

## **Water conflicts and benefits related to hydropower projects: A case study from Sikkim**

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### **Background**

The Sikkim Himalaya has unique and diverse ecosystems with rich socio-cultural and biodiversity values associated with it. The region is a repository of unique and globally significant biodiversity and also provides an ideal habitat for the survival of humans and wildlife (TMI India 2010). Of the total geographical area (7096 sq.km), almost about 82.31% is under administrative control of the Forest, Environment and Wildlife Management Department of the Government of Sikkim. The forest cover in the state consistently increased in the last two decades to about 47% (3359 sq kms) in 2011, while far less than 12% of land was available for cultivation until 2012. Agrobiodiversity is equally rich in the human managed traditional agricultural systems (250–4300m) of Sikkim which is attributed to diversity agroclimatic zones along the rising altitudes. Sikkim Himalaya houses around 40% of the biodiversity wealth that occurs in the Indian Subcontinent (Sharma and Dhakal 2011; Acharya and Sharma 2013). Within the wider Greater- and Trans-Himalayan Range, Sikkim is bestowed with the snow and glacier fed rivers originating in the upper catchments of Teesta and Rangit which show enormous potential for hydropower generation.

Apart from the Government of Sikkim's policy to promote ecotourism as an industry in the state, hydropower sector is one of the potential areas for generating revenue to enhance the socio-economic condition of the people. Hydropower is considered as the green power available to mankind and the Government of Sikkim's policy has been to synchronize development imperatives with conscious efforts on environment sustainability (EPD 2010). With the opening of this sector for private developers, Sikkim has looked forward for developing and exploiting its huge hydropower potential which has been assessed to 8000 MW at peak season with a firm base of 3000 MW. The total hydropower potential in the state so far is 5352.7 MW and they are in different stages of implementation ([http://www.sikkimpower.org/power/about\\_us.aspx](http://www.sikkimpower.org/power/about_us.aspx)).

The water resources of Sikkim contribute to the welfare and the prosperity of the upstream and downstream dwellers by contributing to integrated agriculture, ecotourism, energy development, fisheries, river rafting and other small industries. Detailed information on the impact of hydropower projects on the fragile environment, biodiversity and livelihood, culture and customary institutions of the communities is not available. At several locations, hydropower projects have created conflicts and discontent among the local and indigenous communities in Sikkim and along the Teesta River in West Bengal. This case study highlights the conflicts, community-culture-development nexus and the growing issues raised by hydropower projects in the Rangpo-Dikchu stretch in Sikkim.

### **Hydropower projects in Sikkim**

The North-Eastern Region has been identified as India's powerhouse and at least 156 large hydroelectric power projects with a total installed capacity of 46,857 MW are proposed and allotted to power developers (private and public agencies) which are under different stages of

construction in the region (Ministry of DONER <http://www.mdoner.gov.in/content/hydro-power-projects#Mar12>). It is important to note that Sikkim and Arunachal Pradesh in North-East India stand in a strategic location where these hydropower projects have been proposed and initiated over the years.



**Power Project under construction at the Teesta River at Chungthang, North Sikkim**



**A sick power project of LANCO near Singtam, East Sikkim**

Sikkim, one of the states in the North-Eastern Region, has allotted around 25 hydropower projects for construction with a calculated installed capacity of 5284 MW mainly capitalizing the water of River Teesta and Rangit and their tributaries (Ministry of DONER <http://www.mdoner.gov.in/content/hydro-power-projects#Mar12>). Since the last decade (2001- ...), the Government of Sikkim invited hydropower developers to harness the river waters to fulfil the energy demand of the state as well as to bring economic prosperity. Besides the large hydropower projects, the Government of Sikkim has developed a policy to harness energy from available water in the form of micro, mini and small hydropower projects with the total installed capacity of 278 MW. The revenue expected to be generated from the power sector by 2015 comes to the tune of Rs.1500 crore per annum (EPD, 2010).

As many as six power projects have been envisioned in the River Teesta supported by multiple high level dams built within 175 km distance with an estimated generation capacity of 3635 MW (Lepcha 2013), while Teesta Low Dam (III and IV) in Darjeeling District of West Bengal before the Coronation Bridge are near completion. Of the six planned in Sikkim, the Teesta Stage V NHPC hydropower project was commissioned in 2008 that is expected to generate 510 MW during peak season. The main issue related to the utilization of hydropower provided by different power developers (13%) to the state government is the cost of transmission of power to the eastern grid due to higher transmission costs that is expected to increase the tariff substantially.

