AHEC's Pathetic Cumulative Impact Assessment of Ganga Hydro projects
Flawed, Shoddy, Biased and Unacceptable

Uttarakhand state in North India is on a hydro projects building spree. The Upper Ganga System alone, including Bhagirathi and Alkananda Rivers and their tributaries, till their confluence at Dev Prayag, has more than 130 large and small hydro power dams planned, commissioned and under construction. The overall impact of such an unprecedented cascade of dams on the fragile river system and surrounding environment is a matter of serious concern.

Looking at the ecological and cultural sensitivity of the region, Central Empowered Committee (appointed by the Supreme Court) referred the Kotlibhel IA, 1B & 2 projects back to the Forest Advisory Committee for reconsideration of Forest clearances issued under the Forest Conservation Act (1980). A sub-committee of FAC after visiting the area, recommended that a "thorough study of the carrying capacity of Ganga tributaries has to be undertaken." MoEF hired The Alternate Hydro Energy Center of IIT Roorki (AHEC IITR), without undertaking any bidding process. The stated reason for not inviting any other institute was: "Considering the exceptional nature of job and limited availability of time it is suggested that instead of adopting the bidding process we may seek proposal from only one institution of choice."

Looking at the shoddy and biased cumulative impact assessment report done by AHEC-IITR, it is clear that MoEF hired AHEC only to facilitate dam building permissions, without any consideration to the ecological balance and impact of the mega dam schemes on local populations.

MOEF commissioned two studies: *Assessment of Cumulative Impact of Hydropower Projects in Alaknanda and Bhagirathi Basins* which was given to AHEC, IITR & *Assessment of Cumulative Impacts of Hydroelectric Projects on aquatic and terrestrial biodiversity in Alaknanda and Bhagirathi Basins, Uttarakhand*, which was given to Wildlife Institute of India, Dehra Dun.

A number of objections were raised about AHEC's independence, competence and experience in undertaking such an important study. An Intervention Application has been filed by JP Dabral and Bharat Jhunjhunwala in the ongoing Supreme Court Writ Petition (202 of 1995) in Feb 2011, the IA is still pending before the SC. Between 2001-2010, AHEC has published barely 8 publications on rivers out of its 301 publications. 7 of these are about water quality and merely one is on environmental impact of small hydro power projects. AHEC does not have any publications related to all the issues covered in the TOR, namely geology, glaciers, landslides, ecosystem sustainability, ground water regime, river flows, cultural and religious impacts, wildlife and aquatic flora and fauna. Activists have made a representation to IIT, Roorkee and MOEF in 2010, requesting that the study may be withdrawn from AHEC and giving suggestions regarding interpretation of TOR in case study was continued with AHEC. None of the questions raised have been answered either by AHEC or the MoEF.

The report by AHEC, commissioned by the NRCD, MoEF has been put on the MoEF website in June 2011. It has all the fallacies that were feared and expected.

Where is the Cumulative Impact Assessment? The report was supposed to do a cumulative impact assessment of various hydropower projects and related developments in Alaknanda and Bhagirathi basins. However, the report does not go beyond listing individual project impacts (which too are not comprehensive or adequate). Listing of impacts of various individual projects in one chapter or table, or classifying an impact as local or cumulative does not qualify for the report to be called a cumulative impact assessment. The report was expected to also assess what are the TOTAL impacts of the projects and what are the additional impacts that go beyond the totaling of individual project impacts. The report has completely failed to do this and hence does not qualify as a cumulative impact assessment report. In fact the report is more about how to continue to build big hydro projects rather than making an assessment of the cumulative basin wide impacts of hydropower projects, which also shows the pro hydro bias of the consultants.

Cumulative impacts NOT ASSESSED Specifically, some of the cumulative impacts that the report has not assessed include:

1. Cumulative impact on hydrological flows, at various points within project, at various points within a day, season, year, over the years and cumulatively across the basin and impacts thereof. This will include impacts on various hydrological elements including springs, tributaries, groundwater aquifers, etc. This will include accessing documents to see what the situation BEFORE project was/ is and what would be after. The report has failed to do ALL THIS.
2. Changes in sedimentation at various places within project, at various points of time within a day, season, year, over the years and cumulatively across the basin and impacts thereof.
3. Cumulative impact on aquatic and terrestrial flora and fauna across the basin due to multiple projects.

4. Impact on Green House Gas emissions, project wise and cumulatively. No attempt is made for this, on the contrary an attempt is made in section 8.6 to suggest that there is no issue here, which is shocking denial of scientifically established facts, see for example the report of the World Commission on Dams or the UNFCCC criteria for CDM credits for large hydro. Interestingly, this attempt of the report to underplay this impact is in complete contradiction with a report submitted to the Union Environment Ministry in Dec 2010 by IIT consortium, including IIT Roorkee, where the AHEC is stationed[1].

