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# Socio-economic impacts of Sorang hydroelectric power project in District Kinnaur, Himachal Pradesh, India.

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**Abstract**

Electricity is one of the key determinants for economic growth of a nation. Over the past decade or so, hydropower projects (HEP) around the world have attracted much attention concerning the environmental and social impacts that have arisen from such developments. Construction and operations of dams have always been associated with changes in the physical and biological environment. No doubt electricity generation is the need of the hours for development, but the large projects do involve the submersion of forests and the displacement of people. Socio-economic and cultural impacts arising from project construction and environmental transformations are rooted in the complex interactivity between social and biophysical environments. Human communities are integral components of their environment as well as potential agents for environmental change. Hence environmental changes in settled areas are often profoundly interlinked with subsequent changes that occur within society. The interests of local must be listened to and taken care of during the planning and the policy makers must adopt a model or strategies so that the impacts and effects of such type developmental activities can be minimized and local people who are living in the vicinity as well as who have sacrificed their belongings. To maximize the positive impacts and mitigate the negative environmental, social and economic impacts sustainability of water resources projects is required. This paper refers the perception of the public with regards to the impact of the Sorang HEP and other development activities and need for sustainable development to maintain balance with the environment of hilly and fragile area.

**Keywords**: Hydropower Projects (HEP), Socio-economic, Environmental Impact Assessment (EIA), Sustainability.

**Introduction**

The increasing global demand for energy combined with the ongoing quest for clean, renewable energy has been a topic of perceived interest amongst countries of developed and developing status worldwide. Hydropower is a renewable, economic, non-polluting and environmental friendly source of energy. It has been one of the sources of energy harnessed for centuries in different parts of the world. Hydropower has generated a great deal of interest because it is inexhaustible source of energy & a moderate method for providing electricity to far flung areas in hilly regions. India has achieved remarkable progress in the field of power development since independence in 1947.The rate of growth of installed capacity, though impressive, has not been able to keep pace with the increase in power demand and as a result the country is presently facing peak power shortages of varying degree in various regions of the country. It has been estimated that country needs to add about 9% of its installed capacity every year in next decade so as to meet increasing power demand. India has an enormous hydro electric power potential of around 148700 MW (84044 MW at 60% load factor) (Singh, 2008). The present installed generating capacity in the country is 1, 07,973 MW. Out of which the share of hydro power is about 25% (i.e.26, 910 MW) **(Fig.1).**

**Hydro Electric Power Projects (HEP) in Kinnaur**

With the growth of economy, the demand for energy increases tremendously due to rapid industrialization, better standard of living and increased infrastructure network. As conventional sources of energy are limited, there is an immediate need to explore new and alternative source of energy. Hydro electric power is one of the alternative sources of energy, and Himachal Pradesh has been blessed with vast hydro electric potential in its five river basins, namely Sutlej, Ravi, Beas, Yamuna and Chenab. **Table 1**.summarizes hydroelectric power potential of kinnaur and gives their detailed status of development.

**General Features of the Sorang Hydro project**

The Sorang hydroelectric project is a run-of-the-river type development on Sorang Khad, a tributary of Satluj River, in district Kinnaur, Himachal Pradesh. The project consists of construction of trench weir across Sorang Khad at an elevation of 1943.50 m. The water flow directed shall be fed through 1.540 km. long head race

 

tunnel (HRT) and 183 m long pressure shaft and 970 m long buried penstock to a underground powerhouse on the left bank of Tikkadda Khad near the confluence with Satluj river. The Project thus utilizes a head rated of 667.15 m. to produce 100 MW of power. The power generated at Sorang HEP is proposed to be fed into HPSEB 220/66KW substation at Kotla near Jeori and Kunihar in District Solan. The present power supply position in the Northern Region indicates that there is shortage of peak power as well as energy of varying degree in most of the states. The anticipated power supply position in the year 2006-2007 indicates that the gap between the demand and supply would increase further in the coming years. It can thus be concluded that power and energy generated at Sorang HEP would get fully absorbed and would help in bridging the gap between demand and supply to some extent both in respect of peak power and energy requirements.