### **Study sites and methodology**

The study sites are located in the project affected areas extending from Dikchu (27°23'66" N and 88°33'94" E) in the upstream to Rangpo (27°10'25" N and 88°32'01" E) in the downstream covering a distance of about 54 kms. The representative sampling sites viz., Tumin, Dikchu, Singbel, Ralap, Makha, Lingee, Lower Lingmoo and Lower Khamdong are located in the upstream (area lying above Dipu Dara NHPC Stage V Power House) and Rashyap, Sirwani, Manpari Busty, Lower Tokal-Bermoik, Namphing, Singtam, Mazitar, Mining and Rangphu are located in the downstream (areas lying below the NHPC Stage V Power House) (Fig.1). A total of 1256 MW of energy is expected to be generated after the commission of the project by the power developers (Table 1).

This study was carried out to assess the conflicts between different stakeholders and the social undercurrents around hydropower projects of East and South Sikkim. It was based on extensive field visits, focus group discussions, telephonic and face-to-face interviews with key informants and officials, and rapid interactions with locals and other stakeholders in and around the project area, followed by secondary literature review, media reports, etc.

This study was planned to identify the benefit sharing mechanism developed for providing incentives to the project affected populations taking into account the upstream and downstream communities. The target population for the survey included various stakeholders of the upstream and downstream areas, institutions of power developers and local institutions within Rongpo-Dikchu stretch along the Teesta River.

Table 1. Project institutions directly involved in the utilization of river waters in East Sikkim.

| <b>Project Institution</b>                                 | <b>Address of the Institution</b> | <b>Project Sites / river utilized</b>                |
|--|-----------------------------------|--|
| NHPC* (510 MW)   | Balutar, Singtam                  | Dikchu, Dipudara, Balutar, Makha, Ralap, etc.-Teesta |
| LANCO<br>(4x125=500 MW)                                    | Reshyap, near Sirwani             | Reshyap –Teesta                                      |
| Sneha Kinetics (3x36=92MW)                                 | Dikchu                            | Dikchu –Teesta                                       |
| Madhya Bharat Power Corporation Ltd. (2x48=96MW MW)        | Ranipool-Singtam                  | Ranipool-Rongni Chu                                  |
| Gati Infrastructure Ltd.<br>(Chujachen 99MW, Bhasmey 51MW) | Chujachen, Bhasmey                | Rolep-Chujachen-Rongli tar, Namli-Pendam-Bhasmey     |

\*NHPC Stage V was commissioned in 2008



**Participatory consultation workshop at Singtam on Hydropower issues and impacts**



**Field survey and interview with affected households**

Representative sample households were selected on random basis to identify the affected households, benefits being provided by the power developers, change in the living standard of people, agricultural yield, land price before and after the implementation of the project, and so on. The survey also covered the hydropower project institutions, local community-based institutions and panchayats located around the project affected areas.

