

## Comments on Satluj basin CEIA Report by ICFRE for GoHP

The following are our comments on the Satluj basin CEIA study conducted by the ICFRE for Directorate of Energy, Government of Himachal Pradesh :

1. **Inadequacies in baseline data collection and impact assessment:** The section 3 of ToRs on data collection states, among other things, *“The estimation of supportive capacity of the basin would involve preparation of existing scenario i.e. the preparation of detailed baseline status of the basin. This would be accomplished through the steps outlined in the following sections. Clear base line data would be given for each sub basin.”* (emphasis added)

### a. Water Resources

It was expected for the CEIA report to have studied the data related to natural water springs as per points 2 and 4 of the section 5 of the ToRs on water resources. The study was also to study impacts on water users in terms of water availability and quality (point 6 of section 11 of the ToRs on Impacts due to hydropower development).

*This report has fallen much short of these objectives of conducting a detailed study of the existing scenario and the impacts of HEPs within the river basin because:*

- i. While assessing the water availability in natural water springs, on the one hand the study acknowledges the high dependence of communities on traditional water sources for irrigation, drinking and livestock purposes in all three zones, but on the other hand it repeatedly emphasises on the lack of “systematic data” on data on existing springs, water discharge therein in all three zones. This consultants failed to access this important baseline data regarding the discharge in natural springs from DIPH. DIPH maintains detailed data on the discharge of most of the important water springs in the area.
- ii. In CEIA report page 610, 58% of respondents PAP have cited reduced water availability as a major concern of hydro power projects; On page 616 in Focus Group Discussions (FGD) conducted in Nathpa Jhakri, Baspa II & Karcham-Wangtoo HEPs 68% have shown concern regarding drying of natural springs & water resources; 3 NGOs interviewed showed their concern on tunneling activity done by un-scientific methods of blasting has huge impact on ground water and drying up of natural water resources; out of 22 Gram Panchyat Pradhans and Up-Pradhans , 80 percent respondents expressed their concerns about drying up of natural water resources. Adverse impacts of HEPs and their allied activities on natural water springs was also reported by the staff of the DIPH that was interviewed for the purpose of the study (page 620). This clearly indicates drying up of water sources due to construction of hydro projects is a major problem.
- iii. The CEIA report failed to study the impacts of the already constructed HEPs on water discharge in the natural springs. It is ironical that even in instances where data accessed under RTI Act has been cited by local project affected communities to this

effect, for instance by PAV's of Karcham Wangtoo Hydropower project<sup>1</sup> and Nathpa Jhakri Hydro project, the consultants did not find it adequate to review the information shared by the communities. In case of Nathpa Jhakri Hydro project the claim of communities that 128 water sources were affected was put aside by stating that, *"However no document was provided to substantiate the claims."* While there is a report prepared for Satluj Jal Vidyut Nigam Limited (SJVNL) by WAPCOS **"Cumulative Impact Assessment (CIA)" SJVNL– 09/2006 ; 5-6 DHI Water & Environment P3050220 (C)"** which clearly states that *"It has been reported that more than 30 chashme have dried up in Yangpa village due to the construction works for Sanjay Vidyut Pariyojna. Also, it was found out during primary surveys conducted for the study that more than 8-12 chashme have dried up in Nathpa-Jhakri areas due to NJHEP project."* This has been backed up by the data provided by IPH department in the abovementioned report.

- iv. The report also failed to find out from DIPH or the District Administration the truth behind the statements of the local people regarding the project proponent of Karcham–Wangtoo HEP having compensated the losses (due to drying up of or reduction in discharge of springs) & having provided an amount of to Rs. 1.66 Crores through the Chairman Local Area Development Authority Reckong Peo to mitigate the impacts (page 630).

This inadequacy in the report vis-a-vis data available with the DIPH is partly revealed in the letters given in **Annexure 6.8**. The request for information made to the DIPH by the Director(HFRI), included block-wise existing and projected water demands, status of piped water availability in various villages, daily amount of water supplied, sewage generated and sewage treatment for each habitation with piped water supply. No information was asked of the DIPH regarding the natural springs in the project areas, seasonal data on spring discharge or the impacts of the already constructed projects on the water discharge in these springs.

