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Hydroelectric power project and its impact on livelihood of tribes: A case study of holi tehsil of district Chamba, Himachal Pradesh, India

Pawan K Attri[1], Rupal Sood[2] Diksha kumari[3], Aman Kumar[4]
[1] Faculty, School of Environmental Sciences, Department of Interdisciplinary Studies, Himachal Pradesh University, Shimla, Himachal Pradesh, India
[2] Research Officer, Tribal Research Institute, Tribal Development Department, Shimla, Himachal Pradesh, India
[3, 4] Phd Scholars, Department of Interdisciplinary Studies, Himachal Pradesh University, Shimla, Himachal Pradesh, India

Abstract
The hydroelectric projects in hilly areas have attracted attention concern about social and environmental impacts. The objective of this study is socio economic impact of Bajoli Holi H.E. Project (180MW) in Chamba district. It has affected tribal lives in many ways such as migration of large population, change in land use pattern, loss of agricultural activities, deforestation, damage to water resources and biodiversity. The survey revealed that 57% Respondents as showing resulted as highest percentage of strongly unfavorable reaction about the hydro project in this tribal area as they told they didn't get promised compensation by the project company as well as their family members who got job in this project are now fired without any reason. Whereas 11% people showed favorable response towards this as they think this will develop the conditions of their village in every sector like job, transportation, income sources etc. 94% responded with yes for the great increase in risk of landslides, 89% of population responded as that project construction has destroyed wildlife including both flora and fauna. While 88% of people agreed they have threat of earthquake as well increase in landslides during monsoon.An increase in dust level, air pollution and in noise level due to drilling and blasting. 81-85% people responded there is loss of agricultural land, impact on ground water and destroys of grasslands. Whereas 80% people feel that confliction of migrant workers is also a negative impact. The positive impact in villages was employment generation but most of the jobs that local people worked for were short term, whereas positive impact also seen in the field of roads, health and education. The negative impacts included agricultural loss with poor plant growth and water scarcity due to project development lead to shortage for irrigation as well as drinking purposes. Tree mortality and landslides were common features in most of the villages with vibrations caused by drilling and blasting during construction of reservoir will definitely affect riverine ecosystem and aquatic life. No doubt hydropower projects have made an important contribution to the human but such developments had significant impacts on local livelihood and the environment. The local issues must be taken into consideration. The policies should be framed by accurate examination of local sites so that the proportionate balance between biotic and its components of the environment can be maintained and the potential capacity of rivers can be utilized properly.

Keywords: hydro power, socioeconomic impact, tribes, holi, chamba

Introduction

Hydroelectricity is the creation of electrical power using the gravitational power of falling water as it utilizes the persistent progression of water without winding up the water assets. Hydropower has been viewed as environmentally friendly; as it produces no solid or liquid wastes. Hydroelectric activities offer open doors for framework improvement and monetary development; yet in the event that not all around planned, actualized and worked, they can possibly unfavorably influence the wellbeing and prosperity of neighborhood just as far-off downstream networks. Hydroelectric force venture if not utilized with alerts can create unfriendly effects on fish, untamed life and other normal assets (Erlanger T.E *et al*.2008)[5].

India is blessed with immense amount of hydro-electric potential but the demand for power is growing exponentially in accordance with the high level of developments on both infrastructure and social fronts. According to the 2011 Census India is home of more than 1.2 billion accounting over 17% of the world' shuman population is moving towards unquenchable thirst for energy. As well as it is the fifth largest consumer of energy in the world accounting for 3.7 % of the world's consumption, its total primary energy demand is expected to be almost double by 2030(Kumar & Mohan,2012)[18].

The vast majority of the hydropower capability of India lies in the Himalayan states which should be outfit for human turn of events. Himachal Pradesh has been marked as the" Power State" with a good potential to produce electric energy. Today, pressure isn't simply to make electric power, yet to make electric power with great innovation utilize which is not so much harming but rather more ecologically agreeable. There are likewise inquiries concerning whether the influence created from these activities would assist increment with getting to power for poor people and the weak areas of society, as the area of these undertakings in far off and troublesome landscapes, privatization, and the motivating forces offered will bring about a significant expense for the power produced (Dharmadhikary,

