To,
Executive Secretary, The Inspection Panel
1818 H Street, NW, Washington, DC 20433, USA

Sir:

Kindly find attached a request for Inspection of the Loan to THDC India Limited for the Vishnugad Pipalkoti Hydro Electric Project.

The following documents are attached, please.

Sl No	Details	Page Nos
1	Request from [redacted] and others in Hindi.	2-4
2	English translation of request from [redacted] and others	5-7
3	Request from Bharat Jhunjhunwala.	8-9

We bring to your kind notice that we have had a long exchange with officials of the World Bank in regard to this loan. We had submitted a representation to Ms Isabel Guerrero, VP, South Asia, WB in March 2012 attaching therewith copies of earlier exchanges with the WB officials. We have received a reply to this representation from WB Officials in June 2012. However, the reply only re-states the positions taken in earlier exchanges hence we are not giving a point-wise rejoinder to this reply. These documents are attached for your kind perusal, please.

Sl No	Details	Page Nos
4	Representation submitted to Ms Isabel Guerrero, VP, South Asia, WB, March 2012.	10-189
5	Reply received from WB to above representation dated May 22, 2012.	190-199

Needless to say, we are not satisfied with the reply given by WB officials and we request the Inspection Panel to make an inspection of this loan, please.

Yours truly,
Bharat Jhunjhunwala
Address: Lakshmoli, PO Maletha, Kirti Nagar, 249161 India
Phone: +91-99171-44777 Email: bharatjj@gmail.com

श्रीमान कार्यकारी सचिव

निरीक्षण पैनल

1818 एच स्ट्रीट, एन डब्ल्यू, वाशिंगटन, डी सी 20433, यू एस ए

मान्यवर,

इस पत्र को भेजने वाले हम और वे जिनका हम प्रतिनिधित्व करते है, उत्तराखंड के चमोली जिले में अलकनंदागंगा के किनारे रहते है। हम सभी विष्णुगाड–पीपलकोटी जलविद्युत परियोजना से प्रभावित होने वाले है। हम नही चाहते की हमारी अलकनंदागंगा को सुरंग में डाला जाये या उसे किसी भी तरह बांधा जाये। चूंकि:–

- अलकनंदागंगा के मुक्त बहाव से मिलने वाले सुख का आकलन नहीं किया जा सकता है। इसका आकलन भी बांध प्रयोक्ता ने नही किया गया है।
- अलकनंदागंगा पर बांध से अनेक लाभ छीन जायेंगे जैसे की नदी से मिलने वाली मछली व बालू आदि।
- अलकनंदागंगा को टनल में डालने से पानी की पत्थरों के साथ रगड़ समाप्त हो जायेगी और नदी के पानी के विषेष गुण समाप्त हो जायेंगे।
- अलकनंदागंगा पर वर्तमान में कार्यरत विष्णुप्रयाग जलविद्युत परियोजना से जलीय जैविक विविधता पर दुष्प्रभाव के कारण पड़ रहा है। जरुरत तो विष्णुप्रयाग परियोजना को हटाकर जैवविविधता को बचाना है ना कि नये बांध बनाकर जैवविविधता नष्ट किया जाये।
- इस बांध के कारण चीर फीजेन्ट के जीवन पर असर पड़ रहा है जोकि लुप्तप्राय पक्षी है।
- बांध से विद्युत उत्पादन के लिए कभी भी नदी का पानी छोड़ा जाता है। जिससे नदी में पानी का प्रवाह भी अनिश्चित हुआ है। कितने भी नियम कानून बनाये जाये पर वास्तविकता यह है कि नदी में पानी विद्युत उत्पादन के अनुसार छोड़ा जाता है।
- इस बांध में पर्यावरणीय बहाव की मात्रा न्यूनतम रखी है। अलकनंदागंगा की वर्तमान स्थिति को बरकरार रखने के लिये कितना पानी छोड़ना चाहिये इसका आकलन नहीं किया गया है।
- इसे बैराज़ के कारण पानी में गाद रूक जायेगी और नीचे मछली आदि जलीय जन्तुओं आदि के पेट भरने को यह उपलब्ध नहीं होगी।
- सुरंग परियोजनाओं में जहां से नदी को सुरंग में डालते हैं फिर बिजलीघर तक, जहां से पानी बाहर निकलता है, वहां तक नदी तल सूखा रहता है या बहुत ही कम पानी रहता है। इससे जलीय जन्तुओं पर विपरीत प्रभाव पड़ेगा।
- स्थानीय लोगो का नदी पर अधिकार नही बच रहा है। धार्मिक व सांस्कृतिक कार्यों जैसे स्नानपर्व, दाह–संस्कार, नदी–पूजन आदि के लिए नदी में पानी नहीं रहता। सूखी नदी के कारण, नदी के किनारे रहने वालों को खासकर पशुपालकों को पानी नहीं मिलेगा।

- पूरी नदी घाटियों में सुरंगें बनने से पहाड़ कमजोर हो रहे हैं। जिससे भूस्खलन बढ़े हैं। इस परियोजना में बनने वाली सुरंग से भी यही होने वाला है।
- सुरंग परियोजनाओं में सुरंग निर्माण हेतु किये जाने वाले विस्फोटों के कारण जल स्रोत सूख रहे हैं। इसका कोई भी हल नही होता। हाट गांव के हरसारी तोक में लगभग 6 स्त्रोत सूख गये, पर इस पत्र के लिखने तक कोई वैकल्पिक व्यवस्था नही की गई।
- सुरंग के ऊपर के मकानों में दरारें पड़ रही हैं जिसके कारण मकान कमजोर हो जाते हैं और हल्के भूकंप से भी गिर जाते हैं। भूमि में भी दरारें पड़ जाती है। इन सबका कोई मुआवजा नही मिलता है। हाट गांव के हरसारी तोक के ही कई मकानों व जमीन मे दरारे पड़ी पर इस पत्र के लिखने तक कोइ उचित व्यवस्था नही की गई।
- अलकनंदागंगा पर एक के बाद एक बन रहे बांधों के आपसी गुणात्मक प्रभाव नकारात्मक हो रहे हैं। जिनका कोई अध्ययन भी नही हो रहा है।
- बांध परियोजना कार्यों से उठी धूल के कारण पशुओं के चारे खराब होते हैं। विस्फोटकों की धूल व मिट्टी से क्षेत्र का चारा व खेती खराब हो जाती है। वन क्षेत्रों पर भी दूर तक नकारात्मक प्रभाव पड़ते हैं।
- इस परियोजनाओं के बनने से बहती नदी का पानी झील में बदल जायेगा है। झील जिस भी आकार की हो उसके जल में आक्सीजन की मात्रा घट जाती है।
- इस परियोजना के कारण उत्तराखंड मे जीव जन्तुओं पर भी बुरा असर पड़ा है। टिहरी झील के कारण बंदरो, सुअर, भालू व बाघ आदि का प्रकोप आबादी वाले इलाको में बढ़ा है। झील यहां भी बनेगी।
- इस परियोजना की झील से धुंध, बिमारियां व झील के ऊपर की भूमि पर बुरे प्रभाव पड़ते हैं।
- चूंकि उत्तराखंड राज्य हिमालय के मध्य में है। यहां का वातावरण अपेक्षाकृत ठंडा ही रहता है। इन बांधों के कारण जो वन क्षेत्र कम हो रहा है उससे गर्मी बड़ी है जिसने वैश्विक गर्मी को भी बढ़ावा दिया है। इस बांध के जलाशय से भी मीथेन गैस का उर्त्सजन होगा जिससे भी वैश्विक गर्मी बढेगी। ग्रीन हाऊस गैसों में, संसार में जलाषयों से पैदा होने वाले कुल उत्पादन में भारत के जलाषयों से 17 प्रतिशत की बढ़ोत्तरी होती है। इन जलाषयों में बांधों के जलाषय भी है।
- बांधों की वजह से यहां जो गर्मी बढ़ी है। उसका स्थानीय फसलों व फलों पर ज्यादा बुरा असर पड़ता है।
- निर्माण में लगे हजारों लोग एक ही स्थान पर रहते हैं। जिससे प्रतिदिन की गंदगी व विभिन्न बीमारियां बढ़ती हैं। अनियोजित तरीके आने वाले कामगारो के कारण स्थानीय समाज, वन, पर्यावरण पर भी बुरा असर पड़ता है।
- संस्कृति और महिलाओं की स्वतंत्रता पर सबसे बुरा असर पड़ता है। जिसका कोई मुआवजा नही हो सकता है।

