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Research Paper

A Post Scenario of Hydroelectric Power Development in Kinnaur, Himachal Pradesh, India

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Abstract
Development projects, primarily hydroelectric power projects, are considered viable renewable energy sources and contribute to sustaining the economy at large. However, it has been contested for the excessive exploitation and appropriation of the environment and ecology. Such development models have been challenged worldwide for threatening human survival and degrading ecology and the environment. Hydroelectric development in the geographically fragile regions of the Himalayas is on the rise owing to the great potential of hydro energy in the region. The development of hydroelectric power projects, which have a direct and substantial economic impact on the Himalayan region of Himachal Pradesh, is a fundamental driver of the region's economic progress. Unfortunately, the development and operation of hydroelectric power projects have had a considerable negative effect on the environment and way of life in the area. In particular, there are now more geological risks such as landslides and rock falls. The construction of hydroelectricity projects in Himachal Pradesh is now being opposed throughout the state. Kinnaur residents who have suffered socioeconomic and environmental consequences from existing hydroelectric power projects have united to resist any future hydropower development in the Sutlej Valley. This paper which is based on secondary literature primarily focuses on the significant hydropower projects in the Kinnaur district of Himachal Pradesh, India, which is threatened by extensive hydroelectric power project development activities.

Keywords: *Hydroelectric Power Projects, environment, livelihood, effects,*

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I. INTRODUCTION

Development is a process that results in growth, advancement, positive change, and the inclusion of physical, economic, environmental, social, and demographic components. The goal of development is to raise the population's living standards and overall quality of life, as well as to create or expand local and regional income and job possibilities while protecting the environment's resources (Mehta, 1999). Development projects, especially the construction of dams for energy generation, are considered means that usher the nation to a new dawn of development. Therefore, efforts are being initiated to construct more and more dams on the river basin across the states of India since independence. There is no contest that these dams have yielded positive outcomes of development and contributed to nation-building. However, we cannot bypass the flipside of these dams, which led to the massive displacement of people from their homesteads and pushed them to reel in the pains of deprivation and impoverishment (Thukral, 1992). Construction of run-of-the-river (ROR) projects and large-scale water storage reservoirs/dams alongside the river basins in the Himalayas has been on the rise in recent years owing to the great potential of hydro energy in the region (Kumar and Katoch, 2016). With a wide variety of vegetation and wildlife, the Himalayan region is spread out from the Eastern Himalayas to the Northern Himalayas. Considering its hilly terrain, the Himalayan areas have an abundance of natural water resources that enable flora and fauna to thrive. Himachal Pradesh has enormous potential for hydropower generation because of its numerous glaciers and frozen lakes, as well as snow-fed rivers like Chenab, Ravi, Sutlej, Yamuna, and Beas (Balokhra, 2015). Tribal areas in Himachal Pradesh, such as Kinnaur, Lahaul-Spiti, Pangi, and the Bharmaur area of Chamba district, have a great hydropower potential; nonetheless, the development of hydroelectric projects in these areas significantly impacted the livelihood of those project-affected people, particularly the tribal group. (Baker, 2014).). In order to satisfy the energy need, hydropower generating is a crucial step. Many people are interested in hydropower since it is a never-ending source of energy and a cheap way to bring electricity to isolated locations in high terrain. Large dams have served as an

indivisible unit in India's impressive power development efforts since independence. Himachal Pradesh has been classified as a "Power State," signifying that it has a significant capacity for electricity generation. In addition to producing electric power, there is pressure to do it in a sustainable and less damaging manner by using good technology. Due to the negative social and environmental effects of such development, hydropower projects all over the world have attracted a lot of attention nowadays. Dam operation and building have long been associated with environmental changes in both the physical and biological realms. Large-scale dams in India have been connected to many of the same social and environmental problems that have been documented elsewhere, despite the fact that hydropower development offers economic and social benefits (Khagram, 2004).