5. Cumulative impact of mining of various materials required for the projects (sand, clay, boulders, coarse and fine granules, etc.)

6. Cumulative impact of blasting of so many tunnels on various environmental and social aspects.

7. Cumulative impact of muck dumping into rivers (the normal practice of project developers) and also of muck dumping done properly, if at all.

8. Impact of silt laden water (rejects from the delisting chambers) into the river channel downstream from the dam, and how this gets accumulated across the non monsoon months and what happens to it. This again needs to be assessed singly and cumulatively.

9. Impact of release of silt free water into the river downstream from the power house and impact thereof on the geo morphology, erosion, stability of structures etc, singly and cumulatively.

10. Impact of differential water flow (during peaking hours power generation vs none in off peak hours) downstream from power house in non monsoon months, with sudden release of heavy flows during peaking/ power generation hours and no releases during other times.

11. Cumulative impact of all the project components (dam, tunnels, blasting, power house, muck dumping, mining, project roads, project township, deforestation, transmission lines, etc) for a project and then adding for various projects. Same should also be done for the periods during construction, during operation and decommissioning phases of the projects.

12. Cumulative impact of deforestation due to various projects[2].

13. Cumulative impact of non compliance of the environment norms, laws, Environment clearance and forest clearance conditions and environment management plans. Such an assessment should also have analysed the quality of EIA reports done for the hydropower projects so far. The quality of the EIA reports of hydropower projects has in general been very poor.

This is a reality, a norm rather than a theoretical proposition, the study acknowledges this at some places, but makes no attempt to assess the impact thereof. In fact the CEC and Supreme Court orders in 2009 on Kotli Bhel 1A and 1B projects actually required an assessment of *effectiveness of the mitigative measures and compliance of the stipulated conditions on which various projects have earlier been cleared,* see FAC minutes of meeting dated May 30-31 2011 on http://moef.nic.in/. This particular legal requirement of CEC and Supreme Court order is yet to be fulfilled.

The government of India through a decision of an authority chaired by the Prime Minister has decided that no hydropower projects will be built on the initial 135 km stretch of Bhagirathi River. AHEC report lists hydropower projects on this stretch as under construction projects, and tries to build up a case of restarting work on projects in this stretch.

This is only a partial list of cumulative impact assessments that have not been assessed by the IIT R report.

Pro Hydro bias of the AHEC, IIT R The consultant team lead by Dr Arun Kumar, Head of Alternate Hydro Energy Centre, IIT Roorkee has shown their pro hydropower project bias at many places, repeatedly across the report. The assessment of Cumulative Impacts of Hydropower Projects needs to be done by a credible, independent agency. But the pro hydropower project bias shown by the consultants clouds the objectivity of the report and thus discredits the consulting team and organisation as independent, objective team. Here are a few of the instances where the consulting team has shown their pro hydro bias:

- The government of India through a decision of an authority chaired by the Prime Minister has decided that no hydropower projects will be built on the initial 135 km stretch of Bhagirathi River. Strangely, AHEC report not only lists hydropower projects on this stretch as under construction projects, but even tries to build up a case of restarting work on projects in this stretch (e.g. in last para in section 12.3, page 12-5). Such advocacy of abandoned projects is not even part of the mandate of this report; on the contrary it is positively AGAINST the mandate of the consultants.
- The report at several places keeps talking about the huge hydropower potential in Uttarakhand and the amount of power & revenues that the projects can generate for the state govt. This is very strange coming in this report & when these issues are not part of the mandate of the report. Moreover, the assessment of the

[1] IIT Consortium, which includes IIT Roorki has mentioned 'Potential release of green house gases from the impoundments' as a critical impact of hydropower project in Upper Ganga basin in 'River at a Glance' Draft Management Plan for Ganga Basin submitted to the NGRBA in Dec 2010

[2] IIT Consortium Ganga River basin Management Plan mentions "The area under the influence of hydroelectric projects is suspected to undergo decline in its forest cover and experience enhanced landslides."

potential hydropower generation and revenue thereof in the report does not even take into account the recommendations made in the report about environment flows, certain rivers to be left free of hydro projects[3] and so on. This also shows how non serious is the report about its own recommendations.