The project will export approximately 464 GWh of electricity per annum. It will utilize the natural flow of the Sorang Khad to generate electricity and hence does not involve the construction of a reservoir. A concrete trench weir, with a bottom intake and de-sander, will be constructed across the Khad, approximately 30 m in length and with a maximum height, from the deepest foundation to the crest, of approximately 7 m. The water will be diverted through an interconnecting channel at the bottom of the weir into a desilting basin before being conveyed into a head race tunnel, penstock tunnel and surge shaft. The water will pass from the penstock tunnel into the underground powerhouse that will accommodate two (2) 50MW Pelton wheel turbines vertically mounted and coupled with synchronous generators. The powerhouse will be fitted with a ventilation tunnel. From the powerhouse, the water will be discharged back into Satluj River, via a tail race tunnel. It will enter the Satluj River immediately downstream of the power house site. The voltage of the electricity generated at the generator terminals will be 11KW which will be stepped up to 220KW at the switchyard of the powerhouse. The switchyard will be located above ground. The electricity will be exported to the grid via an 18km double circuit transmission line from SHEP to HPSEB's Kotla Sub-station. **(Fig.2)**

**Materials and Methods**

Sampling is a process of systematically selecting respondents, cases and households in the research study. Though a standard sample size comprises 15% of the total population, that is, 43; to get more accuracy in the result the researcher has taken 20% of the total population, that is, 58. Household Socioeconomic status is collected by questionnaire survey, interviews and field observations. The universe of the study would be 290 households covering the four villages around Sorang HEP. Details are given in Table 2. A systematic random sampling was done to choose four villages two each from east and west of the Sorang HEP. The criteria were to choose one from far region and the other from near to project area. 20% of the households were chosen from each of the village.

**Results obtained from household questionnaire:**

It is found that 67.24% respondents are male and 32.7% respondents are female during household data collection. Average Age of respondent was 42.36 and Average Age of head of household was 57.77 ranged from 34-70years and 68.96% family that responded belonged to joint family, whereas 31.03% families were from nuclear family.

**Educational Status in Region:**

Education is the double-edged blade, which can eliminate the efforts of socio-economic inequalities, but which can itself introduce a new kind of inequality between those who have it and those who do not. In all cases it is the best indicator of socio-economic development of a region and is a basic need too. The census definition considers a person to be literate who can read and write with understanding in any language. The literacy level of the district increased from 58.36 % in 1991 to 75.2 % in 2001.Of the total literacy rate in 2001, male constituted 84.3 % whereas female 64.4 %. While Kinnaur district may have "miles to go" in the field of education, the current status of this critical sector of human development constitutes a remarkable achievement. Advances in the field of education comprise one of Himachal Pradesh's greatest success stories. Most of respondents were graduate in the region ie 18.38% followed by 16.43% middle, 16.15% metric, 15.87% Senior Secondary and 15.32% primary respectively (Fig.3) . Only 10.3% respondents were post graduate where as 7.52% respondents were illiterate.

**Status of Environment after HEP:**

Hydropower dams can cause several environmental problems, even though they burn no fuel. Damming rivers may permanently alter river systems and wildlife habitats. Fish, for one, may no longer be able to swim upstream. Hydropower plant operations may also affect water quality by churning up dissolved metals that may have been deposited by industry long ago. Hydropower operations may increase silting, change water temperatures, and lower the levels of dissolved oxygen. Some of these problems can be managed by

 

constructing fish ladders, dredging the silt, and carefully regulating plant operations Hydropower has advantages, too. Hydropower's fuel supply (flowing water) is clean and is renewed yearly by snow and rainfall. Furthermore, HEPs do not emit pollutants into the air because they burn no fuel. With growing concern over greenhouse gas emissions and increased demand for electricity, hydropower may become more important in the future. Hydropower facilities offer a range of additional benefits. Many dams are used to control flooding and regulate water supply, and reservoirs provide lakes for recreational purposes, such as boating and fishing.