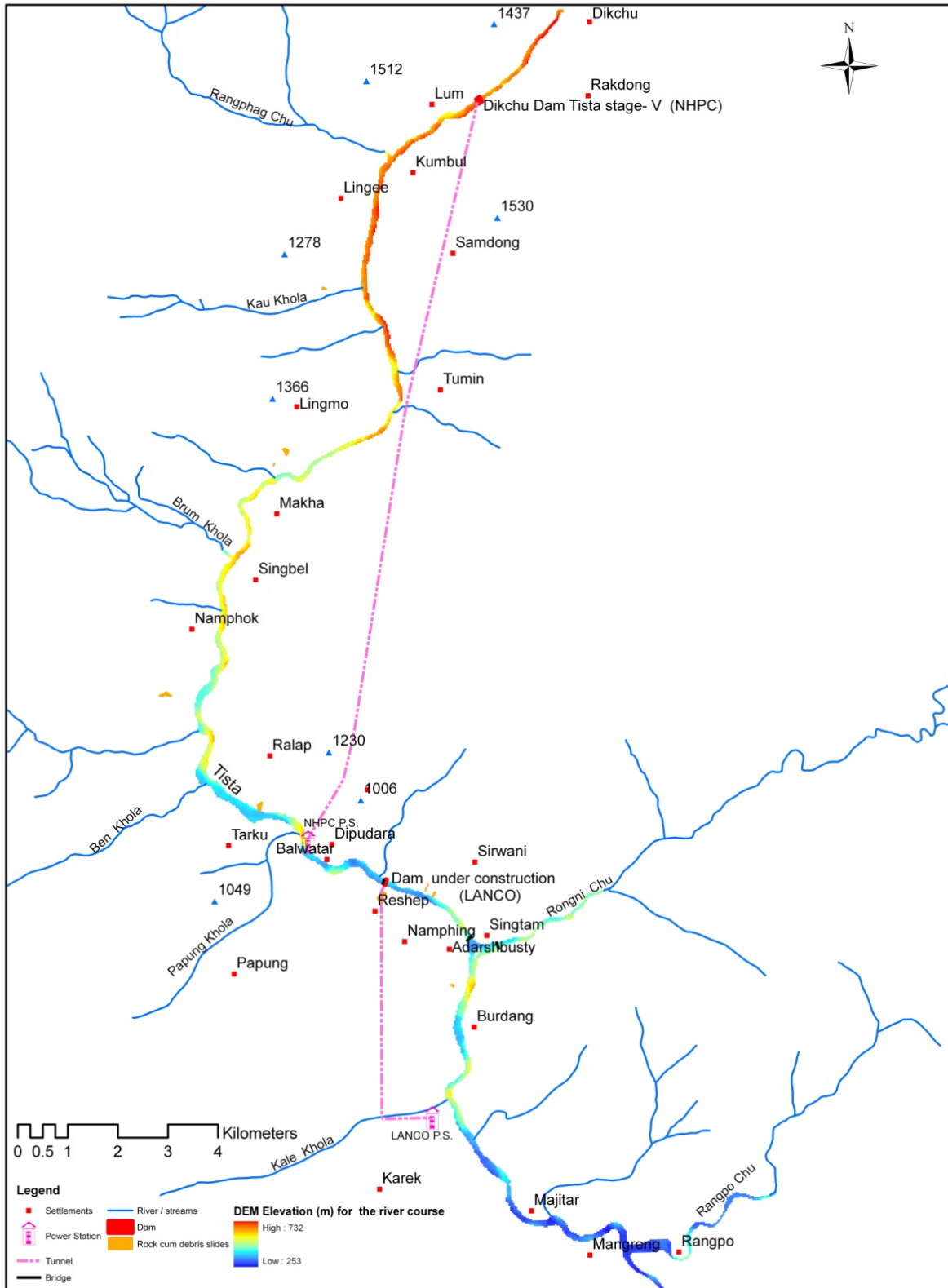


Figure 1. Teesta and its tributaries along the Rangphu-Dikchu stretch of the study area.

## **Impacts, conflicts and environmental sustainability**

The majority of respondents (90%) expressed that environment damage, dam construction and flooding, irregular water release through the Dikchu dam, drying up and disappearance of water resources particularly, rural springs and streams, heavy tunnelling work, landslides and soil erosion, flash floods during monsoon are the major prevailing issues that are associated to hydropower projects. While, 60% downstream respondents revealed that sand quarrying business has been hampered due to non availability of sand owing to irregular river flow. As a consequence livelihoods of many families (wage labours in quarries in the river banks), truck drivers, fishermen have been severely affected. Majority of the upstream and downstream stakeholders are hardliners against the dam-based projects of which 95% expressed that no dams should have been built. While 70% said that no project is acceptable which cause even a negligible negative impact. Almost all the respondents from institutions, and upstream and downstream communities expressed that their participation in decision making process of NHPC Stage V was completely nil during project construction phase as well as after commissioning in 2008. Local residents along the Teesta River observed that river water flow occasionally become bare minimal and even children cross the river.

The other issues that came out from the stakeholders consultation were temperature rise (reason cited was less wind blowing due to low volume of water), lack of protection measures (wall) in reservoir area and along the river belt and human inhabited area such as Manpari Busty in Singtam, landslides and flash floods, decline in agricultural productivity in the river belts, deteriorating quality of forests and biodiversity, conflicts between the power developers/government and the communities over land acquisition and for employment. It was evident from the survey that most of the local institutions (NGOs/CBOs/Panchayats) were not satisfied with the institutional arrangements/role for the selection and implementation of activities at the local level.