- उत्तराखंड 4–5 स्तर के भूकंप संवेदनशील क्षेत्र में आता है। जो अत्याधिक खतरे वाला क्षेत्र माना गया है। राज्य में भूकंपों से हजारों लोग मारे जा चुके हैं। इतने सारे बांधों के निर्माण से भूकंप का खतरा और बढ़ेगा। यह वैज्ञानिक तथ्य है कि बांधो से भूकंप आते है। बांधों से भूंकपों की तीव्रता बढ़ती है। हम अलकनंदागंगा घाटी में क्यों इसे आमंत्रण दे?
- बांध की पर्यावरणीय जनसुनवाईयां पूरी तरह धोखा साबित हुई है। लोगो को ना कोई जानकारी दी जाती ना ही उनके विरोध को मान्य किया जाता है। ये पूरी तरह सिद्ध हो चुका है। यहां हुई दोनो जनसुनवाईयों में यह साबित हुआ है।
- पूर्ववर्ती बांधो से कोई सबक नही लिया जा रहा है। यह परियोजना गरीब के प्राकृतिक संसाधनों को अमीर को हस्तान्तरित करती है। परियोजना से होने वाले अन्य पर्यावरणीय दुष्प्रभाव स्थानीय लोगों को झेलने पड़ेंगे। उत्पन्न बिजली शहरों कों चली जाती है। समग्र आकलन नहीं किया गया है कि स्थानीय लोगों को कितनी हानि और लाभ हुआ है।
- इस परियोजना का विभिन्न तबको पर किस प्रकार का अलग–अलग असर होगा इसका आकलन भी नही किया गया है।

इसलिये हम चाहते है कि इस परियोजना को विश्व बैंक पैसा ना दे। पर्यावरण और लोकहित में यह परियोजना बंद होनी चाहिये।

हस्ताक्षरकर्ताओं के नाम व पते कृपया उजागर ना किये जाये।

हस्ताक्षरकर्ता

[redacted]

The Inspection Panel has removed the names of the signatories of this Request for reasons of confidentiality.

[redacted]

To,
Executive Secretary, The Inspection Panel
1818 H Street, NW, Washington, DC 20433, USA

Sub: Request for Inspection of WB Loan to Vishnugad-Pipalkoti hydroelectric project (Report No: 50298-In: Proposed Loan In The Amount Of US$ 648 Million to THDC India Limited with the Guarantee of the Republic of India For The Vishnugad Pipalkoti Hydro Electric Project, June 10, 2011)

Sir,

This letter is being sent by us and the local people affected by the Vishnugad-Pipalkoti people whom we represent. These are the people of Chamoli District who live on the banks of the river Alaknanda-Ganga. We are all going to be affected by the Vishnugad – Pipalkoti Hydro-electric Project. We do not want our river to be diverted or controlled in any way. This is because –

• The joy of a free-flowing river cannot be measured. This has not been estimated by the dam users.

• The dam will reduce the benefits people have from the river. For example, the fish and sand got from the river will no longer be available.

• With the river being diverted into a tunnel, the water is no longer freely flowing past the rocks and stones. This is robbing the water of its special qualities.

• The Vishnugad Hydro-electric Project will have negative impact on the aquatic biodiversity. The need is to save this biodiversity by removing the existing dams and not to create more dams.

• The dam is also affecting the life of the endangered bird ‘Cheer Pheasant’

• River water will be released at any time of the day for generation of electricity. This makes the water current in the river uncertain and often causes deaths downstream. This has also led to landslides making the rim very dangerous. No matter how many rules are made, the truth is that water is released according to the needs of the project.

• The dam has kept the environmental flow of the river at a minimum. The accurate environmental flow required for the river has not even been estimated.

• Silt getting collected in the reservoir is a common problem with dam projects. With many dams being constructed, silt from one reservoir washes ahead and gets collected in the next reservoir. This affects the aquatic life and local temperatures adversely.

• In Run-off-the river projects, all the way from where the river is pushed into the tunnel till it resurfaces at the Power House, the river basin is either dry or has very little water in it. This also affects aquatic life adversely.

• The rights of the locals on rivers have not been protected. There is no river water available for religious and cultural rituals like bathing festival, funeral rites, river worship, etc. Due to dry rivers, the people who live on the river banks, especially cattle herders, do not get enough water.

• The mountains are weakening due to the digging of tunnels in the whole river valley. An increase in landslides in the region, are a direct consequence of this. The tunnel being built for this project will also have the same consequences.

• Due to the explosions caused by digging of tunnels in Run-off-the river projects, the sources of water are drying up. In most cases no solution is provided by the project proponent. In a Harsari Tok of village Haat, 6 sources of water have already been affected but till the time this letter was written, no alternative system for providing water to the affected people has been created.

• Cracks appear in the houses under which the tunnel passes. As a result of this, the houses become weak and collapse in very light earthquakes. Cracks appear in the land also. No compensation is paid for this. In the same Harsari Tok of village Haat many houses have developed cracks but till the time this letter was written, no action had been taken

• The effects of building one dam after another on the same river has created several negative impacts. However, no cumulative impact assessment study has been done.

• Due to the dust arising from the dam construction site, fodder for animals is getting destroyed. This is also affecting agricultural land and the forest cover of the state.

• With the coming of these projects, the flowing water of the river changes into stagnant reservoir water that reduces the oxygen quantity in the water. Tehri reservoir water is said to be unfit for drinking.

• Fauna have also been adversely affected because of these projects in Uttarakhand. The Tehri Dam reservoir has caused the destruction of the natural habitat of several species. Hence, the terror of monkeys, pigs, bears and tigers has increased in populated areas.

• The reservoir made by this project also causes fog and diseases. It also negatively affects the land around the reservoir.

• Since Uttarakhand is in the middle of the Himalayas, its environment remains comparatively cooler. The deforestation caused by the building of dams has led to an increase in temperature which is also contributing to the problem of global warming. The emission of methane gas here will also add to the problem. If we look at the emission of green house gases from reservoirs in the world, India’s share has gone up by 17%. Reservoirs created by dams are a part of this problem.

• The rise in temperatures due to the dams is also affecting local crops and plants.

• Thousands of people are engaged in construction work. They live in the same place. The dirt and unhygienic conditions has resulted in an escalation in the spread of diseases. Since most of the workers are immigrants, this movement of people also has an effect on the local culture, and environment for which there can be no compensation.

• The local culture and women's freedom are the worst affected. There can be no compensation for this.