- The report says in section 1.6, "Considering the above, hydropower generation appears to be a viable alternative to meet the ever increasing power demand… its share in the mix of power has significantly reduced and is far below the desirable level." The authors are not quoting anyone here. Now what is a desirable level of hydropower share in power sector is neither discussed in the report nor is it part of the objectives of the report. Similarly, viability of the hydropower projects is subject to a number of studies and questions, one of them is supposed to be studied by this report. It is uncalled for, for the report to start with a conclusion about the viability of the hydropower projects.
- In section 8.6 the report makes a bland statement (quoting outdated IAEA statement of 1996) "hydropower is one of the cleanest ways to generate electricity in terms of GHG emissions." This is a most unscientific statement, considering that WCD report and even UNFCCC has recognised that reservoirs can be significant sources of GHG emissions particularly in tropical and semi tropical climate.

Considering the cultural and ecological uniqueness of rivers in Upper Ganga Basin, they belong to the Management class of A or B and deserve optimum e-flows allocation. However the report relegates them to class C or D which automatically means meager e-flow releases. This is completely wrong.

These are only a few of the instances showing bias of the consultants FOR hydropower projects; there are many more, which are not listed here. It is clear that such a bias discredits the report at the outset, when the report is about cumulative adverse impacts of hydropower projects.

Inadequate Recommendations on Environment flows Looking at the massive scale of the impacts of cascade projects, one of the most crucial tasks of the report was its prescription for maintaining e-flows. In fact one of the major objectives of the report was to make an assessment of environment flow requirements when projects divert large stretches of rivers into the tunnels. The report does a poor job of this.

The consultants have downplayed the current ecological and social status of the Upper Ganga River Basin. The range of eflows recommended through the report rests on Environment Management Class of the river in question. Rivers with a lower Environment Management Class (because of degraded ecology and unwillingness of the society to protect these rivers) are allocated lower range of eflows. However, rivers in the Upper Ganga Basin are some of the most unpolluted, pristine and ecologically important rivers in the country. The social, environmental, cultural, religious, aesthetic, recreational and economic importance of Bhagirathi, Alaknanda and their tributaries and the various Prayags etc., needs no elaboration. Considering these facts, rivers in Upper Ganga Basin deserve the Management class of A or B. However, most of the rivers are relegated a C or D class (and Environment Weight-age Band of D), which is completely unjustifiable. The basic categorisation is wrong and eflows recommended through these assumptions are not acceptable for rivers in Upper Ganga Basin.

The report says that the consultants had limited data on river cross sections and velocity of flows. Secondly it says that it could not apply the Building Block Method due to lack of data, time, manpower and other resources required. But in that case the consultants should have asked for data, time and resources required rather doing a poor job of the environment flow assessments. Thirdly, the consultants have rather mechanically applied the methods to assess environment flows. Thus while the study by the Wildlife Institute of India (Dehradun), also on cumulative impact assessment of hydropower projects on terrestrial and aquatic biodiversity concludes (the WII study is not yet in public domain, but see the minutes of the FAC meeting dated 30-31 May 2011 on MEF website, which has quoted some relevant portions of WII study presented to FAC) has concluded that the Kotlibhel 1B, Kotlibhel 2 and Alaknanda Hydro projects should not be built due to the serious nature of the impacts of these projects, the IITR study just mechanically calculates the environment flows for these projects and implicitly says the projects can go ahead!

Moreover, in addition to environment flows, the river also needs certain flood flows at least once a year. Even the report of the Central Water Commission that this report quotes has made recommendation for flood flows, but this report has not followed the CWC recommendation for flood flows.

Wrong facts on fisheries The report says (row 8, column 1-3 in ES Table 1B on page E -23) that Rishi Ganga is a no fish zone. This is factually wrong, for example, the Project Design Document submitted for the Rishi Ganga project for its application to get CDM credits lists the fish found in the river! In fact, no basis or reference is given for characterising a large no of rivers as no fish zones (e.g. Bharon Ghati, Loharinag Pala,

[3] This is listed as an Action Point even in the Ganga River Basin Management Plan though it is not confined to Upper Ganga River Basin.

Jadh Ganga, Alaknanda, Vishnuprayag, Dhauliganga projects). Almost all of these characterisations seem wrong. More importantly, some of these may be due to the hydropower projects already built (e.g. Tehri, Maneri Bhali I and II on Bhagirathi and Vishnuprayag on Alaknanda). Not recognising these realities substantiates the shoddiness of the job the consultants have done.

The classification of rivers into No Fish Zone, Trout Zone and Mahseer Zone, or Epirhitronic, Metarhitronic and Hyporhritronic is ambiguous. There are also a few community conserved Fish Sanctuaries in this region but the report fails to mention them.