2008)[16]. Himachal Pradesh is extremely rich in hydel resources and the state has about 25% of the national potential in this respect. The main rivers in Himachal Pradesh are Satluj, Yamuna, Beas, Ravi and Chenab. It has been estimated that about 7436 MW of hydel power can be generated in the state by constructing various major, medium, small and mini/micro hydel projects on these five river basins. The basin wise potentials are Satluj (13,332 MW), Beas (5,995 MW), Chenab (4,032 MW), Ravi (3,237MW) and Yamuna (840 MW) (Pamecha & Sethi, 2012)[12]. While the large and medium hydroelectric projects have been in the line of fire for their harmful environmental impacts, the small hydroelectric projects of less than 5 MW capacities seem to have escaped the lens. However, small hydropower plants also influence the microclimate as well as spatial distribution of macro invertebrate of the project site and surrounding area of hydro power projects. More than 400 projects have been allotted and 43 are already commissioned in the Himachal Pradesh (Sharma and Rana, 2014)[8. 15].

For any growing economy, power is a vital input needed to fuel the engine of economic growth and to fulfill the basic needs of the entire population of a country. In Himalayan region the livelihoods are closely linked with eco-systems. The whole world is facinga serious threat from climate change, large parts of fragile Himalayan region are being hande doverto corporations to harness environment conservation. Loss of biodiversity cannot be compensated with hydroelectric potential through power projects, it has show nutter disregard for the economic growth, and such project saime datoverall development of populace, ever remain question able as to the irreal value. The considered project Bajoli Holi H. E. Undertaking (180 MW) is under development by GMR Pvt. Ltd. is one such plan in the state situated in Chamba region that is being created in Ravi stream bowl.An installed capacity of 180 MW has been proposed by harnessing a gross head of about 288.5 m available in a 15 km stretch of river between Bajoli and Barola villages. The proposed project was initially envisaged a right bank of river Ravi with a powerhouse proposed at Barola village but later changed to the left bank.Hydroelectric projects in hilly areas have attracted attention concerning the social and environmental impacts that have arisen from such hydroelectric power projects. Construction and operation of dams have always been associated with changes in the social, physical and biological environment. Some of the negative impacts of hydroelectric projects include loss of vegetations, topographical disturbances, changes in river flow patterns, involuntary resettlement, health problems, loss of cultural values and marginalization of local people. The impacts due to hydropower development, especially of reservoir and dams are always extensive in term of space. It covers upstream, on site, and downstream areas and surrounding of hydropower plants. Generally that all the hydroelectric projects in fragile areas like Chamba district have been given all attention regarding its technical design and economical issues of the project and very least or almost negligible attention on social and environmental factors, which are much more important in context to the remote, tribal culture rich and very high earthquake sensitive zone of this district of Northwest Himalaya.Hydro-electricprojectsinthis ecologically sensitive state, raise serious questions of long term sustainability of the Himalayas as a region of bio-diversity, carbon sink and a region that moderates global climate.

Damage to this complex system and livelihoodsare fundamentally affected causing immense hard ship to in habitants and loss of income to house holds, a large population is replaced, And the original land use pattern, socio-economic systems, agro-socio-forestry systems, and traditional ecological practices lead to an end. Traditional crops of the area, forests, vegetation, and fauna including micro-organisms show sudden disappearance. People displaced from a site adjust to new habitats, where their religion-cultural traditions, socio-economic web and occupation especially agriculture crumbles (Gaur, 2007) [7].

The hydroelectric power project has a greater degree of negative socio-economic impact on the use of water resources, aesthetic values and human health etc. Socio-economic impacts could be positive if the electricity revenues are shared with the local communities, or negative, if local agents absorb the costs associated with hydropower development e.g., road repairs due to heavy truck traffic, loss of productive agricultural and forest land and reduction of fishing resources.

Hydroelectric Projects can cause several problems, even though they burn no fuel. By building dams on rivers may permanently alter river systems and wildlife habitats. Fishes and other river fauna may no longer be able to swim upstream. Also no doubt hydropower projects have made an important contribution to the human lives but such developments had significant impacts on local livelihood and the environment.