• On the Richter scale, Uttarakhand comes in the IV & V seismic zone. This is considered a high-risk zone. Thousands of people have been killed as a result of these earthquakes. It is a known fact that the risk of earthquakes increases with the building of so many dams. Dams also increase the magnitude of earthquakes. Why are we inviting trouble in the Alaknanda Ganga Valley?

• The Public Hearings under the Environment Protection Act are a complete sham. The people are not given any information. Their opposition is not taken into account. This is what happened at both the hearings in the valley.

• We have not learnt any lessons from dams built earlier. These projects transfer access of natural resources from the hands of the poor to the rich. The local people also have to bear the negative impact of such projects on the environment while the electricity reaches the urban centres. There has not been any overall assessment of the impact on the local people.

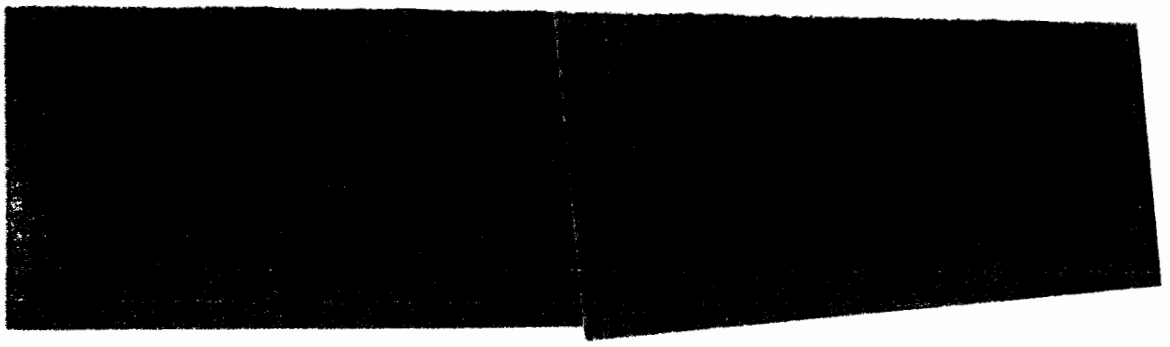
• The impact of the project on different stakeholders has not been assessed.

It is due to all these reasons that we do not want the World Bank to extend financial support to this project. This project should not be financed for environmental reasons and in public interest.

We request you to kindly not disclose the names and address of the signatories.

Signatories:

The Inspection Panel has removed the names of the signatories of this Request for reasons of confidentiality.



DR BHARAT JHUNJHUNWALA, PhD (Florida)

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Phone: 99171-44777; Email: bharatjj@gmail.com

July 23, 2012

The Inspection Panel,

The World Bank

Washington

Sir:

I request that an inspection may kindly be carried out of the loan granted by World Bank to Vishnugad-Pipalkoti hydroelectric project for the following reasons:

1 I live downstream of the project and I am directly impacted by the project in following ways: (1) Deterioration of water quality; (2) Global warming due to methane emissions; (3) Loss of aesthetic, non-use spiritual and cultural values of the River Alaknanda. These huge costs have been ignored by officials of the World Bank under the pretext that 'robust' estimates for these values are not available. The Officials forget, however, that assuming these values to be zero is also tantamount to using an equally fickle value. The only logical recourse was to use a best-estimate which the WB Officials have persistently refused to use.

2 The primary mandate of the World Bank is poverty alleviation. In my assessment, this project does exactly the opposite. The environmental costs are imposed on poor people while benefits from generation of electricity are harvested by the rich people living in the cities. WB Officials harp on the fact that certain mitigation measures are in place but they have not made any study of the *value* of environmental costs imposed on poor people and the *value* of the benefits from the mitigation measures. As a result huge costs are being imposed on poor people in the name of unverified gains.

3 The economic gains from electricity are grossly overvalued as explained in detail in our representation to Ms Guerrero. WB officials have not even replied to this point in their reply of May 22, 2012.

I request the Inspection Panel to inspect this loan and not allow World Bank money to be used against its mandate.

Yours truly,

Bharat Jhunjhunwala

Representation to Ms. Isabel Guerrero, Vice President, South Asia Department, World Bank on violation of Operational Policies in grant of loan to THDC India for Vishnugad-Pipalkoti Hydro Electric Project

By

Prof Varun Arya, Formerly President, IIT Delhi Alumni Association

Kisor Chaudhuri, FRGS, Biogeographer, Haridwar; Phone: 9458947930

Sudarshan Chhotoray, Film Maker, Bhubaneswar

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2	Critique of World Bank's Project Appraisal Document for Vishnugad Pipalkoti Hydro Electric Project dated June 10, 2011, August 30, 2011 by Bharat Jhunjhunwala
3	Rejoinder to "Responses to recent emails from Mr Bharat Jhunjhunwala" dated November 23, 2011.
4	Critique of Study of Cumulative Impacts of Hydropower projects on Ganga River by AHEC, IIT, Roorkee and WII, Dehradun, by Bharat Jhunjhunwala, August 31, 2011
5	Paper on "Comprehensive assessment of environmental and economic costs of electricity generation is necessary" by Bharat Jhunjhunwala
6	Supreme Court judgment on Tehri hydroelectric project
7	Notice by local people cancelling agreement with THDC
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9	Purchase of electricity by Uttarakhand Power Corporation, 2010

Introduction

The World Bank has approved a loan of USD 648 Million to THDC India Limited for supporting the 440 MW Vishnugad-Pipalkoti Hydro Electric Project (VPHEP). This document raises grievance of the affected people before the authorities of the World Bank. It is submitted that the loan has been sanctioned without accounting for various negative externalities of the project and will lead to poverty generation instead of poverty alleviation.

Several Operational Policies of the World Bank have been violated in sanctioning the loan. These violations are detailed in this document.

We had sent two representations to WB Staff in July 2011 and August 2011. We have met Mr Roberto Zhaga, Country Representative of WB in India in August 2011 and subsequently gave another representation which is annexed to this representation at Annexure 2. We have received a reply in November 2011. We have given rejoinder to this reply on December 19, 2011 which remains unreplied till date. Subsequently we have met Mr Hubert Nove-Josserand at World Bank Delhi office. However, it seems that WB Staff have not taken the objections on board and are continuing with disbursement of the loan. Hence, we are making this representation to WB Head Office.

Our main complaint is that externalities have not been factored in, impact on biodiversity has been ignored and the economic analysis overvalues the benefits of the project. These concerns are shared by a large number of local leaders, activists and citizens, who support this petition.

We would be grateful for you to order a thorough review of the loan and immediately stop disbursement till our objections are taken on board.

Externalities

The Project Appraisal Document[1] ignores several externalities which affect the people negatively.

1. Water quality

The negative impacts of the project on Water Quality have been ignored. Millions of people take bath in the Ganga River and carry small bottles of water to their homes. Water of the Ganga River is known to have special bactericidal qualities, beneficent radioactivity, high levels of copper and chromium, coliphages and special molecular structure which has psychological impact on the bather. Water of the river is known to remove pollutants much faster than other rivers. These special qualities of the water are in part due to the chemical, bacteriological and molecular structure of the water. IIT Roorkee has given data of water quality upstream and downstream of the Vishnu Prayag project which is of similar capacity and structure and located immediately upstream of the Pipalkoti project being financed by the WB. These are given below.

Table 1: Impact of Vishnu Prayag Hydro Electric Project on Quality of Water

[1] Report No 50298-IN Titled "Project Appraisal Document on a Proposed Loan in the Amount of US$ 648 Million to THDC India Limited with the Guarantee of the Republic of India for the Vishnugad Pipalkoti Hydro Electric Project, June 10, 2011.