Wrong conclusions about impact on springs, drinking water and irrigation The report could not assess the impact of projects on springs "due to limitations of data". The report has failed to do justice to this crucial aspect. However, if the authors had been objective and astute, they could have easily found from local communities the impact of the projects on the local springs and thus their access to drinking water and irrigation. This experience is universally negative and the authors could have found this out for the completed and ongoing projects. On the contrary, consultants have claimed "negligible" impact in case of 23 projects, low impact for 7 projects and medium impact for just one project out of the 31 projects listed in Table ES 1A to 1C on pages E22-24. IIT Consortium's *River Ganga at a Glance: Identification of issues and priority actions for Restoration,* a part of Ganga River Basin Management Plan also states "drying of local water sources" as a critical impact of hydropower schemes. Thus the Cumulative Impact Assessment report is in contradiction with the IIT Consortium report in this aspect too.

SANDRP analysis shows that per MW generation of hydropower projects in India has come down by a huge 25% in last 20 years. None of the four major hydro projects in these basins, viz. the Maneri Bhali I, II, Tehri and Vishnuprayag projects are generating electricity as promised at the time of techno economic clearances. The % under performance ranges from 9.2% (Vishnuprayag) to 33.26% (Maneri Bhali II). Maneri Bhali II and Vishnuprayag projects have never generated electricity at the promised levels.

The conclusion of the IIT R report is certainly known to be wrong in case of Loharinag Pala, Pala Maneri, Phata Buyng and Singoli Bhatwari. In case of Vishnuprayag project, page 11-35 says the impact on springs and drinking water is L-Med, but in table 1A on page E-22, the impact is listed as negligible, showing inconsistencies within the report. Again in case of Vishnuprayag, the report on page 11-35 says "there are not many springs in the area" through which the 19.4 km of river gets bypassed. The authors have the same conclusions also for Maneri Bhali I and II, this is shocking and untrue.

Moreover the report says (sec 7.2, page E-11) that "The impact of HPs on irrigation is generally positive and localised." This is also completely wrong, if springs get destroyed in building hydropower projects, the impact on irrigation would certainly be negative and devastating since springs are the main source of irrigation in these areas. There are several instances where the traditional irrigation techniques like Kuhls and Guhls have been destroyed in the area due to the hydropower projects. In case of 5 projects the report assesses this impact to be Positive!

Objective assessment of hydropower performance not done The consultant has tried to assess the performance of the hydropower projects in terms of generation, but has failed to do an objective assessment. On the contrary, by using rather irrelevant factors like generation per unit discharge, per unit head and per river stretch, the consultant has tried to show the performance of the projects in rather charitable light. Moreover, they have not assessed the actual generation, but assessed the promised generation, thus misleading the readers. Thus, Srinagar project, which is yet to start generation and which has been mired in serious controversy of violation of environment norms and laws, building project beyond the height or capacity permitted and in submergence of religious sites, is sought to be shown in positive light by saying (page E-15), "For Srinagar project, 336 unit of power is generated from each m of diverted river". The project now stands stalled due to the High court and MoEF order.

If the consultant was really interested in assessing the performance of hydropower projects, they should have assessed how the actual generation per MW has been changing over the years and how the actual generation compares with the promised 90% dependable generation. These aspects help reflect the actual generation performance of the hydropower projects. About 89% of operating hydropower projects in India are generating power at below the promised 90% dependable generation.

The performance of Bhagirathi and Alaknanda basin hydro projects is no different. For example none of the four major hydro in these basins, namely the Maneri Bhali I, II, Tehri and Vishnuprayag projects are generating electricity as promised at the time of techno economic clearances. They are all generating at below the promised generation level, the % under performance ranging from 9.2% (Vishnuprayag) to 33.26% (Maneri

Bhali II). Maneri Bhali II and Vishnuprayag projects have never generated electricity at the promised levels.

Unfounded conclusions Some of the unfounded conclusions of the report include the following.

- The report concludes (para 11.10.12 page 11-27) that "The socio-economic impacts are positive in all cases". This is shocking, not only because it is untrue, but no plausible basis is given for this statement. This when the report itself says (page 1-14), "This study does not include socio-economic survey of the area, the effect of Hydropower Projects on landscape, livelihood of people living in the area around the hydropower projects…" How then did the report make sweeping conclusion that the socio economic impacts are positive in all cases?

The report says, without any basis that a threshold of *70%* may be fixed for the length of a river that can be either submerged or diverted by hydropower project in a basin! Such unscientific and biased recommendations are a prescription for disaster and an invitation to build as many hydropower projects as possible in any basin.

- The report says (para 11.10.7 page 11-26), "The run of river schemes do not disturb the discharges in a substantial way except that the stretch of the river between the barrage and the power house is bypassed." This is incorrect since the flow pattern even downstream of the power house changes in non monsoon months when the projects try to operate as peaking stations. This has a lot of different impacts on the downstream stretch of rivers, including leading to death of people and cattle and destruction of properties in the downstream areas. The ignorance of the consultant of this seems very strange.
- The conclusion of the report in the same para that "The impact of RoR HPs on aquatic ecosystem is low to medium and localised" is also strange. The aquatic biodiversity in river does not exist in isolation in different stretches, but exists as an integrated process across the basin and when that process is disrupted by a dam and tunnel, it has river basin wide impacts.