The methodology mainly consists the systematic observations, data collection, interpretation and analysis of the samples including one hundred households taken from the 5 panchayats namely as Holi, Kuleth, Deol, Nayagram and Bajol where randomly survey was done from 20 households from each panchayat. It included the affected households with a sample of respondents amongst the academicians, politician, member of non-governmental organizations and social workers for assessing the general problems of the project affected areas and to draw suggestions to address the major problems of the area was also drawn purposively. The primary data for the present study was collected on specifically designed and pre-tested interview schedule through personal survey technique on aspects for socio-economic impacts of the hydroelectric power project had different.

Socio-demographic parameters. The secondary information from different offices, publications, reports etc. were also collected for the area, population, literacy, sex-ratio etc. The time period of six months was adopted for the collection and analysis of data from March 2019 to August 2019.

Bajoli Holi Power Project is in Chamba district of Himachal Pradesh. The Dam site of the project is situated in Bajol village whereas the powerhouse site is located near Barola village, which is about 2 km downstream of Holi. The proposed diversion site is located between Bajoli and Nayagram villages and is about 15 km upstream of Holi, a large village in the area. Most of the study area of Bajoli Holi H.E. Project lies within the Sub-tehsil Holi district Chamba, which covers an area of about 1793.30 sq kms while only the upper catchment falls within total population of Holi sub-tehsil is 14,514 which belong to 3,032 households. The population of Scheduled Castes (SC) and

Scheduled Tribes (ST) is 2,500 and 10,880, respectively. The population in the age group of 0-6 years accounts to be 2,049. The sex ratio in sub-tehsil Holi is 929. Holi tehsil has population density of 13.82 persons/sq km.