**Dying Teesta during January**



**Flooding Teesta during July-August**

## **Impact of head race tunnels, and conflicting issues of drying water sources**

It is widely evident that none of the power projects that are constructed in the mountain areas in the North-East India are based on the geo-hydrological assessment. The Himalayan mountain systems are fragile, geologically sensitive, and vulnerable to landslides. The Environment Impact Assessment reports as of now are not prepared strictly based on scientific methodologies using latest tools and techniques.

Our focused group discussions, interviews with local inhabitants of the hydropower project sites and careful field observation revealed that rivulets, streams, springs, and water seepages are rapidly disappearing in rural areas causing acute shortage of drinking and irrigation water. Indigenous communities also argued that use of dynamites in road construction and in underground tunneling by hydropower projects are the primary causes that develop cracks in aquifers resulting into water loss. Similarly, it is widely observed that cementation work has a terrible impact on springs which alters their occurrence and reduces their discharge or flow. In such events, inadequate amount of water percolates down into the aquifers, preventing the spring's recharge during the monsoon season and causing it to essentially run out of water during the dry season.

Landslides along the mountain slopes and in the spring catchments (mostly hydro power project-induced) at/near the spring discharge points are the causes of drying up of springs in Rangpo-Dikchu stretch. Major hydropower project construction activities have utterly retarded the percolation of rainwater into the underground aquifers.



**Springs are drying rapidly at all the locations of the hydropower project sites across the state due to high intensity explosions in the tunnels, road construction etc.**

About 80% of the respondents from Singbel, Dikchu, Samdong, Dipudara, Sirwani, Dochum, Namgeything, Namphing, Burdang, Mazitar Jholungey and Rangphu expressed that more than 60 local water sources particularly rural springs/streams have disappeared completely in the last 10 years due to heavy tunnelling, high intensity explosions in the tunnels, landslides, etc. The locals perceived that ground water is being lost due to leakage from the tunnels (e.g. tunnels in Dipu Dara stretch and Rashyp, Jholungey). More than 80% respondents reiterated that the water sources have decreased both in terms of discharge and quantity due to land degradation, especially in the recharge areas and catchments. The dams constructed along the River Teesta and Rangit have blocked the natural river water and reduced downstream river levels, thus reducing the amount of water in the downstream ecosystem and impeding the passage of nutrients and silt, sand and fish and other aquatic organisms.

### **Impact on human health**

The increasing impact on human health especially reverberated by the incidence of new diseases has threatened the mountain areas in the recent years. Cases of dengue fever, malaria, and HIV-AIDS have become common in Sikkim as the District Medical Officer Singtam at the District Hospital acknowledged. On September 2, 2013, six persons were tested positive for Dengue at Rangpo Primary Health Centre. Seven cases of Dengue had earlier reported to be infected at the Singtam-Rangpo area (Sikkim Express September 3, 2013). Our personal interviews with the health officials have revealed that cases of new diseases are appearing due to heavy immigration of population from the plains over the recent years into Sikkim for employment in hydropower projects.

Regarding the water quality and health condition of the local communities, 77% of the respondents acknowledged that human health is deteriorating due to the increase in pollution and contamination of the water sources. Almost all the respondents of the upstream and downstream communities reported that there is serious decline both in the number and volume (average annual flow) of water resources such as springs, rivulets and streams by 35-40% as a consequence of various project related activities.

### **Unequal employment opportunities**

Of the total upstream and downstream respondents surveyed, about 29% have observed that no employment opportunities have been provided to the local people in the power projects. About 71% of the respondents have said that opportunities mostly in the form of paid labourers, small contracts and contractual jobs have increased. In addition, they also revealed that job opportunities on regular basis are negligible. Only the affected households of the NHPC that had given away their land have been given regular employment, especially on clerical positions; other private power developers have not given employment to the affected households in their companies.