On the whole the report by the AHEC of IIT-R is a very shoddy piece of work and needs to be rejected and a credible agency be asked to take up the cumulative impact assessment afresh.

- The report asserts without giving any basis that (p 12-5) "Glaciers are much higher altitudes, upstream and distant to be affected by hydropower projects."
- The report concludes that in case of 22 of the 31 projects assessed, the impact of the project on the cultural and religious places is negligible, which includes all projects on Alaknanda except two. This is a shocking conclusion when Alaknanda projects are slated to destroy all five holy prayags (confluence of rivers). For example the Vishnuprayag project, as the name signifies is one of these five prayags, but its cultural and religious impact is described as negligible. Same is the case with Kotlibhel 1B, which will destroy devprayag.
- The report says (page E-15), "Storage base project provide base load and are operated accordingly." This is completely wrong and shows the ignorance of the consultants about operation of hydropower projects. Storage based project are in fact in better position to provide peak load than run of the river projects that do not have adequate storage capacity. In fact provision of peak load power is supposed to be one of the USP of the storage based HEP.
- The report says life cycle energy ratios for hydropower plans reach values ranging from 170-267 for ROR and 205-280 for reservoirs but no specific reference is given for this (like many other figures), nor is it substantiated with any calculation for Indian conditions. In any case this is not part of the mandate of the report.

Unfounded recommendations The report makes several unfounded, unjustified recommendations.

- The report says that a threshold of 70% may be submerged or diverted by hydropower project in a basin. This is indeed a shocking recommendation. Firstly, no basis is given for this figure of 70%. Secondly, this is a prescription for disaster and invitation to build as many hydropower projects as possible in any basin, since the calculation of the river length is supposed to include the tributaries and some lengths of some of the tributaries may not be suitable for one reason or other in any case, for hydropower projects. Such recommendation shows not only pro hydropower bias of the consultant, it also shows that the consultant lacks the scientific rigour.
- The report says that fish passes, fish ladders and fish lifts can partly restore upstream migration of fish impacted by hydropower projects. But the report is unable to provide a successful attempt to achieve this in Indian conditions.

Misrepresenting the WCD report The report arbitrarily uses 10% of the mean annual flow to be released as environmental flow as a recommendation of the World Commission on Dams. This is misleading and incorrect as WCD report makes no such recommendation. In fact WCD report says, "Targeting particular ecosystem outcomes increasingly results in flow releases that go beyond the historical notion of a 'minimum release', often arbitrarily fixed at 10% of mean annual flow. A minimum release may serve to keep the river wet but it may not be an ecologically effective measure" (p 239). It further says (p 294), "Dams should provide for an environmental flow release to meet specific downstream ecosystem and livelihood objectives identified through scientific and participatory processes."

Moreover, the WCD report says (p 239), "Locally driven processes to establish the objectives of environmental flows will lead to improved and sustainable outcomes for rivers, ecosystems and the riverine communities that depend on them. Ecosystem responses to dam operating regimes are variable, so dam owners should undertake regular monitoring and a five yearly evaluation of environmental performance. This evaluation should inform modification of environmental flows where necessary."

Unfortunately, the IITR report has shown no value for locally driven processes anywhere in its report.

Cut Paste job? The report makes a recommendation (no 21 in section 12.6.6, p 12-9): "Typically, river restoration focuses on surface systems and their longitudinal and lateral connections, whereas the vertical dimension has been largely ignored". This is a bit strange and irrelevant recommendation. More interestingly, this sentence appears word to word in the following document: http://www.jnabs.org/doi/pdf/10.1899/08-017.1.[5]

The IIT R report tries to undermine the issue of GHG emissions from hydro projects by quoting an outdated 1996 report. In the process, it ignores the scientifically established impact of reservoirs emitting methane, it also contradicts reports from MoEF, NEERI, UNFCCC, WCD, UNEP and even the Ganga Basin Management Report that the institute was part of it. Needless to add, it also undermines its own credibility in the process.

However, the report does not refer to this document. This gives rise to a suspicion that portions of the report (like the one cited above) have been used from other documents without giving specific quotes or reference.