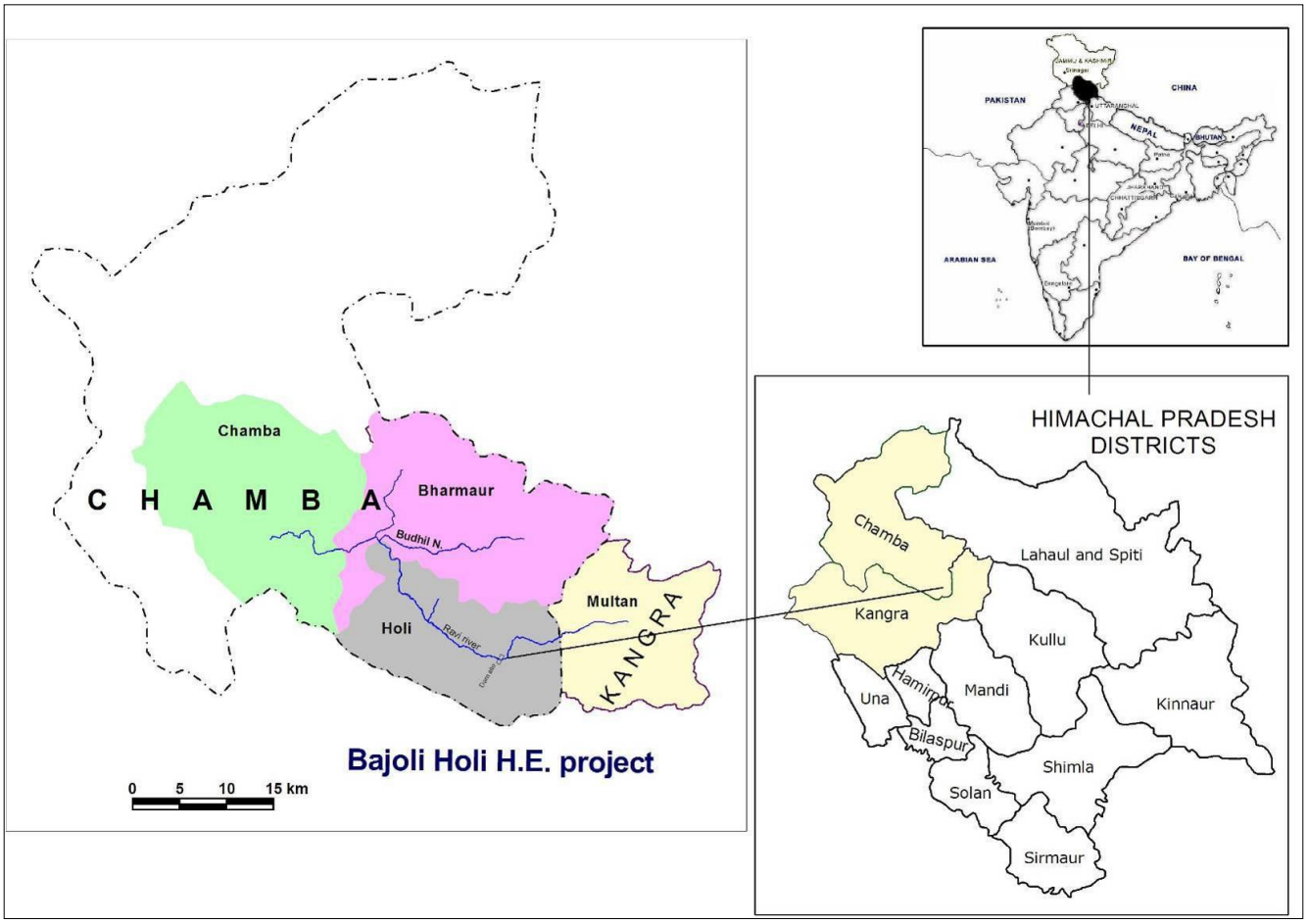

Fig 1: Map of the Study area Bajoli Holi H.E Project.

Result and Discussions

The numbers of households are 1741 and the total human population of these villages is 9278 out of which 927 belong to Scheduled Castes and 8306 belong to Scheduled Tribes; which constitutes the maximum population. The maximum number of households is in Sutkar village under Holi panchayat having the total population of 836 and the least number of households is in Deoshar Village. The number of BPL families in the study area is 545.

The sample of 100 households to study the Population of males and females came out to be with 281 numbers of people as males and 273 numbers of people as females which contributes as 51% and 49% of the entire population of the studied area.

The population of the study area came out to be 554 number of people of the total population where upto 14 year it is 125 number of people with 10% of the entire population between 15-60 years 373 number of people with 67% of the population, above year it is 56 number of people with the 23% of the entire population.

Employment to villagers in hydroelectricity projects diminished the social capital of communities. The out migration of younger people from villages to towns where hydropower project construction sites were located caused social disintegration, leaving villages occupied mainly by the elderly who were unable to undertake agricultural activities and sustain informal networks. This loss of social capital had greater impacts on small- and medium-scale farmers, whereas the few affluent villagers employed wage labor for farming. Many young villagers who had been working for the companies now have little or no knowledge of the traditional agriculture that formed the basis of the village economy before the companies arrived. The majority of those who benefited from employment in companies included smallholder farmers and less-educated youth who were given unskilled jobs, mostly as casual laborers or temporary watchmen at construction sites.More affluent villagers with experience in contract work were able to obtain contracts with hydropower companies for various types of work. Most contractors said they made good profits and that this improved their financial situation. However, some contractors reported good pay rates by companies initially but unsatisfactory rates for later work. Many villagers were also given supply jobs for a variety of items, such as sand and stones, food provision for company canteens, and building materials. Larger contractors and suppliers invested their earnings in assets such as buildings or vehicles, which ensured longer-term returns.

The hydroelectric projects, being large engineering undertakings, also resulted in immigration of workers from

outside to the project townships and into residential colonies around the project sites. This provided opportunities for some local people to engage in business and trade of various kinds.

Most spontaneous response to hydro power project development in this area

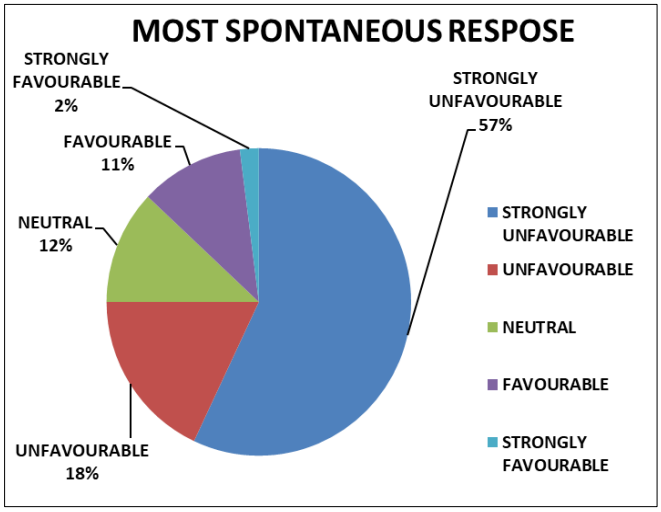

Fig 2: Showing percentage spontaneous response to hydro power project in study area