Sl No	HP	Temperature	pH	Dissolved Oxygen	Conductivity	Total Dissolved Solids	Turbidity	Nitrates (NO3-N)	Biological Oxygen Demand	Fecal Coliforms
5	Vishnu Prayag u/s	6.6	7.6	8.92	81.4	38.3	1.2	2.14	1.8	39
5	Vishnu Prayag d/s	8.9	7.8	9.04	192.8	94.9	1.1	3.4	1.6	21
	Change	-2.3	-0.2	-0.12	-111.4	-56.6	0.1	-1.26	0.2	18
	Change (%)	-34.8%	-2.6%	-1.3%	-136.8%	-147.8%	8.3%	-58.9%	11.1%	46.1%
	Severe?	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes

Source: Assessment of Cumulative Impact of Hydro Electric Projects on Alaknanda-Bhagirathi Basins, Alternate Hydro Energy Center, Indian Institute of Management, Roorkee, India, 2011.

It is seen that there is severe impact on temperature, Conductivity, TDS, NO3, TP and Fecal Coliform. Reduced temperature means that fish and fungi that require a particular temperature regime may not survive. Reduced conductivity, Total Dissolved Solids and Nitrates mean that dissolved salts have been removed from water. Users of water will not get these salts. Increase in turbidity means that light will not penetrate and aquatic life will be negatively affected. Increased Biological Oxygen Demand means that dead organic matter has increased. Increased fecal coliforms are harmful to human health.

The negative impact of VPHEP will be similar as the project is similar in capacity and structure to Vishnu Prayag. VPHEP is 440 MW against 400 MW for Vishnu Prayag. Both have a barrage and diversion tunnel.

In response to our earlier communications WB staff has contended:

> *One can postulate costs and benefits that cannot be appropriately quantified and are therefore not considered sufficiently robust for inclusion in the cost-benefit analysis. It is important to use only robust data as the results of any analysis can be influenced (in either direction) by inclusion of variables for which no robust data are available. The results of this conservative analysis, including sensitivity analysis, indicate that VPHEP is an economically viable project.*
>
> *This comment refers to the operating Vishnuprayag HEP of which the World Bank has no specific knowledge. However, we note that this project is near the largest population center in the area and the greater population in the vicinity of this project is presumably influencing the values noted for the specific variables (***Annexure 3***).*

We submit that ignoring these costs merely because 'robust' data is not available is violation of OP 4.02 - Environmental Action Plans. Para 4.02.2 of the OP states:

> *An EAP (Environmental Action Plan) describes a country's major environmental concerns, identifies the principal causes of problems, and formulates policies and actions to deal with the problems. In addition, when environmental information is lacking, the EAP identifies priority environmental information needs and indicates how essential data and related information systems will be developed.*

Therefore, it was necessary for World Bank staff to require that relevant data be collected. In this case, the actual impact on water quality will be known only after the project has been commissioned and damage to water quality has been done. One way to avoid this is to examine data from similar project. The World Bank Staff have made a grave error by not factoring in the data available from similar projects.

A related issue is of sediments. In response to our earlier communication WB Staff has contended that the quality of water of the river is largely influenced by the sediments. These sediments will continue to be released through the spillway system. This argument ignores the impact of the project on *creation* of sediments. The sediments are created by mechanical weathering when fast flowing river water rubs against the stones. Diverting most water through tunnels will remove this weathering and reduce creation of the sediments. WB Officials have not taken this factor into account.

We appreciate the difficulty of accurately quantifying certain costs and benefits. However, given the early stage of our knowledge and data on some of these, very large impacts could be missed by ignoring them completely. These costs are so huge that the adverse impact on people may far outweigh the positive impacts due to electricity generation. Solution to this difficult problem is not to ignore it—this is where citizens of India expect the World Bank's leadership to take charge and challenge the established methodology. We are very happy to help the WB in finding proxies, and alternative methods to value the as yet unquantified cost-benefits of these projects, but ignoring these costs may be a serious error.

2. Aesthetic, cultural and existence value of river

The Ganga River is worshipped as a living Deity by millions of people. These people obtain a huge aesthetic, non-use and existence value from free flow of the river. Non-use value refers to the satisfaction or utility obtained by people from the knowledge that a particular resource exists even though they may not use the resource. People of India derive satisfaction from knowing that River Ganga is flowing freely. This value will be reduced by the Pipalkoti project. We have undertaken a quick study of these values and found a large value. Copy of our study is attached at **Annexure 1**.

In response to our earlier communication, WB officials have contended:

> *Specifically as concerns your observations on the aesthetic value of the river, this is an example of a value that can be posited but which is difficult to measure with existing data or contingent valuations methods in general. This value is above (exogenous to) the project level and, therefore, more appropriately reviewed in a higher level decision-making process that examines the relative costs and benefits of river basin development versus non-development (***Annexure 3)***.*

Our communication to WB staff is placed at **Annexure 2.** The response of WB Staff, including rejoinder to the response given by us, is placed at **Annexure 3.**

In making this statement, WB Officials have violated the following OPs:

Table 2: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	4.00 Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	G2. As part of the EA, as appropriate, conduct field based surveys, using qualified specialists.	The environmental damage has been ignored instead of undertaking surveys
2	Ditto	G3. Consult concerned government authorities, relevant non-governmental organizations, relevant experts and local people in documenting the presence and significance of Physical and Cultural Resources, assessing the nature and extent of potential impacts on these resources, and designing and implementing mitigation plans.	Relevant NGOs and experts have not been consulted. In the main, local contractors who are direct beneficiaries of the project have been consulted.
3	OP 4.02 - Environmental Action Plans	2. An EAP describes a country's major environmental concerns, identifies the principal causes of problems, and formulates policies and actions to deal with the problems. In addition, when environmental information is lacking, the EAP identifies priority environmental information needs and indicates how essential data and related information systems will be developed.	WB Staff has ignored the problem of aesthetic value instead of formulating policy to deal with it. It has failed to collect relevant data on use- and non-use values.
4	OP 4.04, Annex A - Definitions	1 (a) All natural habitats have important biological, social, economic, and existence value. (There is specific mention of rivers here.)	The existence value has been ignored even though specifically enjoined by OP 4.04.
5	Ditto	1 (b) Critical natural habitats are: … areas initially recognized as protected by traditional local communities (e.g., sacred groves)…	River Ganga is a critical natural habitat because it is recognized as sacred by millions of Indian people but WB staff has not taken this into account.

6	Ditto	1 (e) Appropriate conservation and mitigation measures remove or reduce adverse impacts on natural habitats or their functions, keeping such impacts within socially defined limits of acceptable environmental change. Specific measures depend on the ecological characteristics of the given site. They may include full site protection through project redesign;	The adverse impact on the river can be greatly minimized by making a partial obstruction instead of a barrage and allowing free flow of a socially acceptable amount of water as environmental flow. WB Staff have not fully considered this alternative. They have also not looked at what is the socially defined limit of water diversion. They have instead blindly relied on a study by Indian Institute of Technology, Roorkee. The said study has been severely criticised by us as well as other academicians. Copy of our critique is attached at **Annexure 4**.
7	OP 10.04 - Economic Evaluation of Investment Operations	3. Consideration of alternatives is one of the most important features of proper project analysis throughout the project cycle.	The alternative of making a partial obstruction has not been examined.

WB officials have also ignored that a robust methodology for assessing 'non-use values' has been developed and used to decommission the Elhwa Dam in Washington, USA. Such estimates are available in studies done by Planning Commission of India. The economic value of three national parks has been assessed by the Planning Commission using this methodology. The Commission has worked out the following values for benefits on 'willingness to pay' basis.