Salariya (2015) titled "Development for Whom?" "A Socio-Psychological Perspective"analyzes the hardships experienced as a result of the development of the Chamera-I power project, which is controlled by NHPC. People Affected (PAP) and Not Project Affected People (Not-PAP), two broad categories, can be used to categorize the impact. PAPs are the ones who are currently dying every second, every hour, and every day as a result of the negative repercussions of this developing activity. Every scientific investigation's main objective is to find problems with already-passed laws. The PAP category should include those who live close to development projects, even if they are barely one meter or even less from the designated line. People who have been displaced must receive benefits, and they should participate in the rehabilitation process because they were not included in the developmental process. A benefit-sharing participatory paradigm that supports those in the middle is needed to address this problem.

Kumar and Katoch (2016) in their study "Environmental sustainability of run of the river hydropower projects: A study from western Himalayan region of India" examines how the public perceives and gathers information on the environmental effects of both small and major run of river (ROR) hydropower projects in India's western Himalayan region. The primary and secondary data reported in this study imply that none of SHPs' environmental effects are "small" in comparison to those of large hydroelectric power projects (LHPs). Regarding small hydroelectric power projects (SHPs') effects on aquatic life, water pollution, the frequency of landslides, and the volume of water in neighboring natural water sources, the general public was in favor of them. SHPs produce more muck in terms of observable environmental indicators, but they are more sustainable when considering the length of the water flow diverted and the required land area. Given the potential negative effects of SHPs in the Himalayan region, it is suggested that the current 25 mega watt (MW) environmental impact assessment (EIA) criterion for hydropower development be lowered to 5 MW. The main environmental issues raised by project-affected individuals throughout the construction phase were air pollution, water pollution, noise pollution, and land degradation brought on by unscientific muck dumping. Native people are more knowledgeable about their own environmental sectors. If the people are included in the decision-making process and made aware of their rights, it is possible to mitigate these effects to a great extent. Additionally, it's critical to make sure that environmental effects don't outpace nature's ability for renewal.

Lata et al. (2017) conducted a study of "Environmental and Social Impact Assessment: A Study of Hydroelectric Power Projects in Satluj Basin in District Kinnaur, Himachal Pradesh, India". The study's findings showed that there were little possibilities for genuine public involvement in the creation and evaluation of the hydroelectric power projects (HEPs), and that indigenous were marginalized by executing agencies and the state/central government. HEPs had benefits including better roads, fewer deforestation incidents, improved healthcare facilities, and less reliance on alternative energy sources. The fall of the joint family system, homelessness, property damage, building cracks, socioeconomic inequities, problems with law and order, social disintegration, and deprivation of the right to natural resources were some of the negative effects. To strengthen these projects in an environmentally responsible way, preventive steps to limit the negative effects have been suggested.

Kumari (2022) in her study titled "socio-economic study of Baspa-2 hydel project in Kinnaur distict Himachal Pradesh" revealed that hydroelectric power plants have had a variety of effects on people's lives. These include things like altered socio-cultural norms, altered customs and traditions, a collapse in the joint family structure, a disappearance of the commercial horticulture and agricultural systems, a loss of means of subsistence, etc. Local residents' concerns must be taken into consideration at every level of development, and politicians must adopt a strategy to maximize beneficial outcomes while limiting negative environmental, social, and economic effects.

HYDROELECTRIC POWER PROJECTS IN KINNAUR

Kinnaur is located in Himachal Pradesh's northeastern corner. In accordance with the Fifth Schedule of the Indian Constitution, the area has been designated as a scheduled area. It is a mountainous, hilly environment with a diverse range of wildlife. Pooh, Kalpa, and Nichhar are the three sub-divisions that make up Kinnaur. The five tehsils are Nichar, Kapla, Sangla, Pooh, and Moorang, and there is also one sub-tehsil called Hangrang. Near Shipki La, which is located in Kinnaur, the river Sutlej enters India from Tibet (Bajapi, 1991). The river is noted as having enormous hydroelectric power potential. One of the most practical forms of clean, renewable

energy is hydroelectricity. The majority of these initiatives are ROR initiatives in the Sutlej river basin or its tributaries. The region is home to a large number of small- and medium-sized hydroelectric plants, ranging in size from 9 MW to 1,000 MW. Some of these projects have been constructed, while others are still in the planning stages. The construction company is being accused of invading the indigenous people's private property (Balokhra, 2015). Due to the large concentration of harmful development brought on by hydroelectric power projects, this area was chosen. The list below includes some of the largest hydroelectric power projects ever built.