During the questionnaire regarding the construction of hydro project in their area, the most spontaneous response from the respondents of selected 100 households resulted as highest percentage with 57% as showing strongly unfavorable reaction about the hydro project in this tribal area as they told they didn't get promised compensation by the project company as well as their family members who got job in this project are now fired without any reason. Whereas 11% people showed favorable response towards this because somewhere they think this will develop the conditions of their village in every sector like job, transportation, income sources etc. Few showed neutral response with 12 % because they are confused and they do not know much about it as they generally lack the awareness.

Positive impacts perceived by respondents (%) yes, no, can't say

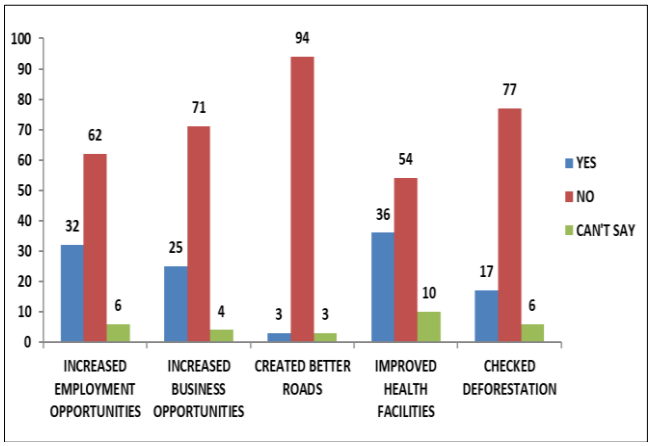

Fig 3: Showing Positive impact response to hydro power project in study area

Positive impacts perceived by respondents regarding the construction of hydro project in their area resulted as 63% respondents do not believe that this project increased any employment opportunities for local people. However, 32% of respondents believe that they got increase in employment opportunities because of this project while 6% people gave can't say response regarding increased employment opportunity out of 100 household.

(Table.7,Fig.11)About the increased business opportunity due to hydropower project the 75% of respondents said no for the increase in business momentum.25% said yes while 4% they can't say.

For the transportation facility they were asked to did they get better roads?? 94 % was disagreed and 3 % agreed and 3% responded as can't say.

To seek improvement in the health status of this area they were asked about the improved health facilities due to this hydro project 54% of people said no,36% said yes and 10% responded as can't say.

It showed that there is no change in transportation facility and health facility status.

Next was about the check of deforestation 77% of the population said no, where as 17% of people responded yes and 6 % of population as can't say.

Negative impacts perceived by respondents (%) yes, no, can't say

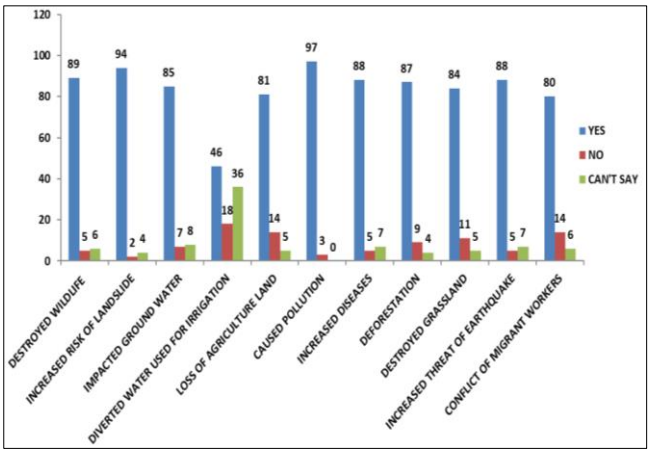

Fig 4: Showing Negative impact response to hydro power project in study area

To know about the negative impacts perceived by the respondent 97% of people responded that yes pollution has increased as the biggest negative impact in the area,94% responded with yes for the great increase in risk of landslides, 89% of population responded as that project construction has destroyed wildlife including both flora and fauna.88% of people said yes that they feel threat of earthquake as well increase in diseases. 81-85% of people responded that yes there is loss of agricultural land,impact on ground water and destroy of grasslands.80% people feel that confliction of migrant workers is also a negative impact. Few percentage of population i.e 4-8% responded as can't say about the negative impacts they are perceiving from the project construction.