- v. The report in Para 4.5.1 states "Assessment of impact of tunnel construction on local groundwater and spring discharge (mountainous area) during construction of tunnel and post-construction of tunnel is very difficult to quantify without any historical measured data of spring discharge. There is no data on spring discharge of study area. Therefore, an attempt has been made to assess the impact of tunnel on groundwater using the hydro-geomorphological information for the proposed tunnel construction area in Sutlej basin."

The CEIA report conveniently accepts on page 680, *"the field investigations done at Nathpa Jhakri project site, that few springs which were affected due to the tunnel construction (HRT) of the project, have regained their original position after construction of tunnel."* While in report there is no mention of the springs which are investigated, any baseline data on before and after discharges and the most important in which month of the year the investigation was done.

This observation made by the consultants is false and is contradicted by the facts.

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<sup>1</sup> The RTI data for KWHP shows that out of 167 natural water sources, 43 have completely dried up, and flow reduced in case of 67 traditional water sources, whereas in case of NJHP 128 water sources were affected due to project activities (page 630).

Since DIPH regularly maintains database on seasonal discharge in most of the natural springs in the area, especially the ones that are utilised by the Department as sources of water for various Water Supply Schemes (WSS), it was very much possible to assess the impact of tunnel construction on spring discharge. This secondary data, maintained by the DIPH should have been the basis of assessing the impacts of construction of tunnels rather than the hypothetical modeling that has been used in the study. It is not surprising that this hypothetical modeling does not reflect the reality that has been revealed by the data supplied by DIPH regarding drying up of springs due to tunneling undertaken during the construction of various projects in the state, and particularly in the Satluj basin.

#### b. Forest Resources

Section 11 of the ToRs on the Impacts due to Hydropower Development requires study of impacts on terrestrial ecology, flora and fauna due to hydropower development and the impact due to loss of forests. The background section of this report which provides several baseline information as well as qualitative data – clearly indicates that land and forest based livelihoods are the central economic activity of this region. Although the report provides the extent of private and forest land to be diverted for each of the 38 HEPs studied, the documentation of baselines and impacts related to forests is inadequate on following counts:

- i. The report fails to provide adequate documentation to establish the economic contribution of forests in the lives of the local people. Consequently, the report has failed to present detailed information regarding the extent of impact upon the livelihoods of the local people due to the construction of HEPs – be it for day to day living or commercial purposes.
- ii. On Page 628 the report states “Chilgoza (Neoza) contributes significantly in the local community livelihood. About 781 Chilgoza Pine trees were cut due to Forest land diversion for Tidong-I further 248 ha has been proposed in the middle zone for the proposed project will further have negative impact on loss of forest and produce”. This again is an extremely inadequate description of a grave problem related to this endangered specie given the fact that on page 548, the report states “The species grows between 1600 and 3300 m above sea level and is sparsely distributed in H.P. covering a total area of about 2060 ha with most of the area falling in Kinnaur district (2040 ha) and a small portion (20 ha) in Chamba district (Troup 1921)”

The report has failed to assess how much area has already been diverted from this limited chunk of land under Chigoza belt and how it will be impacted if all the projects under different stages of implementation will come up. Only then the real threat to this endangered specie, which is also known to be difficult to regenerate, due to hydropower development and the mitigative measures therefor could have been assessed by the report.

- iii. The report has failed to access and document information regarding the illegal destruction of forests and forest wealth during the construction of HEPs on

account of illegal muck dumping, encroachments, unscientific and unauthorised road cutting, quarrying and unauthorised construction of tunnel. These violations of the Forest Clearance conditions are monitored by the State Forest Department (SFD) and are documented in the form of damage reports and the damage bills raised by the SFD upon the project proponents. The Tidong I HEP and Karcham-Wangtoo HEPs have been notorious regarding such violations that have been taken note of by the SFD in terms of the damage bills raised or even an FIR lodged by the local range officer in the case of uncontrollable and heavy destruction of forests by Tidong I HEP. However, the report has not studied or presented any data regarding these violations that is available with the SFD or even visible to the naked eye in the case of Karcham Wangtoo and Tidong I HEPs.