Table 3: Willingness to pay for maintaining national parks

Intangible benefit	Annual value	Location
Recreation/Eco-tourism	Rs 427 and Rs 519 per Indian Visitor (two estimates)	Keoladeo National Park, Bharatpur
Eco-tourism	Rs 35 per local visitor	Kalakadu Mundanthurai Tiger Reserve, Tamil Nadu
Eco-tourism	Rs 9.5 per local visitor	Periyar Tiger Reserve, Kerala

Source: Mathur (2003), Archana S And Arvinder S Sachdeva, Towards An Economic Approach To Sustainable Forest Development, Perspective Planning Division, Planning Commission, Government Of India, November 2003, Working Paper Series, Paper No. 2/2003-PC.

WB officials have further contended that they believe that Government of India has taken this aspect into account:

> *We believe that Government of India has carried out this process in its various deliberations with respect to the Bhagirathi and Alaknanda basins (as reflected in the corpus of studies and consultations carried out and negotiations with the State Government of Uttarakhand), parts of which are being developed for hydropower generation* (**Annexure 3).**

We submit that Government of India has not undertaken such a study. The recent study undertaken by IIT Roorkee, which was commissioned by Ministry of Environment and

Forests for the purpose of determining whether any restrictions need be placed on dams on the River Ganga, also has not made an effort to estimate non-use and existence values.[2] The study has wholly relied on anecdotal evidence to conclude that the non-use value will not be adversely affected. We are attaching our detailed critique of the IIT study for your perusal at **Annexure 4**. We submit that WB official have violated following OPs in relying on this study:

Table 4: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	4.00 Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	G2. As part of the EA, as appropriate, conduct field based surveys, using qualified specialists.	Survey of non-use value has not been undertaken.
2	9.0 A NEW INSTRUMENT TO ADVANCE DEVELOPMENT EFFECTIVENESS: PROGRAM-FOR-RESULTS FINANCING (DRAFT)	4(d) Provides assurance that Bank financing is used appropriately and that the environmental and social impacts of the program are adequately addressed. The Bank will assess the program's fiduciary and environmental and social management systems and, as necessary, will agree with the government on additional measures needed to provide reasonable assurance that the loan proceeds are used for program expenditures, that these expenditures are incurred with economy and efficiency, and that affected people and the environment are protected.	The responsibility of assuring that the affected people and environment are protected rests with the WB Staff. This responsibility is not discharged by blind reliance on a study commissioned by the Ministry of Environment and Forests and which has been criticized (Please see **Annexure 4**).

3 Biodiversity

The Pipalkoti project will have a negative impact on biodiversity—especially aquatic biodiversity. A study was commissioned by Ministry of Environment and Forests to Wildlife Institute of India to assess the impact of hydropower dams on aquatic biodiversity. The study has given following biodiversity scores:

Table 5: Biodiversity values calculated by Wildlife Institute of India

Sl	Project	Location	Biodiversity Value (Score)
1	Kotlibhel 1B	About 100 km downstream	18
2	Vishnugad-Pipalkoti	Project financed by WB	08
3	Alaknanda-Badrinath	About 50 km upstream	17

2 Assessment of Cumulative Impact of Hydro Electric Projects on Alaknanda-Bhagirathi Basins, Alternate Hydro Energy Center, Indian Institute of Management, Roorkee, India.

Source: Table 6.1, Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity in Alaknanda and Bhagirathi Basins, Uttarakhand, Wildlife Institute of India, May 2011.

In our assessment, the high biodiversity score of downstream Kotlibhel 1B project occurs because there is no downstream project to the proposed site. The high score of the upstream Alaknanda-Badrinath project occurs because there is no upstream project to this site. The low score of Vishnugad-Pipalkoti Project occurs because the upstream Vishnu Prayag project obstructs upward migration of fish and also downward flow of organic debris which is food for aquatic life. Furthermore, WII has not delineated the mitigative measures. It has only said that biodiversity index is low and that suitable mitigative measures should be put in place. What these measures may and whether they will be effective has not be studied or commented upon. Our critique of the study by Wildlife Institute of India is attached at **Annexure 4**.

VPHEP has been given Forest Clearance by Ministry of Environment and Forests on the basis of this low score. The Forest Clearance was challenged by us before the National Green Tribunal which has upheld the clearance granted by the Ministry. We are challenging the order of National Green Tribunal in the Supreme Court.

Our submission to the WB is that the assessment of biodiversity made by Wildlife Institute of India is under challenge; therefore, it is incorrect for WB to rely blindly on the same. Reliance on the study by WB Staff has violated following OPs:

Table 6: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	Table A1 - Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	A2. Assess potential impacts of the proposed project on physical, biological, socio-economic and physical cultural resources, including transboundary and global concerns, and potential impacts on human health and safety.	WB Staff is expected to assess these impacts. WB Staff have not made such an assessment. They have relied on the study by Wildlife Institute of India which is under challenge. WB Staff have not taken on board our critique of the study.

2	OP 4.04, Annex A - Definitions	Critical Natural Habitats are: 1b (ii) sites identified on supplementary lists prepared by the Bank or an authoritative source determined by the Regional environment sector unit (RESU). Such sites may include areas recognized by traditional local communities (e.g., sacred groves); areas with known high suitability for bio-diversity conservation; and *sites that are critical for rare, vulnerable, migratory, or endangered species*. Listings are based on systematic evaluations of such factors as species richness; the degree of endemism, rarity, and vulnerability of component species; representativeness; and integrity of ecosystem processes.	The site of VPHEP supports the Cheer Pheasant which is an evolutionary relic. The Wildlife Institute of India study[3] recognizes that Vishnugad-Pipalkoti project will lead to extinction of the Cheer Pheasant (Page 76). This species is an "evolutionary relict (meaning that it does not have any close relatives in the evolutionary scale)" (Page 64). The area is also habitat to the Smooth-Coated Otter (Page 72). IT is also on the migratory path of the Mahseer fish. The site of VPHEP is liable to be classified at Critical Natural Habitat in view of above. WB Staff have made an error in not taking these factors on board.
3	Table A1 - Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	B1. Use a precautionary approach to natural resources management to ensure opportunities for environmentally sustainable development. Determine if project benefits substantially outweigh potential environmental costs.	Precautionary approach requires that the site may not be disturbed in view of the site being habitat to endangered Cheer Pheasant and Otter. WB Staff have not considered this.
4	Ditto	B3. Where projects adversely affect non-critical natural habitats, proceed only if viable alternatives are not available, and if appropriate conservation and mitigation measures, including those required to maintain ecological services they provide, are in place.	We have suggested to Wildlife Institute of India[4] that the environmental impacts of the hydroelectric projects will be much reduced if part of the water is removed from the river by making a partial obstruction instead of a barrage and allowing free flow of a socially acceptable amount of water as environmental flow. This will allow upstream migration of fish and downstream flow of debris and sediments. This alternative has not been examined by Wildlife Institute or WB Staff.
5	OP 4.04 - Natural Habitats	4. The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats.	The area is a Critical Natural Habitat as explained at point No 2 above. WB Staff have ignored this.
6	OP 4.01 - Environmental Assessment	8(a) Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.	VPHEP should be classified as category A in view of the impact on Cheer Pheasant, Otter and Mahseer fish. The impact of the project has not been compared with the alternative of partial obstruction.

[3] Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity in Alaknanda and Bhagirathi Basins, Uttarakhand, Wildlife Institute of India, May 2011

[4] In personal discussion with Dr V B Mathur at Wildlife Institute of India sometime in late 2010.