The survey reveals that along with loss of agricultural lands, water resources, trees, Gharats (water mills) and other farm buildings, access to common property resources, shops, commercial buildings, businesses and livelihood opportunities would be adversely affected resulting in decrease in household income of the displaced families. The socio cultural impacts that would arise due to the project would include break-up of community cohesion, disintegration of social support systems, disruption of women's economic activities, loss of time, disappearance sacred places of worship and other cultural property.

Impoverishment risks

Present project is likely to create impoverishment risks as part of the socio-economic impact study exercise to identify adverse project impacts. The impoverishment risks analysis model adds substantially to the tools used for explaining, diagnosing, predicting, and planning for development. The most relevant impoverishment risks to the project affected people are as follows:

- **Landlessness**
  The proposed land acquisition will remove the main foundation upon which peoples' agricultural productive systems, commercial activities and livelihoods are constructed.
- **Joblessness**
  Loss of employment and wages may occur and the landless labourers may lose their main sources of income.
- **Homelessness**
  There are houses involved in land acquisition for the project. So, there will be negative impact on this count leading to homeless.
- **Marginalization**
  Marginalization will occur when people lose most of their cultivable land and ultimately their economic power. Middle-income farm households become small landholders. Economic marginalization which takes place due to fall in agricultural production is often accompanied by social and psychological marginalization and manifests itself in a downward mobility in social status.
- **Loss of access to common property**
  Loss of access to commonly owned assets(Forestlands, water bodies, grazing lands, and so on) is often overlooked and uncompensated, particularly for the asset less as they are considered to be providing indirect benefits to the community which could not be quantified. But absence of the same does affect the quality of life of the community. However, during construction activities there will be movement of men, material andequipment having extra load to available infrastructure which would have to be strengthened in advance.
- **Social dislocation**
  Though there is not much of displacement but community dispersal affects structures of social organization and loss of mutual help networks. Although this loss of social capital is harder to quantify, it impoverishes and dis-empowers the affected persons. In the present case, the hydro-electric project will lead to heavy transportation during construction phase which will lead to increase in dust particles in the air and increased noise pollution in the adjoining villages. Residential structures would also be affected due to the proposed construction activity at the site area. A project of this magnitude is likely to entail both positive as well as negative impacts on the socio-cultural fabric of area.

a. Positive Impacts

One of the main reasons for promoting hydroelectric schemes is most importantly their environmentally friendly character. This form of energy, unlike the energy from other conventional sources, entails no discharges of wastes or emission of toxic gases. It is virtually free from pollution and thus can be looked as “technology of the future” for the rural and remote areas. The following positive impacts are anticipated on the socio-economic environment of the local people of villages of project area during the project construction and operation phases: i) A number of marginal activities and jobs would be available to the locals in the project improves the job opportunities during construction phase. ii) Developer bringing large scale investment to the area will also invest in local area development and benefit will be reaped by locals. Education, medical, transportation, road network and other infrastructure will improve. iii) The availability of electricity to the rural areas will reduce the dependence of the locals on alternative energy sources namely forest. iv) With increased availability of electricity, small-scale and cottage industries are likely to come up in the area. v) The proposed project site is well connected by road. Efforts to be made to be develop eco-tourism, which could earn additional revenue.

Negative Impacts

The construction of hydroelectricity projects caused changes in land use, conversion of agricultural lands and forests to roads, tunnels, buildings, or other components of the projects. Agricultural land and Horticultural land (mainly Apple Orchards) in villages that had been affected by construction work for hydroelectricity projects were damaged to various degrees. Participants attributed loss of forests to cutting on mountain slopes, landslides caused by construction on fragile land and dumping of earth on forest vegetation. Also tree mortality due to loss of water from soil related to tunnel construction, landslides were said to be a common feature in most of the villages and people attributed this to the vibration caused by drilling and blasting during construction of tunnels. Farms were covered by mudslides in the monsoon, resulting in destroyed crops no compensation was paid for such ‘‘indirect’’ damage to property.