Almost all the respondents repeatedly stressed that there is lack of employment opportunities for the local people in the hydropower project institutions, especially the private sector companies. Even if the locals are employed, they are employed on contractual basis in clerical posts and as casual labour. Furthermore, the local institutions indicated that construction works of the power developers are mostly allocated to the non-local contractors.

### **Increasing disasters and hazards from hydro power projects**

The hazards (landslides, soil erosion and flash floods) after the construction activities (road construction, dam construction, etc) have resulted into economic loss, damage to the houses and agricultural land, etc. of the communities in the project areas. This situation is also reported from the Dzongu area in North Sikkim where a few hydropower projects are under construction (Lepcha 2013).

Out of the total respondents surveyed, 35% revealed that the incidence of the number of landslides and soil erosion has increased dramatically. While, 30% of the respondents were of the opinion that the frequency of flash floods have increased owing to frequent release of water from the Dikchu dam during monsoon.

We observed that there is a great fear of unavoidable natural calamities such as landslides and earthquakes. Sikkim has been classified as geologically fragile and is part of seismic Zone V prone to high magnitude earthquakes. This was proved by the 18 September 2011 earthquake

(6.9 Richter scale) that caused great damage to the fragile landscapes killing more than hundred lives. The earthquake induced destructive landslides that swept away villages in Dzongu and other areas, was recorded in the hydropower project sites than in other areas.

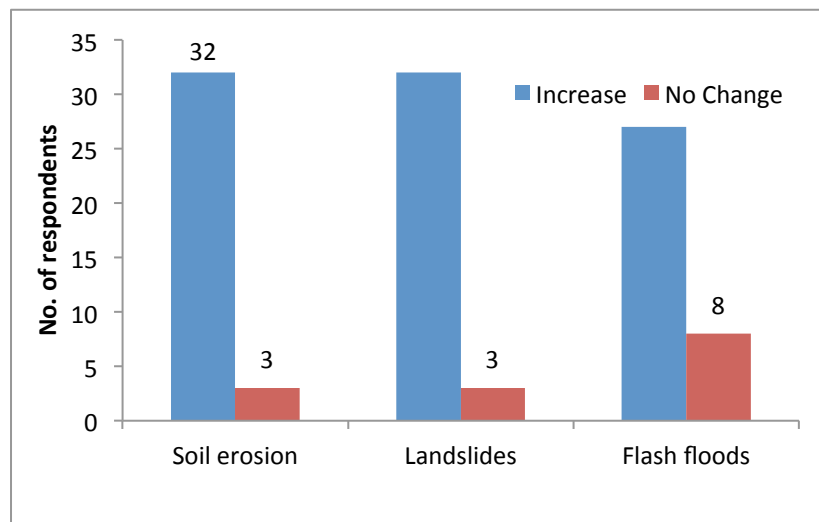
The North-East Region lies at the junction of the Himalayan arc to the north and the Burmese arc to the east and is one of the six most seismically active regions of the world. In the last 100 years as many as 18 large earthquakes have been recorded from this seismotectonic domain, two of which – in 1897 and 1950 – were among the most powerful recorded globally (Rao 2006).



**Roaring and flooding River Teesta at Singtam Bazar, East Sikkim**



**Roaring and flooding River Teesta at the foot of Manpari Busty, South Sikkim near Singtam Bazar**



**Figure 2. Respondent's perception on impact of project activities.**

### **Increasing impacts of traffic pollution, accidents and deaths**

Most of the respondents (95%) are of the opinion that the negative impacts of projects are increasing in the form of pollution, accidents and death incidences in and around the project areas. Of the total upstream and downstream respondents surveyed, 97% of the respondents acknowledged that traffic congestion has increased due to influx of people and movements of light and also due to large size vehicles carrying heavy machineries in the projects/construction sites. About 94% of the respondents strongly argued that pollution has increased in the last 5-6



years. While 69% of the respondents are of the view that road accidents have increased over the last 5 years. However, only 40% of the respondents believe that death cases have increased, while 60% think that sickness such as fever, cough, respiratory problems and hypertension increased. In a tragic incident triggered by the power project, at least 10 people were killed on 19 December 2011, when a concrete steel bridge collapsed over Rangchang khola (river) around 1.15 pm in East Sikkim. According to the local communities, the bridge collapsed due to the heavy weight of a 48 wheelers truck carrying a huge transformer of 1200 MW Teesta Urja Company. The truck with 10 persons plunged 70 ft below in the river. As per the Border Road Officials, the bridge had a capacity of only 70 tonnes (Sikkim NOW 2012); <http://www.indianexpress.com/news/rangchang-bridge-collapse-toll-rises-to-10/890428/>).