Cumulative Impact Assessment in contradiction with Ganga Management Report The IIT Consortium, which includes the IIT-R submitted the Ganga Basin Management report to the National Ganga River Basin Authority in December 2010. The present report does not mention many points which have been mentioned by its (IIT-R) own past report. The Consortium reports states: *"Implementation of these (Run-Of-River and Run-Of-River-(with) Pondage) projects have resulted in significant alteration in hourly, daily and seasonal flows over substantial river length, and in some parts, the river has lost her identity. A substantial part of the river flow is forced through tunnels or has been converted into deep impoundments. An estimated 82 km length of the river in this segment out of total UGS (Upper Ganga Segment) length has been converted into impoundments, major part of the flows has been forced into tunnels. The area under the influence of hydroelectric projects is suspected to undergo decline in its forest cover and experience enhanced landslides. Potential release of green house gases from the impoundments, drying of local water sources and damage to residential structures and moderation in local climate leading to breeding of mosquitoes and other insects, causing health hazards are also reported. The river ecosystem is under stress and the riverine environment tends to shift to lacustrine environment."* These crucial issues do not find mention in the Cumulative Impact Assessment Report.

Conclusion Considering all this, one is forced to request the MOEF to reject this report and ask for a more credible agency to redo the cumulative impact assessment. However, in the meantime, so that the time and resources spent in doing this report are not completely lost, the MoEF should immediately take the following steps in view of the recommendations of this report:

- Ask the project developers of operating projects to start implementing the Environment Flows recommended by the study, only as an interim measure, pending more rigorous assessment. The developers of the under construction projects should be asked to follow the e-flows recommended by this report if the downstream releases recommended in the environment clearance is lower than the eflows recommended by this report. An empowered committee with 50% representation of the local people should be formed for each project to ensure compliance of this.
- The recommendation of the report (no 16 on page 12-25) that "Gap between two consecutive projects along a stream should be sufficient for the river to recuperate itself" needs to be immediately implemented. For this, the MoEF should institute a credible agency to prepare the criteria for assessment of such distances which will be different for different rivers and different stretches of the same river.
- The recommendation of the report (no 25 on page 12-26) that a number of small streams in these basins "are the main contributors of biological production of the main rivers" needs to be implemented and such streams should be declared as no projects zones. The streams identified by the report include Nayar, Birhi Ganga, Bhyunder Ganga, Balganga and Asiganga.
- The installed capacity of a hydropower project should be planned to be in conformity with the water available after satisfying the needs of environmental flow.

However, on the whole the report by the AHEC of IIT-R is a very shoddy piece of work, needs to be rejected and a credible agency be asked to take up the cumulative impact assessment afresh.

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[5] Ecology and management of the hyporheic zone: stream–groundwater interactions of running waters and their floodplains, by Andrew J. Boulton et al, J. N. Am. Benthol. Soc., 2010, 29(1):26–40 by The North American Benthological Society, Published online: 5 February 2010

The Expert Appraisal Committee on River Valley Projects (MOEF) critical of AHEC-IITR report

This committee considered this report in its meeting on June 2, 2011 and some of the observations recorded in the minutes of the meeting show how shoddy this report is even accordingly to this official, statutory committee:

(i) There is no clear cut recommendation on e-flows. E-flows have been computed by five different models viz. Hydrological Index Method, Modified Tenant's Method, Desk Top Approach, Habitat Simulation Methodology, FRANCE and EMC-HMD and results from these models vary tremendously. A clear recommendation should be made regarding the e-flow rate in pre-monsoon, monsoon and post monsoon. The study does not clearly indicate which model to follow for Indian conditions. **Further, the Building Block Method, the model generally used for computing environmental flows in other studies and seems to be near to Indian conditions, has not been used.**

(ii) The figures given for environmental flow in table 7.16 does not include the figures of EMC-FDC (Flow Duration Curve) method given in table 7.14. Instead it has figures by 75% of Q95 method. It is not clear whether table 7.14 is superfluous or 75% of Q95 method should be discarded.

(iii) The conclusion that 30% of the river stretch is available as free flow does not seem to be correct. The Committee had looked into FRL and TWL of each project and found that there is hardly any free river stretch available between the upper most and lower most projects.

(iv) The cross section of the river taken at one place for computing the discharge & e-flow, extrapolating for the project site would result into misleading conclusions.

(v) The study does not take into consideration the flows required in the tributaries as many of the fishes move to these tributaries.

(vi) The environmental flows only take into consideration the depth required for movement of the fish, however, lacks details of the flow requirements at various times of the year and at various stretches. However, environmental flow needs to be maintained for the whole aquatic biota.

(vii) Environmental flows also need to take into consideration the monsoon flows. Ideally, it should mimic the natural river flow. Importance of monsoon flushing also needs to be given equal importance. The monsoon release has to meet the need of the aquatic biota which primarily needs intermittent large flows in this period. The effect of floods in submergence the wet lands which are important habitat need to be analysed.

(viii) The effect of HEPs on primary productivity of the river like fish catch etc. also needs to be studied.