- iv. In the section 7.8 of the report on Impact due to Diversion of Forests and Land Use Changes, on page 661, it is reported that seven species of flora in the category rare, endangered or threatened were observed. However, the report neither does state any impact that is likely to affect these species nor carries any specific recommendations to mitigate impacts of HEP construction on these important species.

### **c. Agriculture and Horticulture**

The baseline information as well as qualitative data provided in the report clearly indicates that agriculture and horticulture are the primary economic activity of the residents of this region. Given this very important fact the report should have examined closely the impacts of Hydropower on these economic activities but it completely fails to do the same. Given below are the clearcut shortcomings of this section of the report:

The trend in the districts, especially, Kinnaur, Kullu, Lahaul and Spiti is diversification of agriculture to offseason vegetable farming which is becoming an extremely profitable enterprise. Also, cultivation of cash crops like apples and almonds are important part of people's livelihoods. But the study has failed to incorporate impact assessment vis a vis hydroproject construction on these sectors, especially keeping in view the evidence available with the Department of Agriculture and Department of Horticulture regarding the impacts of the already constructed HEPs.

Section 6.10.3 on the 'Report on impact due hydropower on agriculture/horticulture' refers to a 2008 study for the Rampur project by CSK University Palampur June 2008 which had found that the "dust raised by the construction operations being carried out Rampur Hydro Electric Project did not cause any damage to the crops". The section then goes on to say that SJVNL paid compensation of Rs. 1,53,17,904 (Rupees One Crore fifty three lakhs seventeen thousand nine hundred four) for the six panchayats namely - Kharga, Kushwa, Bari, Poshna, Bahawa and Gadej in Dist. Kullu.

In the case of the Karchham Wangtoo Project the Himachal Pradesh State Pollution Control Board report dated 19.2.09 which has details of joint inspection report in affected villages with observations of crop losses and also dust sampling results indicating high level of SPM in the year 2009. The joint inspection committee also studied 3 villages of Sangla valley, a non affected area, and found normal crops in that area as against 70% loss in the affected area in the same time period.

Again, for Karchham Wangtoo Project (Kinnaur) compensation was paid to people whose crops had been affected due to HEP construction based upon assessment made by the state government's horticulture department and other committees formed by the state government from time to time - as revealed by an order dated April 2012 according to which the compensation has been paid for crop loss and other damages. This is a clear evidence of the linkage between hydropower construction and damage to crops as a result of the dust. However, the CEIA report has failed to access such reports and has thus completely overlooked this aspect despite the fact that 65% of the PAPs/respondents in the focus group discussions for under construction projects and 60% of PAPs/respondents for the already constructed projects reported that hydroelectricity project construction has had adverse impact on agriculture and horticulture (page 615 and 616).

The report has failed to study how cultivation would be affected as a result of drying up or flow reduction in water sources, as these seem to be the main source of water for irrigation in the Satluj basin.

#### **d. Damage to Houses**

The study has completely overlooks the impact that the already constructed HEPs have had by way of damage to houses situated in the vicinity of the areas where blasting operations were undertaken despite the fact that 67% of the respondents during focus group discussions for under construction projects have reported damage to houses due to blasting operations for HEP construction. This damage to houses is also substantiated by official studies conducted for the project proponents. One such study on the Nathpa-Jhakri HEP conducted in the year 2002 and titled "Impact Assessment of Resettlement Implementation under Nathpa-Jhakri Hydro Electric Power Project", sponsored by the project proponent and available on the internet at [http://sjvn.nic.in/writereaddata/Portal/Projects/Documents/16\\_1\\_IMPACT\\_ASSESSMENT\\_RESETTLEMENT\\_IMPL\\_20\\_09\\_2012\\_1.pdf](http://sjvn.nic.in/writereaddata/Portal/Projects/Documents/16_1_IMPACT_ASSESSMENT_RESETTLEMENT_IMPL_20_09_2012_1.pdf), clearly discusses the harmful impacts of the project that were neither thought of nor accounted for in the initial estimates of the project, and ended up causing damage worth Rs. 5.45 million to houses located up to 60 meters of project construction.