Table 1 Hydroelectric Power Project in Kinnaur district of Himachal Pradesh.

Sr.no	Hydroelectric power Projects	Status	Potential (MW)	River /khad
1	Nathpa–Jakhri HEP	C	1500	Satluj River
2	Karcham–Wangtu HEP	C	1000	Satluj River
3	Sanjay Bhaba HEP	C	120	Bhaba River
4	Baspa -2 HEP	C	300	Baspa River
5	Sorang HEP	C	150	Sorang Khad
6	Tidong -1 HEP	C	150	Tidong Khad
7	Kashang-1 HEP	C	65	Keshang Khad

C = constructed

(Balokhra, 2015)

Post scenario of hydroelectric power development in Kinnaur

❖ Since the beginning of time, tribal cultures have been deeply influenced by the land, the forest, and the environment. The inhabitants of Kinnaur, like many other tribal communities throughout India, rely on the land and forest for their sustenance and way of life. Since most of the area in the Kinnaur region is categorized as forest, the main issue with the expansion of hydroelectric projects in the state is the diverting of land along river basins. Although land and forests form the foundation of the tribal people's income and way of life, they also play a significant role in tribal culture. From the forest, they gather food, fuel, and fodder. The forest was essential to the Kinnaur tribal community's ability to survive and provide for its members. They build their home out of forest wood and gather it for cooking and heating during the winter. The Kinnaur tribe's issues could become even worse as a result of the forest being diverted. The Kinnaur tribe has maintained an enduring symbiotic interaction with nature and the environment from the beginning of time. They have unalienable customary rights to the land and its forests. The environment and nature have a significant role in how the Kinnaur people live their lives. The environment and nature are the focus of numerous regional fairs and festivals. The Kinnaur people's methods of life place reverence on mountains, springs, lakes, and vegetation. Since the beginning of time, they have been the native guardians of the natural world and the environment.

❖ The ecosystem and ecology are frequently disturbed when the Himalayas are extracted through digging and heavy blasting (Lata and Shashni, 2021). Environmental and ecological disturbance is frequently the result of the exploitation of the Himalaya by tunneling and heavy blasting. Destruction of the forest and landslides are the immediate results of such disruption. Landslides are increasingly a common occurrence in the area. Many locals in the area lose their means of livelihood as a result of the landslides, which frequently erode the fertile ground. Destruction of the forest and landslides are the immediate results of such disruption. Landslides are increasingly a common occurrence in the area. Many locals in the area lose their means of livelihood due to the landslides' frequent erosion of the fertile soil (Asher, 2015). According to the locals, the district is experiencing an upsurge in landslides as a result of the increased building of hydropower facilities in the area. The people of Kinnaur have experienced such large landslides in the past ten years, which at various points have resulted in the

loss of land, forest area, and most importantly means of communication. Due to the geological fragility of the mountains, landslides frequently occur in the Himalayan region. There is a big possibility that the tunneling and blasting will trigger landslides nearby. Back in 2021, two sizable landslides that killed more than 30 people both locals and tourists made national headlines. Studies (Bodh, 2016; Kumari, 2022; Lata and Shashni, 2021; Negi and EP, 2022) have found a drinking water crisis, the disappearance of springs, deforestation, increased landslides and loss of biodiversity due to hydroelectric projects in Kinnaur Himachal Pradesh.