(ix) Around the year study covering different seasonal variations would be required, but the present study represents winter scenario (Nov-Feb) only.

(x) A fast flowing turbulent river with cold temperature also supports some cold tolerant fishes like loaches and snow trouts, hence these species may be present in upper reaches of Alaknanda-Bhagirathi rivers particularly during summers.

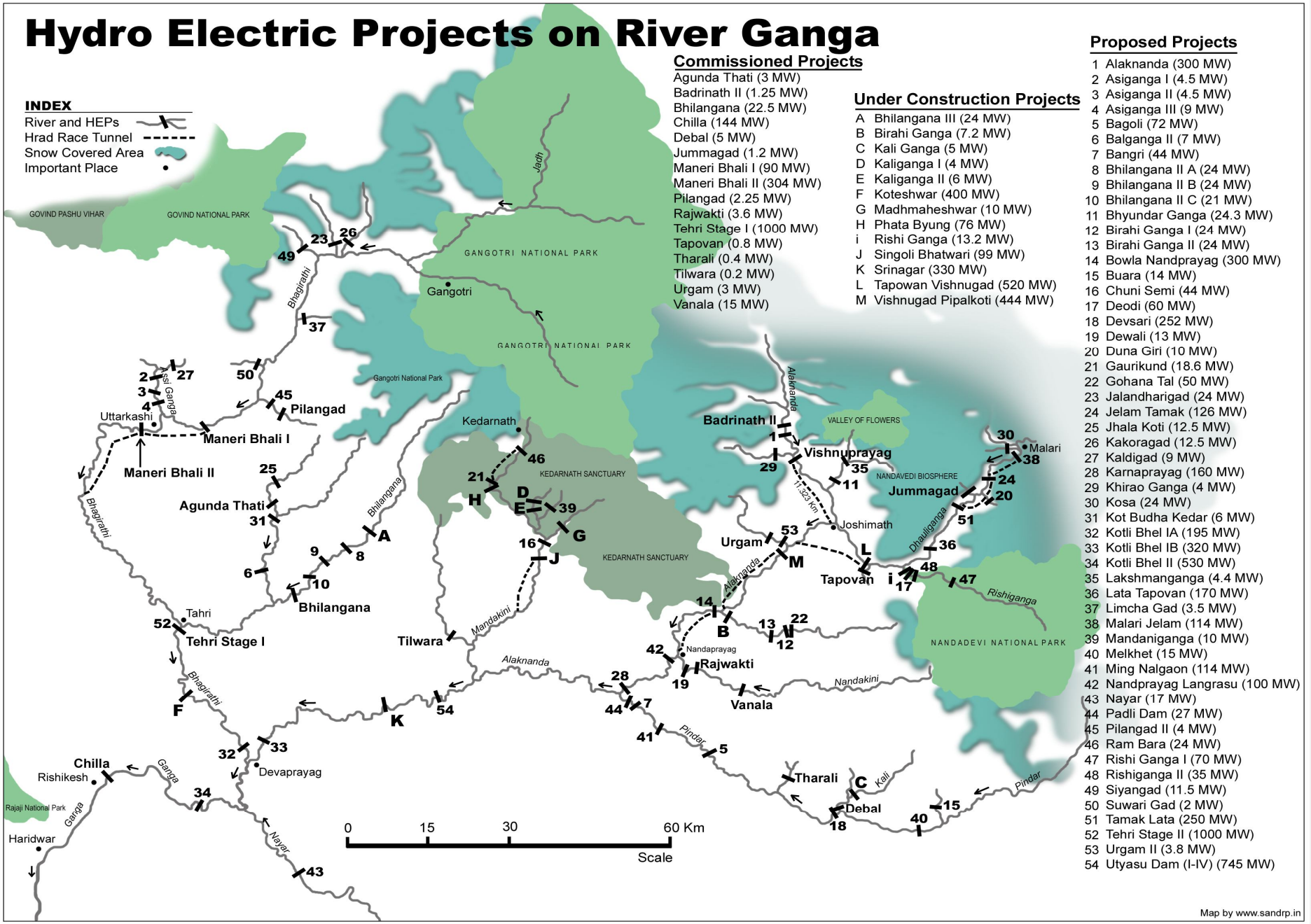
(xi) The available fish diversity, presence of over-wintering/ migratory fishes- mahseer, snow-trout, their body size, presence of breeding and feeding grounds must also be considered in quantifying downstream flow.

(xii) The Garhwal Himalayan waters are reportedly rich in piscine diversity, hence require efforts for conservation.

(xiii) The different life stages and size of the fish should be considered for estimation of environmental flow requirement.