4 Environmental flows

The revised E-Flows (increased from 3 cumecs to 15.65 cumecs) stipulated by Ministry of Environment and Forests are too low. These are based on the IIT Roorkee report which is disputed. Critique of the IIT Roorkee report is attached at **Annexure 4.** Main points regarding inadequacy of the recommended Environmental Flows are:

1 IITR has not done assessment of E-Flows on the basis of Cumulative Impact Assessment.

2 Inappropriately taken Mean Annual Flow instead of Mean Seasonal Flow which is more suitable to Indian rivers with their huge seasonal variations.

3 Relied on specific methods adopted in France and England without giving any justification. The IIT report itself recognizes that the Building Block Method is the appropriate method for assessing E-flows. However, it is stated that this could not be done due to paucity of time and resources. The E-Flows assessed by World Wildlife Fund are about 76 percent on the basis of Building Block Method. This is about 10 times the E-Flows indicative values given by IIT Roorkee.

4 Interpreted 'environment' to mean merely fish, ignoring crucial components such as forests, water quality and phytoplankton.

5 Not calculated the flows required even for the survival of fish.

6 Merely restated the existing practice in Uttarakhand of releasing water that flows lowest 5 percent of the time, without making their own assessment of its appropriateness and adequacy.

7 Not considered the benign alternative of partial obstruction.

8 Not taken into account the state of the river desired by the citizens and social expectations.

WB officials have replied to our earlier communication as follows:

> *The common practice for hydropower projects in India has been to stipulate an environmental flow requirement in the range of 10-15% of the average low flow. At this higher level of environmental flow requirement the project remains economically attractive* **(Annexure 3).**

It is clear from above statement that WB Officials have not made their own assessment as to the adequacy of the revised E-Flows. They have also not examined whether the 'common practice' followed by HEPs in India meets WB OP requirements. They have only examined whether the project will remain economically attractive after implementing the revised E-Flows. It is further submitted by us that installation of a small HEP at the toe of the project renders the E-Flows redundant. E-flows are required not only because they provide water but also because they bring sediments and organic debris which is food for the aquatic life downstream. These sediments and debris will be removed from the water released as E-Flows as it passes through the toe project and render it 'empty'.

5 Alternative of partial obstruction

We suggest that other ways of meeting the increasing demand of electricity such as solar, biomass and wind generation should be explored more thoroughly.

Secondly, we have suggested to WB officials that a redesign of the project will reduce the negative environmental impacts substantially. We have suggested that an obstruction may be made on part of the river bed instead of making a dam across the river bed. This will ensure river bed connectivity. It will make it possible for downward flow of sediments and upward migration of fish. This technique is traditionally used in Uttarakhand for running flour mills known as *gharat.* A stone is placed in the bed of a stream and part of the water is diverted for running the flour mill while allowing the other part flows uninterrupted. This alternative has been implemented at the Bhimgoda Barrage at Haridwar. The barrage has been made to diver water from River Ganga into a canal. However, a big opening has been made in the barrage so that there is continuous and uninterrupted flow of water. This opening was made under an agreement made by the British Government of India with Hindu leaders who had opposed making of a barrage on the complete bed of the river. WB officials have not examined this alternative.

The last alternative is to simply scrap the project. To the best of our knowledge, WB staff has also not made a comparison with the 'no action' scenario. This is violation of following OPs:

Table 7: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	OP 4.00 Table A1 - Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	A4. Provide for assessment of feasible investment, technical, and siting alternatives, including the "no action" alternative, potential impacts, feasibility of mitigating these impacts, their capital and recurrent costs, their suitability under local conditions, and their institutional, training and monitoring requirements associated with them. B3. Where projects adversely affect non-critical natural habitats, proceed only if viable alternatives are not available, and if appropriate conservation and mitigation measures, including those required to maintain ecological services they provide, are in place. Include also mitigation measures that minimize habitat loss and establish and maintain an ecologically similar protected area.	The alternative of partial obstruction has not been examined. The change in benefits and costs due to such redesign has not been examined.
2	Ditto	B5. Consult key stakeholders, including local nongovernmental organizations and local communities, and involve such people in design, implementation, monitoring, and evaluation of projects, including mitigation planning.	WB Staff has not taken our suggestion on board. The alternative has not been discussed with affected people.
3	OP 4.01, Annex B - Content of an Environmental Assessment Report for a Category A Project	2. The EA report should include the following items: (f) Analysis of alternatives. Systematically compares feasible alternatives to the proposed project site, technology, design, and operation--including the "without project" situation--in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements.	The word 'alternatives' in plural enjoins the WB Staff to examine various alternatives. No effort was made by WB Staff to shortlist various alternatives.

4	OP 4.04, Annex A - Definitions	1(e) Appropriate conservation and mitigation measures remove or reduce adverse impacts on natural habitats or their functions, keeping such impacts within socially defined limits of acceptable environmental change. Specific measures depend on the ecological characteristics of the given site. *They may include full site protection through project redesign*;	The OP specifically requires WB Staff to consider if negative environmental impacts will be reduced by project redesign. This has not been done.
5	OP 4.07 - Water Resources Management	(d) Restoring and preserving aquatic ecosystems and guarding against overexploitation of groundwater resources, giving priority to the provision of adequate water and sanitation services for the poor.	The aquatic water system of the river can be much restored by making a partial obstruction instead of a barrage. This has not been considered.

Poverty Alleviation

The project will provide electricity to the nation, including poor people. However, whether this leads to poverty alleviation or poverty accentuation will depend upon whether the environmental, cultural and social costs imposed on them are less than the benefits accruing to them from provision of electricity. WB officials have not undertaken such a study.

We submit that shortage of electricity is not the reason for non-supply of electricity to the poor. The number of rural households to be electrified in April 2005 was 40,853,584. Of these, 5,679,143 were electrified in the period April 2005 to January 2009. Every month 123,459 new households were provided with electricity connections in this period. The increase in electricity required every month for supply to these 123,459 households is 7.3 million units per month at the lifeline consumption of 30 Units per month. Generation of electricity in the country in 2005-06 was 58.1 billion units per month. Generation increased to 65 billion units per month in August 2009. The increase in generation was 6.9 billion units in 41 months or 168 million units per month. Of this, only 7.3 million units or only 4.3 percent was used for rural electrification. The total requirement of electricity for the 40,853,584 unelectrified households is 1.2 billion units per month. This is only 1.8 percent of the generation already achieved. Therefore, the shortage of electricity is not the reason for not providing electricity to the villages and poor households. The reason is the lack of connectivity to the grid, and the low affordability where such a connection is available. There has been little progress on these counts, largely due to the lack of political will to provide electricity to the poor.

It was necessary to examine the quantum of electricity from the project that will reach the poor and set off the same against the monetary value of the environmental costs borne by them. The 100 KwH/month to be supplied free for 10 years to households has to be set-off and compared against the costs borne by them.

Dr Bharat Jhunjhunwala, on of the signatories to this representation has undertaken a cost-benefit analysis of the Kotlibhel 1B hydropower project which is proposed to be built downstream of VPHEP on River Alaknanda.[5] Copy of the study has been provided to WB Staff at the Delhi office. Summary of the study is attached at **Annexure 5.** This project is for 330 MW capacity and is reservoir-based. This is broadly comparable with VPHEP which is for 440 MW capacity and is tunnel based although there will be some differences.

We are giving below summary of costs and benefits as calculated by Dr Jhunjhunwala:

[5] Jhunjhunwala, Bharat, *Economics of Hydropower,* Kalpaz, 2009.