From **Fig. 4** (a), it is noted that 62.06 % respondent felt that environmental conditions of the area became worse after initiation of HEP and only 10.34% respondents felt that it was good whereas 27.58% respondent said that there is no change in the environmental conditions after HEP. This may be due to lack of awareness. Fig.4 (b) revealed that primary environmental problems in the study area are landslide followed by erosion, flooding, siltation, deforestation and pollution respectively.

**Destruction of the forest or Natural Vegetation by Construction of Hydropower Projects vis-a-vis Sustainability of Environment**

Having capacity to generate the HEP from the river Satluj and its tributaries, large number of hydropower projects are undergoing in whole district. Hydropower development in the district is a big source of economy for the state and its help in the growth of economic conditions of the state. Development of HEPs in the area needs sustainable development by maintaining balance between the quantity of development and quality of environment. Sincere efforts are required to ensure that the developments do not disturb the delicate equilibrium of the fragile area.

Fig.5.reveals that 17.24% respondents stated that the deforestation rate is decreasing and hydropower projects development in the study area achieves the target of renewable energy and growth of power and the construction works are carried out in sustainable manner maintaining balance with the environment and natural resources of the area and if the degradation of environment is there, this is negligible. Loss of vegetation, flora and fauna is being disturbed in limited spheres. Whereas, 68.96% respondents disagreed. According to these respondents the construction of large-scale hydropower projects in the fragile area, the flora, fauna, and natural vegetation loss and other negative impacts like displacement of people, landslides, soil erosion and deforestation has been increased after initiation of HEPs. The sustainable development of the area is not possible, without keeping balance between development and preservation of natural resources. However, 13.79% respondents did not state any views.

**Conclusion:**

No doubt hydropower projects have made an important contribution to the human development and the benefits derived from them have been considerable, but along with this such developments had altered and diverted the natural river flows, affecting existing rights and access of the locals to water and resulting in significant impacts on livelihood and the environment. The researcher is not against the installation of power projects but these must be eco-friendly and sustainable in nature and there must be sustainable improvement of human welfare. This means a significant advancement of human development, which is economically viable, socially equitable and environmentally sustainable. If the dams are the best way to achieve this goal, then deserve the full support of the researcher. The local issues must be taken into consideration properly and with true spirit, not in paper and must not be engulfed by the red tapism of the Indian bureaucracy. The policies should be framed in such a way by visiting local sites so that the proportionate balance between biotic and abiotic components of the environment can be maintained and the potential capacity of Satluj and its tributaries can be utilized properly. Before sanctioning any other power project for Satluj basin the World Commission on Dams recommendations must be taken into consideration, which has stressed four fundamental values regarding the dam building, these are; **equity, efficiency, participatory decision-making, sustainability and accountability.** Everything can be generated but water cannot. Once it is lost it will be lost forever, it cannot be generated. So the need of the hour is to use this wonderful gift of god to meet our need not to greed. We must keep ourselves away from the natural cycle of the water and should not disturb it in the name of so called development**.** We must keep in mind that **Nature can live without man but man cannot.**

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**Table. 1 Hydroelectric power potential of Kinnaur**

| Name of the project | River/ khad | Estimated Installed capacity (MW) |
|---|---|---|
| **Harnessed** | | |
| Sanjay Bhaba | Bhaba | 120.00 |
| **Under Execution** | | |
| Nathpa –Jhakri | Satluj River | 1500.00 |
| Baspa Stage – II | Baspa River | 300.00 |
| Karcham – Wangtoo | Satluj River | 1000.00 |
| Keshang | Keshang Khad | 66.00 |
| **Investigation Under Progress** | | |
| Thopan – Powari | Satluj River | 400.00 |
| Shongthong – Karcham | Satluj River | 225.00 |
| Jangi – Thopan | Satluj River | 300.00 |
| Sorang | Sorang Khad | 100.00 |
| Baspa – I | Baspa River | 210.00 |
| Todong | Tidong Khad | 100.00 |