❖ The local economy is entirely reliant on apple cultivation and other agricultural pursuits. Kinnaur is known for its apple production. In addition to having apple orchards, Kinnaur is also well-known for its naturally occurring Chilgoza trees (Pinus gerardiana), which are extremely uncommon and are only found in the Himalayan regions of Afghanistan, Pakistan, and India. In India, Chilgoza trees are only naturally produced in Kinnaur. In addition to apple cultivation, it provides many inhabitants in the area with a sustainable source of income (Asher & Bhandari, 2020). The rare Chilgoza species, which grows naturally in the area, has been seriously threatened by the loss of land and forest due to ROR operations and the construction of reservoirs by large-scale water impoundment. As a result, it affects many local populations' sources of income and subsistence (Negi & EP, 2022).Numerous studies have shown that the high Himalayas' hydropower development and compensatory reforestation of the forest ecosystem have negatively harmed the region's biodiversity and interfered with local land use. Due to hydropower developments, Chilgoza, an important component of the local ecology, is in danger of being extinct. Locals have claimed that their commercial horticulture and agricultural systems have been lost as a result of project building. The primary source of income in these communities is commercial horticulture focused on apple orchards and the planting of seasonal cash crops like peas, potatoes, and rajma. Construction activities for hydroelectric power plants have impacted the surrounding climate, having various degrees of impact on commercial horticulture and agriculture. The vast majority of respondents claimed that the construction of dams had reduced crop productivity.

❖ According to the Seismic Zoning Map of India, the state is located in the extremely seismically sensitive zones (zones IV and V).Twenty earthquakes with magnitudes greater than 5 have been reported from the Satluj valley throughout the course of the previous 50 years. The Kinnaur district also falls under seismic zone 4, which is highly vulnerable to earthquakes (Lata and Shashni, 2021). Excessive blasting and tunneling for the construction of high gravity dams and underground tunnels for the diversion of the river may trigger earthquake situation in Kinnaur.

❖ Dams' social, cultural, and economic consequences on people are collectively referred to as their socio-economic effects. It can range from detrimental effects on living circumstances and physical health to population displacement. The forced or inadvertent uprooting of the human population from their homes, farms, towns, and regions is the most significant adverse effect of dams. The experiences with rehabilitation show the implementation method' flaws (Cernea, 2000). The most impending threat to the locals is mass relocation and displacement, often associated with constructing large-scale dams and reservoirs across the country (Thukral, 1992). The people of Kinnaur are also bearing the brunt of the development, wherein people of some villages are now being displaced to higher slope areas of the same village as the threat of landslides.

❖ Along with the social and environmental costs of building such massive hydropower projects, there is also a violation of the constitutional rights of the local tribal population (Asher and Bhandari, 2020). Greater enforcement is provided by the Panchayats (Extension to Scheduled Areas) Act (PESA) 1996, which requires that all such projects obtain a "no-objection certificate" from the relevant panchayats. However, according to the local gram panchayat members in the project-affected districts, no such certificate has yet been provided. Protests by the populace are prevalent in Kinnaur. The protests of the local population are directed not only at the hydroelectric development in the area, but also at the public and private institutions operating there that willfully violate the rights of tribal people as outlined in the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) (FRA) Act of 2006 and the provisions of the Panchayats (Extension to Scheduled Areas) (PESA) Act of 1996. The involvement and knowledge that the Kinnaur youngsters generated in order to express their concerns and oppose hydroelectric development in the area have now become the region's unifying voice. People are frequently made aware of the approaching threat of such developments through the usage of social media. Social media movements including #SaveKinnaur, #SaveNature, #SaveSatluj, and #NoMeansNo have become extremely popular.

II. CONCLUSION

The study area has witnessed a lot of developmental changes in the last 3 decades. Hydroelectric power project construction is one of the major developmental activities which are responsible for destruction in the area. The large-scale construction of hydroelectric power projects in the Sutlej River basin and its tributaries is a significant threat to the life and livelihood of people. However, it has posed irreparable loss to the ecology and environment of the geographically fragile region of Kinnaur. The disappearance of springs, change in land usage, biodiversity loss and submergence of land and forest owing to the proliferation of hydroelectric projects in the region are matters of great concern for the people of Kinnaur. The impending threat of possible disaster, mass displacement, loss of livelihood sources and loss of cultural identity haunt the people of project-affected areas. There is a need for sustainable development to reduce the climatic variability and vulnerability in the study area. Therefore, local issues must be taken into consideration properly and with true spirit. The role of Gram Sabha (Village Council) is to be further integrated and strengthened.

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