The report has failed to access and report information on this impact which is available not only on the internet but also with the project proponents and the District Administration/Revenue Department which is involved in conducting studies on such damages whenever approached by the aggrieved public.

## e. Land Use Changes

For understanding the impact of any development activity on the physical, biological and socio-economic environment it is important to study the changes in the Land use that the activity is going to cause. The CEIA rightly dedicates an entire section to Land use changes but does not provide any concrete data or evidence or study of the same. Section 9.4.9 on Land use changes states that the study has not been able to undertake a ground truthing of the current data that has been used in the report. The study admits that this is necessary for predicting and changes and therefore impacts.

The GIS mapping data that has been used to study the land use changes over a period of a decade/ten years is actually unreliable for several reasons.

An example of is of table 4.4 on land use/land cover changes in the study area of Sutlej Basin, Himachal Pradesh, which states that the dense forest has decreased in the region by 252 sq kms between March 2001–2012. However, in the same table it is indicated that between October 2000 and October 2012 the dense forest has increased by 515.98 sq kms.

This contradiction in the data is explained in section 4.1.2.2 titled **Land use land cover dynamics in Sutlej Basin** (page 193), “*The middle region of Sutlej basin has deciduous forest cover which becomes leafless during pre monsoon period. Therefore, the area under dense forest cover appears less in satellite imagery data. In contrary, during post monsoon season, the high leaf area index reflects more area under dense forest cover. The change in area during pre and post monsoon is due to variation of signature in satellite data; however the possibility is that the actual area may not change much.*”

While it may be possible to attribute this difference in forest cover to the deciduous nature of the forest and therefore pre and post monsoon seasonal variations in the data, a decrease of 12.24% in dense forest cover area between March 2001 and March 2012 (pre-monsoon scenario) and an increase of 15.20% between October 2000 and October 2012 (post monsoon), is virtually incomprehensible and cannot be explained through this reason. Such a vast variation in data needs a much more detailed study and should form an important component of the baseline information and cannot be interpreted through assumptions. In the absence of this baseline information, the very basis of the conclusions drawn in this report stand to be questioned.

Not only does the report fail to understand this phenomena, but conveniently uses the baseline of the October 2000-2011 data (showing an increase in dense forest cover area and decrease in open forest area) to negate the impacts of hydropower development in the basin and to show them as environmentally benign. We believe that selection of this data set as baseline indicates the bias inherent in the report. Had the study relied on the March 2001-2012 data as baseline, probably the entire

framework and context of this CEIA study would have been altered.

**f. Illegal and unscientific muck dumping**

The report has not studied and presented data available with the HP State Pollution Control Board that has recorded widespread violations of environmental laws due to illegal and unscientific muck dumping by HEPs in the Satluj basin, most remarkably by Karcham-Wangtoo, Tidong I and Baspa II HEPs. Consequently, the report has failed to take into account the issues of environmental loss due to this factor.

**g. Mitigation measures**

The CEIA concludes in Section 9.6 that the impact of hydroprojects in Satluj basin will be unavoidable and can be offset or reduced by mitigation measures. However, the study does not assess the efficacy of any of the mitigation measures adopted by the commissioned projects. For instance, the success of CAT and Compensatory Afforestation Plans of the existing projects have not been studied. Further, the CEIA report itself says that the commissioned projects have not contributed positively in anyway to the socio-economic environment of the area. The report also states that there will be medium level cumulative impacts of these projects on the biodiversity and high level impact on the fisheries and fish fauna. However, there is a huge question mark on the efficacy of the mitigation measures suggested considering that the existing evidence of mitigation measures shows that there is little progress or achievement in any of the areas.