**Table. 2 Number of Surveyed Households**

| EAST | | | | | | WEST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Near** | **Total No. of HHs** | **No. of Surveyed HHs** | **Far** | **Total No. of HHs** | **No. of Surveyed HHs** | **Near** | **Total No. of HHs** | **No. of Surveyed HHs** | **Far** | **Total No. of HHs** | **No. of Surveyed HHs** |
| Bara Kamba | 60 | 12 | Chhota Kamba | 50 | 10 | Chaura | 80 | 16 | Rupi | 100 | 20 |

 

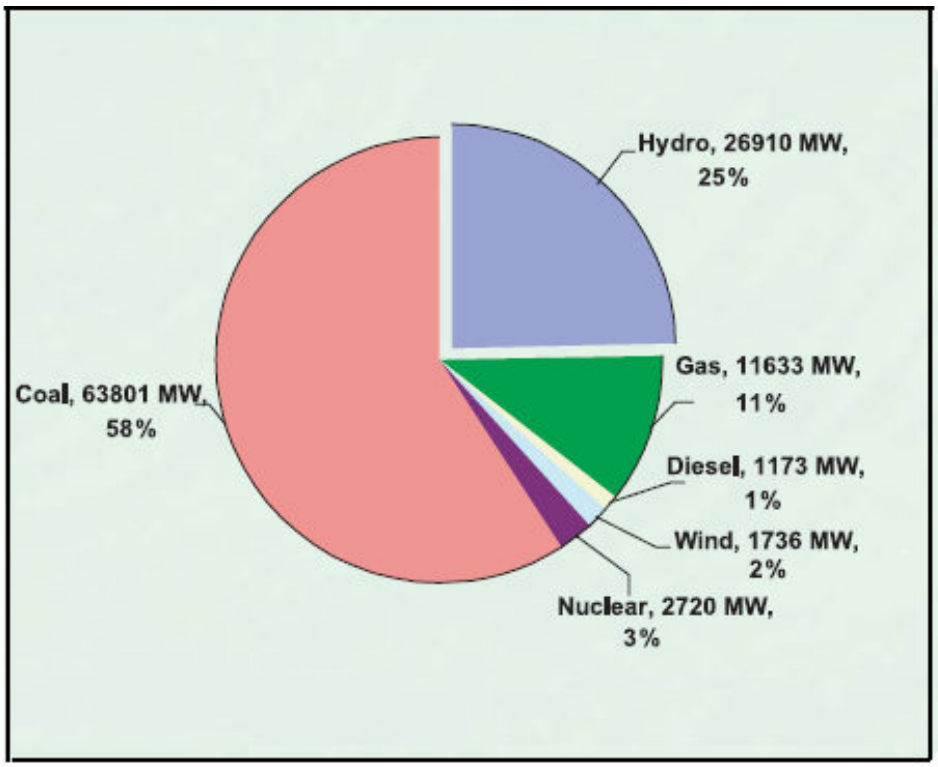


**Fig.1 Shares of different energies in Installed Capacity**

(Source: Central Electricity Authority, Ministry of power, 2006)

 