Table 8: Distribution of Benefits (-) and Costs (+) of Kotlibhel 1B Hydro Power Project (Rupees crore per year)

Chapter No	Item	Total	Employees of NHPC and Government of Uttarakhand	People of India
1	Benefits from generation of power	(+) 103.8	-	(+) 103.8
2	12% Free power to State	(+) 50.2	(+) 24.1	(+) 26.1
3	Employment	(+) 1.5	-	(+) 1.5
4	Costs	(-) 931.8	-	(-) 931.8
	Total	(-) 776.3	(+) 24.1	(-) 800.4
5	Memo: Benefits to employees of NHPC in generation of electricity	-	(+) 121.6	-
6	Memo: Compensation for land	-		(+) 1.3
7	Total, including memo items		(+) 145.7	(-) 799.1

The above table shows that the project perpetrates net economic harm once environmental costs are factored in. It also gives us an indication of the gainers and losers.

Gainers: NHPC and State Government Employees to the tune of Rs 145.7 crores.

Losers: People of the country to the tune of Rs 799.1 crores.

VPHEP is likely to have a similar distribution of costs and benefits. It is totally against the WB mandate of poverty alleviation. It was necessary for WB Staff to undertake such an analysis especially when this possibility was brought to their kind attention. Failure to undertake such analysis is violation of following OPs:

Table 9: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff

1	OP 1.00 - Poverty Reduction	1. The Bank's mission is sustainable poverty reduction. The Bank's support for poverty reduction is focused on actions, consistent with its mandate, to increase opportunity, enhance empowerment, and strengthen security. Within this broad framework, a critical priority is promoting broad based growth, given its proven importance in reducing poverty.	The project imposes huge environmental costs on the people while providing benefits to the well-off sections and is against the WB Mission.
2	OP 10.04 - Economic Evaluation of Investment Operations	1. The Bank evaluates investment projects to ensure that they promote the development goals of the borrower country. For every investment project, Bank staff conduct economic analysis to determine whether the project creates more net benefits to the economy than other mutually exclusive options for the use of the resources in question.	WB has not evaluated whether VPHEP promotes development. It is specifically mandated that WB Staff will conduct such economic analysis. WB Staff have informed us that "The project economic analysis was peer-reviewed by an economist who is an acknowledged expert on evaluating environmental aspects of economic analysis and who has published widely on this topic, including specifically on costing methodologies." (**Annexure 3**). However, WB Staff have not provided us with a copy of this review despite a request being made in the rejoinder to the above note.
3	Ditto	3. The project design is compared with other designs involving differences in such important aspects as *choice of beneficiaries*, types of outputs and services, production technology, location, starting date, and sequencing of components.	Examining choice of beneficiaries requires WB Staff to assess impact of the project on different sections of the society. This has not been done thereby hiding the negative impact of the project on the poor people.

There has been no proper participatory process in the planning or decision making of the project as far as the affected communites in the upstream and downstream of the project or larger society is concerned. Even the highly inadequate EIA was not made available in the language and manner that the people can understand. The World Bank had to order that fresh studies be done. Fresh credible consultation was not taken up before decision to take up the project or to fund it was taken.

VPHEP is being implemented by THDC India Ltd. This same organization has built the Tehri Dam. The track record of THDC in implementing Relief and Rehabilitation (R/R) and environment measures is dismal. The improper and unsafe operation of the Tehri Reservoir has led to avoidable, disastrous floods in the downstream area in 2010 monsoon, so much so that its own Koteshwar project downstream from Tehri was badly damaged. There have been massive landslides affecting additional thousands of people. Vigilance department had launched corruption cases related to the project. The Central Electricity Regularoty Authority, India's electricity regulator, has said that the project operation was inappropriate, it was operating as baseload station when it could have operated as peaking station, leading to huge losses for the economy. Thousands of affected people are yet to receive full rehabilitation package,

including land. Most recently, the Supreme Court of India ordered THDC to deposit Rs 102 crores towards R/R costs and did not allow THDC to fill up the reservoir up to 825 meters due to incomplete rehabilitation. Copy of the judgement is attached at **Annexure 6**.

In reference to our submission on non-use values, WB Staff have replied: "We believe that Government of India has carried out this process in its various deliberations with respect to the Bhagirathi and Alaknanda basins (as reflected in the corpus of studies and consultations carried out and negotiations with the State Government of Uttarakhand)…" We understand from information obtained under Right to Information Act that THDC has undertaken 109 consultations with local people. We have made surveys in the area and find that these consultations have been invariably done with a small section of local people and excluded those who are critical of the project. An agreement made with a group of local people has been cancelled by them due to non compliance of the same. Copy of notice sent to the Government cancelling the agreement is placed at **Annexure 7.**

It is submitted that the track record of THDC in meeting the concerns of the people is dismal and VPHEP may be reviewed from this angle as well.

Contribution to economic growth

1 Net discounted values

THDC is supplying power to Uttarakhand Power Corporation @ Rs 6 per KwH against average purchase price of Rs 2.50 from other sources. Therefore, economic efficiency of THDC is suspect. Indeed, the price of Rs 6 per KwH is determined by Central Electricity Regulatory Commission orders. However, that does not indicate that THDC is 'efficient'.

The objective of the VPHEP is to add to economic development. This requires the benefits to be larger than costs. The cost-benefit analysis filed by THDC before MOEF for obtaining the Forest Clearance does not establish this. The CBA suffers from two major flaws:

1 Future benefits are not discounted to present values.

2 Environmental costs have not been factored in.

The CBR turns negative once these changes are made. This has been done in the Table below.

Column 3 of the Table gives the figures of costs and benefits as stated by THDC. The future benefits have not been discounted to present values. Benefits from employment generation

have also not been shown. The cost-benefit ratio in this column has been calculated by us to be 7.82.

Column 4 of the Table gives the figures after discounting future benefits to current values. Benefits from generation of employment have been added. After these changes the cost-benefit ratio declines to 0.13—primarily due to discounting of future benefits to present values.

Table 10: Cost-Benefit Analysis of Vishnugad-Pipalkoti as per THDC and Alternative calculations by us.

Sl No as per THDC statement	Particulars	Amount as stated by THDC (in Rs crore)	Alternative calculations as per Petitioners (in Rs crore). Lifetime	Explanation
1	2	3	4	5
1	Total Cost	2096.81	2096.81	Loss of timber Rs 2.96 lacs and Loss of animal husbandry productivity Rs 7.24 lacs is ignored since insignificant as stated by THDC.
2	Power generation	409.74 per year or 16,389.6 over 40 years.	243.2 lifetime	Total discounted value (@12%) of power generation is Rs 2027.0 crores. Of this Uttarakhand will get free power of 12%. This is the benefit from the project.
2(B)	Direct Employment of Labourers. Employment generation 2600 man days per days for 5 years.	Not specified	19.5	Benefit is only the additional income from employment. Assuming Rs 50 would be earned by the labourers anyways, the additional income is only Rs 50. 2600 persons x 300 days x 5 years x Rs 50
2(C)	Employment generation due to other activities. Employment generation 2600 man days per days for 5 years.	Not specified	19.5	Benefit is only the additional income from employment. Assuming Rs 50 would be earned by the labourers anyways, the additional income is only Rs 50. 2600 persons x 300 days x 5 years x Rs 50
	Total Benefit	409.74 crores per year	282.2	
	Cost-Benefit Ratio	**7.82**	**0.13**	

THDC has not included certain benefits and costs in its calculation. It has not included the benefits from profits generated from THDC; and also benefits to society from the consumption of electricity. On the other hand, THDC has not included various environmental costs such as drying of water sources, loss of biodiversity, loss of aesthetic value of river, deterioration of water quality etc. These benefits and costs are now included. The revised cost-benefit analysis after making these changes is given at Table below. The benefits become negative and Cost-Benefit Ratio becomes (-) 2.01.