**h. Glacial Lakes**

The threat posed due to glacial lake outburst floods has been inadequately dealt with in the report keeping in mind the fact that such lakes are increasingly being formed in the Himalayas and are posing a threat to the downstream areas and a scare had been recently created due to accumulation of glacial waters in the Parchu lake located in the basin.

**i. Transmission Lines**

Transmission lines are an integral part of any HEP design and substantial forest area has been diverted in the state in order to lay these lines. The report states 2225 Ha (25% of the total) of forest land diversion has happened for laying transmission lines whereas 3929 Ha (45%) were diverted for the construction of HEPs (for components other than transmission lines). This integral component of HEP development with huge impacts has been totally ignored by the report.

2. The ToRs required the study to review of existing and planned developments as per various developmental plans.
  - a. However, the study has failed to take into account the developments related to road development which includes road widening and construction of new roads unrelated to the HEPs. These, like the roads constructed for the purpose of HEPs, result in deforestation, drying up of sub-surface water, increased ecological degradation, soil erosion and sedimentation.
  - b. The study has also failed to take note of the various small hydro-electricity projects being constructed on the tributaries of the Satluj river. According to the website of Himurja (<http://himurja.nic.in/mousigned.html>), the nodal agency of Himachal

Pradesh Government for small hydro-electricity projects, there are 57 projects below 5 MW capacity for which MoUs have been signed by the Government with power producers. Although the ToRs of the CEIA study specify taking into account HEPs above 10 MW only, it does not imply that the small HEPs do not exist and can be ignored while documenting the “existing and planned developments as per various developmental plans.”

### 3. Determination of environmental flow to be maintained by each HEP

Impacts of maintaining environmental flows: The report states in the Section 8.10 (page 674) on Cumulative Impact Assessment of Physical Environment

*“There is a provision for release of environmental flow in the diverted stretch.*

*The*

*requirement of environmental flow takes into consideration the depth and velocity of the flow in the diverted stretch to maintain the ecological security. Therefore, if the flow is equal to or exceeds the prescribed EF, the impact is categorized as Low and is considered Localized.”*

Two out of the four already constructed projects studied in detail in the report, viz. Nathpa-Jhakri and SVP Bhaba do not release any water below the diversion point. All the out flow from the tail race of the Nathpa-Jhakri HEP is utilised for generating power at the Rampur HEP, thus leaving the river stretch for the length of the Rampur project virtually dry too. Plate 5.3.5 shows a dried up river bed below the diversion point of the Karcham-Wangtoo HEP. Thus it can be said that the river bed is virtually dry between the diversion point of Karcham-Wangtoo and the tail race of the Rampur HEP (that is 71 Kms of river stretch or 29.70% of the river stretch between Sipki la and Kol Dam), except for the smaller streams that join the Satluj river between these points and have projects constructed on them which alter the diurnal flow within these smaller streams too. Also, the prescribed environmental flows being adhered to for the under operation and under construction HEPs are way below the limits that the CEIA study has indicated in table no. 5.53, page 479. The report also states:

*About 58% of the Sutlej River length is diverted whereas 22% of the river is submerged, if we take only Sutlej River stretch only from Sipkila (point of entry of Sutlej River in India) to Kol Dam. Otherwise, as the table shows, about 70% of the Sutlej River is diverted and the total affected length will work out to 92%*

For a river wherein the water flows have been interfered so heavily, the actual impacts of this drying up of the river bed should have been studied and incorporated into the report, short of which the observations and inferences made by the report are incomplete and rating the impact on the diverted stretch purely based on the assumption that the specified environmental flows are being maintained, is flawed.