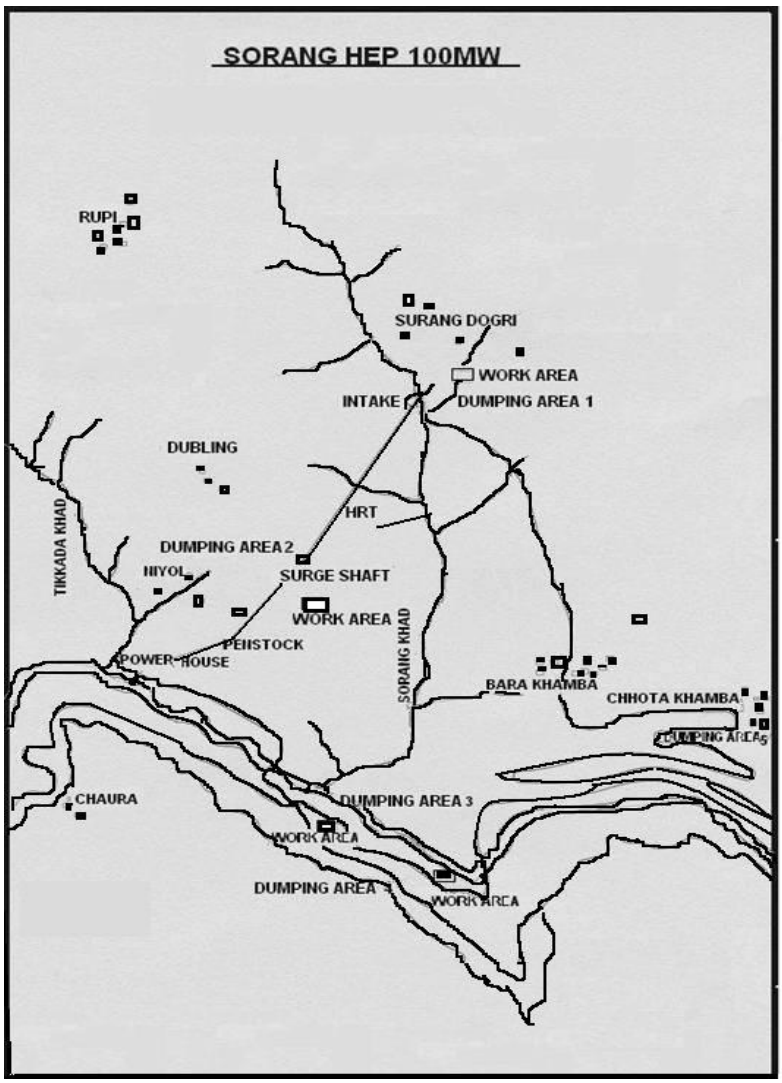


**Fig. 2 Location of the Sorang project components.**

(Source: After CDM-PDD, 2006)

 

