong impact, 1.9% of respondents had weak impact and 1.5% of respondents had moderate impact of Chamera-I on wealth and resources.

Conclusion

In the light of foregoing data description and discussion of the social profile of the respondents, the following observations can be made. In terms of age group studied, not by the way of random selection, majority of respondents are in the middle-aged categories i.e. between thirty to sixty years. Maximum numbers of the respondents interviewed are male. Reasons for the women head of the family are patriarchic society in which it is difficult to find woman head of the families. Women are head of families out of respect, their old age, their experiences in life, but not legally or in revenue record. To find legally woman head of the family is very rare phenomenon.

In view of the social segment wise distribution, the respondents are broadly divided into four categories i.e. general, scheduled castes, scheduled tribe and other backward classes. The study area is mostly dominated by the generalcategory and followed by the scheduled caste, while other have not any representation in the social composition. As far as family structure is concerned the available data states that practice of joint family has decreased and nuclear family has increased after the installation of power projects. People who are in jobs presently, prefer nuclear families and people who are not in jobs they still respect joint family system and adhere to it.The educational profile of majority of the respondents indicates that maximum respondents are either matriculate or less than matriculation. The number of senior secondary, graduate and post-graduate is very small. Rest of a considerable number of respondents; all the respondents interviewed are educated with varying level of education.

With regard to the land owned maximum number of the respondents had good amount of land before the installation of power projects, but presently the picture is different. Only a small number of people own more land while at present majority of respondents has a small size of land. After the installation of power projects, the annual income of the people in general and of the respondents has increased. Particularly, the income of the respondents who have joined service sector i.e. government jobs, NHPC, private, semi-private, etc., has increased. There is very big difference between the income status prior and after the installation of power projects in the area. At present, people of the area are quite well to do as

compared to earlier. Occupational mobility in the study area can also be observed. Earlier most of the people engaged themselves in agricultural activities, but at present they are working in other jobs. The number of agriculturalists has increased while service sector is emerging as an important sector.

It is observed from the data that all respondents have experienced the increase in the amenities and facilities possessed by them in their household and area. Therefore, it is quite possible to assume that the installation of power projects brings about some degree of socio-economic and cultural change, which has also affected the status of the individuals. It may be argued that over the years the standard of living of the respondents has undergone a substantial change.

On the basis of above description, it can be stated that socio-economic description of well-beingness and availability of amenities in the household is a guarantee of better life style and living. As far as these conditions of respondents in the study area are concerns, it is evident from the quantification of data gathered for this specific purpose that respondents for the study area share a mixture of positive as well as negative response. The respondents living in the vicinity of reservoir of this developmental mill. The displaced people have left the place of their origin and resettled somewhere in the other part of the district or village. Respondents were native, who are living there and facing the real problems of daily life and they are paying the real cost of this developmental project.

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