### 4. The methodology adopted for predicting the environmental flows for different HEPs is



*also questionable and can be challenged on the basis of the findings of the following studies:*

- a. Assessment of Environmental Flows for the Upper Ganga Basin by WWF India
  - b. A Presumptive Standard for Environmental Flow Protection by B.D. Richter, Nature Conservancy, U.S.
5. The ToRs had mandated determination of free flowing riparian distance to be maintained between two successive projects in a cascading series in the basin

The study, in Section 5.4.3.2 (page 476–480), deals with this issue in a most cursory manner and only suffices by saying “*Based on the analysis of the potential sites, the conclusion emerges that hydropower at identified sites can be harnessed consistent with environmental sustainability, provided certain measures are taken.*”

This inference is flawed on the following counts:

- a. The inference is based on the assumption that environmental flows, as prescribed, would be adhered to by each project as per the table No. 5.53, following which would entail reduction in capacity to a varied proportion for all the HEPs on the river. There is no recommendation within the CEIA report regarding the reduction of the capacities of the HEPs in the basin in order to ensure environmental flows are maintained downstream of each project.
- b. The inference of the CEIA report regarding the current identified sites being environmentally sustainable stands challenged in the light of the observation made by the CAG in the context of projects in Uttarakhand, which are similar in nature to the projects being constructed in the Satluj basin.

The report in the section on ‘In Stream Flow Monitoring’ (Section 9.4.4, page 715) states:

*Comptroller and Auditor General (CAG) of India (May 2009 – July 2009) has ascertained that the average diversion of RoR projects both small and large on an average have 4–5 km negative impact on downstream flow in Uttarakhand.*

The study has not analysed the distances between the various HEPs. Without the analysis of this important parameter, justifying the current inter-project distances is flawed.

- c. In assuming that the current riparian distance between adjacent projects in cascade on the river are satisfactory, the report has ignored the impacts upon fish migration, nutrients and sediments on account of obstruction caused by dams that are constructed for diverting river water into tunnels.
- d. The report ignores situations like those faced by the local people and the project proponent in the case of Integrated Kashang HEP. In the 2<sup>nd</sup> and 3<sup>rd</sup> stage of the project, the water of Kerang stream has been planned to be diverted to Kashang stream where a common power house (for Kashang stage-I and stage-II and III) being set up for both

projects. The EIA report of integrated Kashang project justifies it by citing the reason of optimum use of land resources by developing a common power house facility. However, on the other hand, the other HEP planned downstream of Kerang i.e. Jangi - Thopan HEP could have used the water of Kerang stream to generate electricity if the water of Kerang stream was not diverted for Kashang stage 2nd and 3<sup>rd</sup> through Kashang-Kerang link tunnel.

The CEIA study should have compared the different parameters like electricity generation, ecological and socio-economic impacts in these two abovementioned scenarios. We strongly feel that there is a need to look into the whole hydro power development planning in the Satluj valley in a rational way so that it causes minimum damage to surrounding environment rather than justify the existing plans.

e. Further, the study itself lists serious impacts of current hydropower development on the ecology that should have warranted a relook at the current project locations and avoid sensitive areas. Some of such excerpts are given below:

- i. **Section 7.8.1 on Impact due to Fragmentation, page 659:** *The diversion of forest infrastructure will have long lasting impacts in terms fragmentation of forest in continuation. In case of mountain area it is mainly occurs in patches along the HP sites either as riparian or as patches from the base of the river. Those provide connectivity to protected areas, in case of the study is there are ten protected area that has varied composition based on the location especially in the higher reaches Trans Himalayan region. The direct socio-economic consequences for fuel wood, fodder and medicinal plant extraction will be affected.*
- ii. **Section 7.8.2 on Habitat Loss, page 660:** *The middle zone relatively have good forest cover and also has specific distribution of few species specific and locations available particular to the elevations such as Betula utilis; Juniperus polycarpus, Pinus gerardiana, Sophora mollis and Taxus wallichiana in the middle zone of the Sulej Basin (Figure 7.11). Considering the number of proposed HP and allied activities including road, the forest land require will negatively impact the existing important habitat for the species specific to the basin.*