### **Cultural erosion and changes in living standard of people**

The stakeholders directly and indirectly affected by the hydropower projects along the Rongpo-Dikchu stretch stressed that due to lack of appropriate consultation, participatory approaches, and benefit sharing mechanism developed by the construction companies of hydropower schemes, the consequences of the impact have resulted in physical loss of homes and lands, disruption of community networks and loss of cultural heritage. The situation has created a transition to alternative means of earning a livelihood to the displaced or directly impacted population, particularly the local and the indigenous people who depend heavily on local land and resources for their way of life and traditional existence.

About 37% of the total respondents from the upstream/downstream communities reiterated that living standard of the local people have increased since the implementation of the hydel projects, while 55% reported that the living standard have been worsened. The remaining 13% observed no changes in the living standard of the people in the project areas.

### **Displacement and a fear of displacement**

The hydropower projects are at different stages of their development, and have acquired a large forested and agricultural area, and several sacred, spiritual and culturally important spaces along the river belts. These projects have displaced a large number local and indigenous people and their land, which is a matter of great concern. As per our study, the confrontation of the local people with the project developers mostly occurred over the low rates of land compensation and no employment being provided by the power developers to the affected households. The areas where conflicts occurred over land compensation, employment (contractual and regular), and damage to land-holdings by the companies are Singbel, Rashyap, Namphing, Dikchu, Jholungey, Sirwani, Lower Dochum and Mazitar. In several locations along the Rongpo-Dikchu stretch, the local people still have fear-psychosis for their displacement due to natural calamities such as earthquakes, landslides etc.

### **Changes in agriculture productivity**

The local farmers expressed that agricultural yield has declined by 10-40% over that last 5-10 years due to development induced issues. Around 95% of the respondents strongly argued that the productivity of their agriculture cereals and pulses declined over the last 10 years by 30-40%. This drastic decline of the productivity was attributed to the declining trend of the disappearance of local springs, streams and small rivulets that are the immediate sources of irrigation. All the respondents strongly argued that the tunnelling and explosion during tunnel construction has created cracks, and earth movement in the agriculture field and/or in the forest areas. The

impacts of tunnels continue till date especially in the cultivated ecosystems, agroforestry systems and in the surrounding forest ecosystems. People have also observed changes in the phenology of some of the socio-economically important species. Around 60% of the respondents said that the size of the fruits such as that of mandarin orange and guava have reduced considerably, losing vigour, colour and taste and as a result lost market competition.

### **Impact of the NHPC power project on dwelling houses**

The survey identified a number of directly affected households by landslides, heavy explosion in the tunnels in the areas namely Dikchu, Makha, Lower Rakdong, Tumin, Ralap, Sumik, Singbel, Sirwani, Dochum, Namegyethang Namphing, Rashyap, Singtam, Sirwani and Chisopani, Mazitar, Mining and Rangphu in the Southern and Eastern part of Sikkim. More than 70% of the communities are directly affected by the hydropower projects while 21% were partially affected and the remaining 9% were not affected.



**Almost 60% of the houses cracked, or many of them tilted at several locations all along the Teesta River due to tunnelling and also due to stop-and-go of dam water at Dkchu East Sikkim**

The direct effect(s) included cracks developed on the walls of the houses, tilted houses, cracks developed on the kitchens or in livestock sheds, dislocation of the poles or beams, etc. due to the vibration caused by the explosives in the tunnel.

### **Rights and concessions**

We came across a number of demands the local people in the project areas of NHPC have which are still not fulfilled. The local and indigenous people of these areas argued that the landscapes, soil, water bodies, cliffs, rivers and streams, and springs are all sacred and disturbance to these sacred entities would cause unpredictable consequences. They reiterated that the culture,

tradition, customary rituals, festivals, language and social life have drastically changed due to the impact of projects in the mountain areas.