(xiv) There are many sites in the Garhwal region having pristine habitats, esteem religious, aesthetic & tourism importance. Gangotri, Yamunotri, Badrinath and Kedarnath are four top Hindu's religious shrines. Millions of people visit these places every year particularly during summer. The rivers, rivulets & streams traversing through these shrines (or near the roads to these shrines) have high sensitivity. Hence besides e-flow (based on downstream aquatic liabilities) the above points need also be considered for estimation of downstream flow.

(xv) Periphytic assemblage on and underneath the bed rocks, boulders, cobbles forms an important food material for snow-trouts, and some other hill stream fishes, hence need also to be studied under CIA.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Maneri Bhali I (90 MW)
Maneri Bhali II (304 MW)
Pilangad (2.25 MW)
Rajwakti (3.6 MW)
Tehri Stage I (1000 MW)
Tapovan (0.8 MW)
Tharali (0.4 MW)
Tilwara (0.2 MW)
Urgam (3 MW)
Vanala (15 MW)
Under Construction Projects
A Bhilangana III (24 MW)
B Birahi Ganga (7.2 MW)
C Kali Ganga (5 MW)
D Kaliganga I (4 MW)
E Kaliganga II (6 MW)
F Koteshwar (400 MW)
G Madhmaheshwar (10 MW)
H Phata Byung (76 MW)
i Rishi Ganga (13.2 MW)
J Singoli Bhatwari (99 MW)
K Srinagar (330 MW)
L Tapowan Vishnugad (520 MW)
M Vishnugad Pipalkoti (444 MW)
Proposed Projects
1 Alaknanda (300 MW)
2 Asiganga I (4.5 MW)
3 Asiganga II (4.5 MW)
4 Asiganga III (9 MW)
5 Bagoli (72 MW)
6 Balganga II (7 MW)
7 Bangri (44 MW)
8 Bhilangana II A (24 MW)
9 Bhilangana II B (24 MW)
10 Bhilangana II C (21 MW)
11 Bhyundar Ganga (24.3 MW)
12 Birahi Ganga I (24 MW)
13 Birahi Ganga II (24 MW)
14 Bowla Nandprayag (300 MW)
15 Buara (14 MW)
16 Chuni Semi (44 MW)
17 Deodi (60 MW)
18 Devsari (252 MW)
19 Dewali (13 MW)
20 Duna Giri (10 MW)
21 Gaurikund (18.6 MW)
22 Gohana Tal (50 MW)
23 Jalandharigad (24 MW)
24 Jelam Tamak (126 MW)
25 Jhala Koti (12.5 MW)
26 Kakoragad (12.5 MW)
27 Kaldigad (9 MW)
28 Karnaprayag (160 MW)
29 Khirao Ganga (4 MW)
30 Kosa (24 MW)
31 Kot Budha Kedar (6 MW)
32 Kotli Bhel IA (195 MW)
33 Kotli Bhel IB (320 MW)
34 Kotli Bhel II (530 MW)
35 Lakshmanganga (4.4 MW)
36 Lata Tapovan (170 MW)
37 Limcha Gad (3.5 MW)
38 Malari Jelam (114 MW)
39 Mandaniganga (10 MW)
40 Melkhet (15 MW)
41 Ming Nalgaon (114 MW)
42 Nandprayag Langrasu (100 MW)
43 Nayar (17 MW)
44 Padli Dam (27 MW)
45 Pilangad II (4 MW)
46 Ram Bara (24 MW)
47 Rishi Ganga I (70 MW)
48 Rishiganga II (35 MW)
49 Siyangad (11.5 MW)
50 Suwari Gad (2 MW)
51 Tamak Lata (250 MW)
52 Tehri Stage II (1000 MW)
53 Urgam II (3.8 MW)
54 Utyasu Dam (I-IV) (745 MW)
GOVIND PASHU VIHAR
GOVIND NATIONAL PARK
GANGOTRI NATIONAL PARK
Gangotri
Jadh
Bhagirathi
Gangotri National Park
Asi Ganga
Uttarkashi
Maneri Bhali I
Maneri Bhali II
Pilangad
Agunda Thati
Bhilangana
Kedarnath
KEDARNATH SANCTUARY
Tahri
Tehri Stage I
Bhilangana
Tilwara
Mandakini
Alaknanda
Nandaprayag
Rajwakti
Vanala
Nandakini
Pindar
Chilla
Rishikesh
Ganga
Rajaji National Park
Haridwar
Devaprayag
Nayar
Badrinath II
VALLEY OF FLOWERS
Vishnuprayag
Malari
Jummagad
NANDAVEDI BIOSPHERE
11-323 km
Joshimath
Dhauliganga
Urgam
Tapovan
Rishiganga
NANDADEVI NATIONAL PARK
Tharali
Kali
Debal
0 15 30 60 Km
Scale
Map by www.sandrp.in