## **6. Report has tailored inferences through selective and arbitrary interpretation of information to underplay impacts of hydropower:**

The report has relied on unsubstantiated assumptions in order to derive conclusions that are favourable to the development of hydropower in the Satluj basin on the following aspects:

- a. **Environmental Flows, carrying capacity and project locations:** The report has assumed EFR requirements (Section 5.4.3, page 473) for fish zone and no fish zone based on the requirement of aquatic life. Based on this EFR, the report has justified all the existing project locations with some reduction in capacity of the existing and planned projects. While prescribing the EFRs, the report has also ignored the fact that the river bed has already been dried up due to the already constructed projects like Nathpa-Jhakri, SVP Bhaba and Karcham-Wangtoo. The report has failed to take into consideration the unsustainability of this current

scenario and the cumulative impact that would occur in case other upcoming projects also do not follow the EFR regime.

- b. **Drying up of springs and impacts of tunneling:** There is enough primary information provided by various respondents regarding drying of natural springs due to blasting activities of HEPs. However, rather than investigating and documenting these impacts with the seriousness they deserve, the report has relied upon hypothetical modelling to prove how tunnelling would have no long term impacts on the health of the springs. The report also relies upon unsubstantiated data from Nathpa–Jhakri HEP regarding dried up springs having got revived after project completion which is countered by the information provided to the contrary by 68% of the respondents in the FGDs (page 615). The report has consequently rated the impact under this head to be locally medium in the case of Karcham–Wangtoo and Nathpa–Jhakri whereas it should have been rated as high.

Damage to houses due to blasting operations of HEPs has not even been considered a serious enough impact despite 67% of the respondents of the FGDs (page 616) conducted for under construction projects having reported such damages.
- c. **Land use change data:** As described in section 1 (e) of this document, skewed interpretation of the land use change data has been resorted to by the report writers in order to play down the ongoing loss of forest cover in the Satluj basin, in which the construction of HEPs is the major contributor. This interpretation made in the report is also contrary to deforestation related figures given by the Forest Survey of India report for Kinnaur district (which forms the major chunk of the study area) which states that forested cover has steadily decreased over the period between 2001 and 2011.
- d. **Length of normal flow:** The criteria adopted for categorizing the length of normal flow after construction of HEPs is arbitrary and not based on any scientific rationale, rating rivers with 15–30% length of normal flow as having low impact. This impact is rated high only in ridiculously high lengths of normal flow of 5% (page 678). This arbitrary criteria has clearly been adopted with a view to depict the cumulative impact for the river Satluj under this head as medium and justify the number of HEPs on the main Satluj river which will have only 8% of length of normal flow divided into many stretches after all planned HEPs have been constructed on the river.
- e. **Area of land use change:** The criteria adopted for categorizing the area of land use change is also arbitrary and not based on any scientific rationale, considering only projects with 1 or more than 1 Ha per MW having a high impact. More importantly, it was expected of the report to have analysed the overall impact of the actual land use change in the ecosystem due to the construction of HEPs and other developmental activities.

7. **Efficacy of mitigative measures:** The report has not studied how effectively the suggested mitigative measures are being implemented in the already constructed or under construction projects. Without having done so, the efficacy of the mitigative measures is questionable. Wherever the report has studied the impact on the social environment, the impacts have been found to be cumulatively low which means that either the suggested mitigative measures are inadequate, not properly implemented and monitored.

## **Conclusion**

The report is an incomplete, half hearted and inadequate attempt at studying, evaluating and predicting the impacts of HEP development in Satluj basin. It seems that the report has been prepared in a way that justifies the current extent of hydropower development in the area. There are several discrepancies that have been pointed in this document and many more that would be pointed out by others. In order to have a holistic document that keeps the scope of the report of “providing optimum support for various natural processes and allowing sustainable development undertaken by its inhabitants ” the missing gaps in the report should be filled even if it requires renewed efforts in data collection and impact assessment.