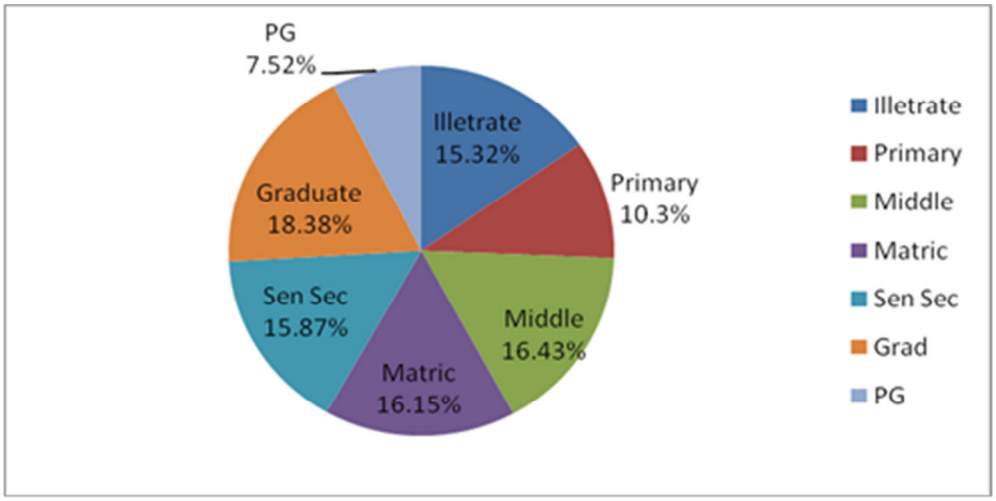


**Fig 3. Educational Status of respondents in the research area**

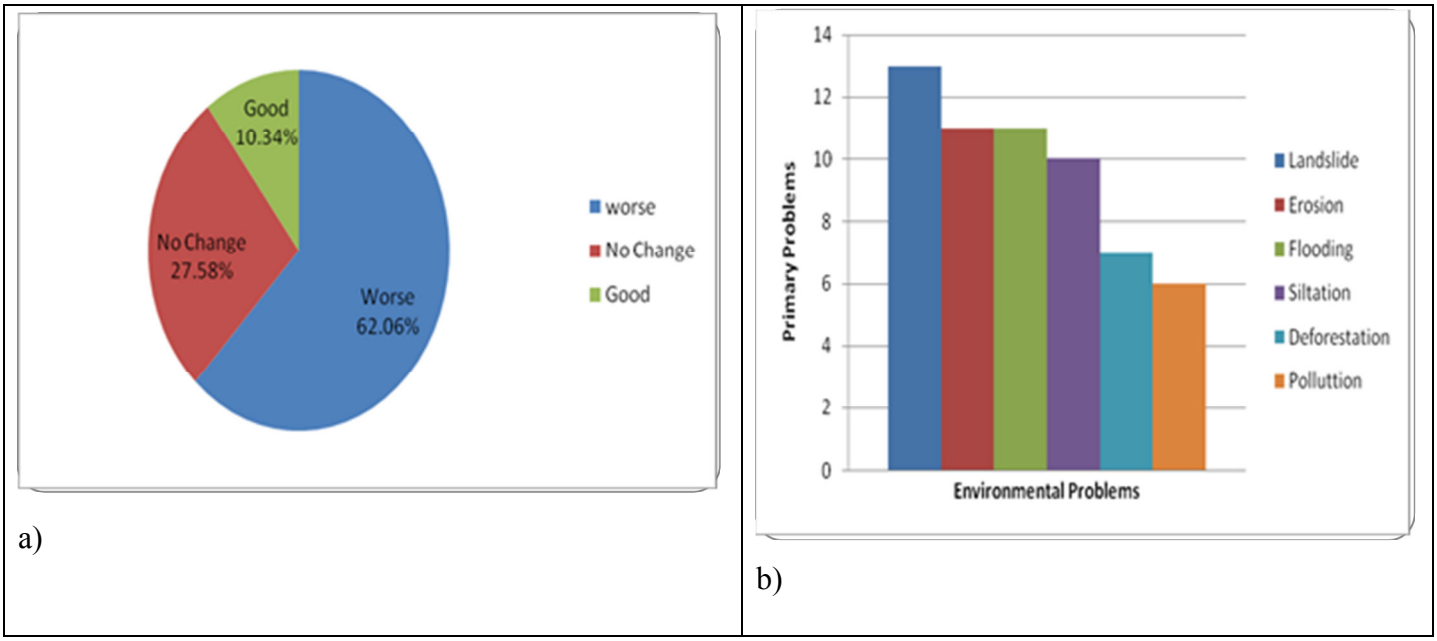


**Fig.4.** a) Shows status of environment after HEP and Fig.4. b) Shows primary Problems related to environment in the research area.

 

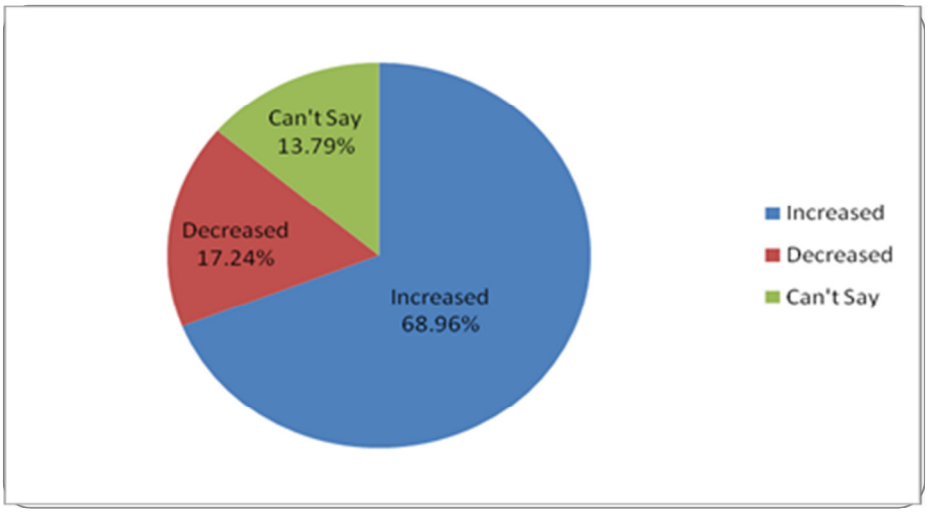


**Fig 5. Shows the rate of deforestation after HEP**

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