The current development paradigm with the promotion of hydropower projects coupled with disregard of traditional institutions, sacredness of spaces and community participation has resulted into the emergence of conflicts and dissatisfaction among the directly and indirectly associated stakeholders. The nature of hydropower project(s) induced conflicts in the region is reflected in environmental unsustainability, geo-bio-physical characteristics, socio-ecological and socio-cultural complexity and political sensitivity.

Table 2. Water governance issues and rights and concessions related to hydropower projects in Sikkim.

| <b>Sl. No.</b> | <b>Water governance issues</b>           | <b>Rights and concessions (as per peoples' perceptions)</b>   |
|----------------|--|---|
| 1              | River water flow                         | Only 50% of the volume of water from the rivers should be utilized for energy generation. Half of the volume of river water should be left free to flow naturally throughout the year.  |
| 2              | Participatory planning                   | The village self government, local-level institutions, traditional institutions and community members should be engaged/made a partner in the selection, planning and implementation of hydro power project activities in the project areas. This is seriously lacking in Sikkim.   |
| 3              | Employment in power projects             | Local people should be given priority for employment which can enhance and improve the living standard of the people and help sustain their well being.   |
| 4              | Insurance of life, property, agriculture | The hydel companies should start insurance policy for damage to life, property, their agriculture crops etc. of the people in the river belts.  |
| 5              | Development and equity                   | The developmental programmes need to be carried out in the entire Teesta-V stretch rather than concentrating in one or two areas.   |
| 6              | Transparency                             | The project developers should not entertain/heed to the political pressure on the administration of Royalty fund at the local level. Transparency, participatory, etc. lacking.   |
| 7              | Geo-hydrology assessment                 | Scientific investigation of geo-hydrology assessment and regular monitoring of the data should be carried out in the power project areas, areas under the head race tunnels and the adjoining areas that are regularly impacted by the projects have to effected to ensure that ground water and aquifers are impacted by the project activities. |
| 8              | Provision of prior informed consent      | The government inviting the power developers and the power project institutions should take prior informed consent in writing from the communities of the areas where such power projects are planned. This is utterly lacking in India and consequently serious conflicting situation arise.   |

|    |                                    |   |
|----|------------------------------------|---|
| 9  | Environmental Impact Assessment    | There should be regular Environment Impact Assessment by the technical expert group consisting of scientists, local people and official from the power project institutions both during the construction phase and after commissioning of the projects. This is lacking in all the power projects in the country. |
| 10 | People centric policy              | The government should develop a people centric and environment friendly policy with reference to river water based hydropower generation.   |
| 11 | Documentation and information flow | Documentation of the impacts on houses, water sources, existing landslides and on biodiversity and environment should be done to create a baseline data. The EIA-EMP reports should be translated in full in local language and made available for the local people.  |

## Conclusion

The hydropower projects that are at different phases of construction and commissioning in the state of Sikkim have raised several serious issues with unanswered questions. The analysis of this case study revealed that these projects failed to take into account the traditional ecological knowledge system of the communities in project planning, construction, and operation, and incorporate the provision of community infrastructure such as water and electricity systems, health and employment in the project areas.

Almost all the stakeholders and most particularly the local and indigenous communities strongly argued that they are not directly involved to ensure their participation in the planning process for hydropower development. As a result several conflicting issues such as impacts on local springs and water resources, declining agriculture productivity, deteriorating environment features, large agriculture land acquisition, adequate and lack of accepted rehabilitation and resettlement of project-affected populations, etc. and appropriate mechanisms for impact mitigation and improvement of livelihoods are yet to be addressed.

Increased rate of pollution due to ever-increasing vehicular movement after project intervention; traffic congestion; accidents (the case of Rangchang bridge collapse); impact of tunnelling to local water resources such as springs; damage and cracks developed by action of vibration in the private land, houses, etc. and fading local cultures and traditions were some of the impacts the stakeholders revealed.

It is widely accepted that the “energy” of a hydropower project is water and is a renewable resource; majority of such projects are utterly controversial since the construction and operation which directly influences the river systems and geology whereby the adverse socio-ecological-environmental impacts become direct and visible. In the context of increasing and rapid capitalization of river waters for hydropower generation and increasing demand of water both for drinking and irrigation in the mountains, the complex geo-hydrological systems and the increasing impacts of climate change, collaborative and strategic approaches are urgently necessary in the Sikkim Himalayan region.

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