Water scarcity due to drying of natural water flows was an impact of project development. While most farmers said they faced a shortage of water for irrigation, some mentioned shortages of drinking water. Farmers felt that the need for livestock rearing declined due to reduced farming, and forests and streams were adversely affected by landslides and muck disposal from tunneling and construction work. They experienced poor plant growth due to dust pollution, loss of agricultural land and reduced agricultural production were factors that drove people to change their occupation from farming to non farming employment

Younger and more educated people in particular withdrew from agriculture and took up employment with the companies, because they felt this was a better livelihood option.

The construction of a reservoir will convert the riverine ecosystem into lacustrine ecosystem. The construction of the reservoir would increase the shoreline by many times as compared to the pre-project shoreline of river Ravi under submergence.

An increase in dust levels and air pollution due to construction and excavation, increase in noise levels due to drilling, quarrying, general earthworks, andlorry movement.

The increase in noise levels due to operation of the different construction equipment. However, even a small increase in noise levels in otherwise calm area is annoying especially during nightime.The explosive energy generated during blasting sets up a seismic wave within the surface, which may affect the structures and cause discomfort to human population. When an explosive charge is fired in a hole, stress waves traverse in various directions, causing the rock particles to oscillate. Blasting also generates ground vibrations and instantaneous noise.

The increased pressure will include uncontrolled logging, hunting, and fishing, wildlife and non-timber forest product collection, livestock husbandry, the shifting cultivation in forest areas and forest fires. These impacts are expected during the economic development of the Ravi basin, and are expected to be managed by the basin level catchment area treatment plan, and the proposed Environmental Master Plan for the state.

Conclusion

With today's energy needs, there is no doubt that forms of clean energy are essential for a sustainable future of mankind and the earth's environment. Hydroelectric power is an attractive source of clean energy because of its ability to utilize the natural resource of water in many different ways, not only for energy production. While there are many benefits to hydropower, there are many drawbacks as well. The Bajoli- Holi Hydroelectric power project in holi Tehsil of District Chamba, links together many different effects of a Hydro power project construction, the people affected by the construction of this massive structure continue to live with the first-hand consequences of such a development project. Indigenous groups/tribal peoples are disturbed, local ecosystems are changed, and an entire new social structure needed to be learned and implemented so as to encourage sustainable development in a population unaware of how to integrate into modern, "civilized" society. The scar of the Hydro power project construction will ever be with these people.

Employment generation in the village was an important socioeconomic benefit, but most of the jobs that local people worked on pertained to the construction phase of the projects and thus were short term. These jobs will cease to exist once the construction phase of the projects is over. occupations by doing non farming work in addition to farming, many abandoned agriculture and livestock rearing to take up employment with companies Most degraded lands suffered short-term impacts and could be reclaimed with appropriate technical and financial commitment. It is imperative, for the livelihood security of the villages, to revive agriculture, forests, or both on degraded lands and initiate land-based economic activities on all available lands. The financial and marketing requirements of villagers need to be supported, as was being done by the hydroelectricity companies in some cases under CSR of the company.

Jobs provided by the hydroelectricity companies to villagers have temporarily solved some unemployment problems but do not provide long-term economic security. Hydroelectricity project companies have primary responsibility for reclaiming lands degraded by their construction activities and introducing new enterprises, services, products, and production methods. Further survey research is needed to establish the extent of occurrence of findings of this study within the population.

In general, people welcomed the project as it will bring infrastructural development and progress in the area. The above findings and observations revealed that most of the people are not in favour of the construction of this project. However efforts need to be made by the project developer and the administration that the indigenous people should not suffer but benefit from this developmental project.

Also no doubt hydropower projects have made an important contribution to the human but such developments had significant impacts on local livelihood and the environment. The local issues must be taken into consideration. The policies should be framed by accurate examination of local sites so that the proportionate balance between biotic and its components of the environment can be maintained and the potential capacity of rivers can be utilized properly. Before sanctioning any other power project, the World Commission on Dams recommendations must be taken into consideration, which has stressed four fundamental values regarding the dam building viz., equity, efficiency, participatory decision-making, sustainability and accountability. It is also recommended that a state level interdisciplinary committee on hydro power be constituted with eminent expert like basin planner, botanist, hydrologist, environmentalist, ecologist and socio-economic experts for solving the pre and post issues of local peoples.

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