Table 11: Cost-Benefit of Vishnugad-Pipalkoti including items not accounted for by THDC.

Particulars	Amount as stated by THDC (in Rs crore)	Alternative calculations by us (in Rs crore), lifetime	Explanation
Items accounted by THDC	409.74 crores per year	282.2	(from table above)
Consumer's benefits from consumption of electricity	Nil	636.9	No benefit in first 4 years. 88% of the 181.3 crore units generation per year is consumed by society. Total benefit to society is assessed at Rs 3.30 per unit (*Economics of Hydropower*, Kalpaz, 2009). Deduct cost of purchase of Rs 2.26 per unit to give net benefit Rs 1.04 per unit. This is discounted to present value.
Profits of THDC	Nil	289.9	No profits in first 4 years. Total project cost is Rs 2091.4 crores. Assuming debt-equity ratio of 1:4; Equity will be Rs 418.3 crores. Assuming rate of profit of 14 percent, annual profit is Rs 58.6 crore. Discounted to present.
Environmental costs	Nil	-5428.8	Environmental costs of Kotlibhel 1B project is assessed at Rs 7.34 per unit (*Economics of Hydropower*, Kalpaz, 2009). That is for a reservoir based project. Assuming the costs to be one-half of that, the environmental cost from Vishnugad Pipalkoti will be Rs 3.67 per unit on 181.3 crore units per year. This is discounted for next 40 years.
Total benefits	409.74 per year or 16,389.6 over 40 years.	-4219.8	Including items ignored by THDC.
Cost-Benefit Ratio	**7.82**	**(-) 2.01**	Including items ignored by THDC.

It is seen that the Cost-Benefit Ratio is not favourable indicating that the costs are greater than the benefits. Funding of such project by WB is violation of following OPs:

Table 12: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	OP 4.00 Table A1 - Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles	A9. Provide measures to link the environmental assessment process and findings with studies of economic, financial, institutional, social and technical analyses of a proposed project.	Linking of environmental assessment with economic analysis requires that environmental factors be assessed in monetary terms as far as possible and a comprehensive analysis undertaken thereafter.
2	Ditto	B1. Determine if *project benefits substantially outweigh potential environmental costs*.	Project benefits do not outweigh environmental costs once environmental costs are assessed in monetary terms.
3	OP 4.04 - Natural Habitats	5 The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, *and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.*	There is a clear requirement to undertake a comprehensive analysis of economic benefits and environmental costs. This has not been done. If done, the costs by far outweigh benefits and the VPHEP does not pass the test.

4	OP 10.04 - Economic Evaluation of Investment Operations	2. The basic criterion for a project's acceptability involves the discounted expected present value of its benefits, net of costs.	The future benefits of the project have not been discounted to present values as per statement filed by THDC with Ministry of Environment and Forests. The cost-Benefit Ratio becomes less than 1 once this is done.

2 Sensitivity Analysis

An additional point is regarding sensitivity analysis. The Pipalkoti project commits natural resources for next 40 to 100 years. A reduction in price of electricity may render the project unviable. However, the negative environmental impacts will be imposed because water sources have been committed for 40-100 years. It was necessary to examine whether the project will remain viable under different energy scenarios.

According to a press release by Clinton Foundation, the cost of solar power is likely to become Rs 4/kWh (**Annexure 8)**. As per our information mega-thermal projects in India are quoting rates as low as Rs 2/kWh (for base load). In such event, the Pipalkoti project will become unviable but the country's natural resources would have been committed. This is in violation of following OPs:

Table 13: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff
1	9.0 A NEW INSTRUMENT TO ADVANCE DEVELOPMENT EFFECTIVENESS: PROGRAM-FOR-RESULTS FINANCING (Draft)	8 The environmental and social systems assessment seeks to make sure that the potential environmental and social impacts and risks are adequately addressed. These assessments will identify measures to enhance performance, build capacity, and mitigate key risks, and will be reflected in an integrated risk assessment. The resulting action plan will be reflected in the legal agreement between the Bank and the government.	Assessment of potential environmental costs *inter alia* includes assessment of potential changes in benefits. The possible decline in future price of electricity had not been factored in and, we believe, also not reflected in agreement with Government of India.
2	OP 10.04 - Economic Evaluation of Investment Operations	5. To obtain a reasonable assurance that the project's benefits will materialize as expected and will be sustained throughout the life of the project, the Bank assesses the robustness of the project with respect to economic, financial, institutional, and environmental risks.	The life cycle analysis of the project, we believe, does not examine scenario in which price of electricity declines.

3	Ditto	6. The economic analysis of projects is necessarily based on uncertain future events and inexact data and, therefore, inevitably involves probability judgments. Accordingly, the Bank's economic evaluation considers the sources, magnitude, and effects of the risks associated with the project by taking into account the possible range in the values of the basic variables and assessing the robustness of the project's outcome with respect to changes in these values. The analysis estimates the switching values of key variables (i.e., the value that each variable must assume to reduce the net present value of the project to zero) and the sensitivity of the project's net present value to changes in those variables (e.g., delays in implementation, cost overruns, and other variables that can be controlled to some extent).	A sensitivity analysis as stipulated has not been done as per our information.

3 Valuation of Benefits

The Appraisal done by WB values the benefits from generation of electricity on the basis of Unscheduled Interchange (UI) values of Rs 12.3/8.4 for lean season and 5.7 for wet season. This is not the correct method to assess the Economic Rate of Return (ERR) (Table 3, Page 83 of WB Document) because UI does not reflect the 'average' benefit. It reflects a momentary spike in purchase price. The purchase price can be driven by many considerations other than benefit to the people. Moreover the UI value for power purchases by Uttarakhand Power Corporation in 2010 was only Rs 4.50. We are attaching details of purchase of electricity by Uttarakhand Power Corporation for 2010 showing this average price for UI overdrawl.

The VPHEP has made a power purchase agreement which does not specify the tariff and only refers to the tariff being determined by Central Electricity Regulatory Commission. However, the sale of electricity by THDC to Uttarakhand Power Corporation from Tehri hydroelectric project was made at Rs 6.23 per kWh (Pl see **Annexure 9).** This too is much higher than the average purchase price of Uttarakhand Power Corporation which stands at Rs 2.53 per kWh. Therefore, use of price of Rs 12.3/8.4/5.7 for economic assessment of the project is wholly inconsistent with the prevailing price of power.

Secondly, the value of Rs 12.3 per unit is much higher than the Willingness to Pay value of Rs 6 per unit. The latter is the correct method for valuation of power. However, should this be relied upon, then, willingness to pay for free flow of rivers should also be factored in.

In response to our earlier communication, WB officials have responded as follows:

> *We used the UI as a proxy as this is an observable value that the Northern region of India will pay for additional capacity from the grid. The 2010 CERC regulations caps the upper bound for UI at Rs 8.73/kWh (that is, the rate cannot "spike") which has been used to value the energy in the dry season. The UI rate associated with average*

> *frequency during the same period is Rs 5.7/kWh which has been used to value the energy in the wet season. Ninety percent of the energy expected to be generated from the VPHEP will be generated in the wet season, and this energy is valued at Rs 5.7/kWh.*

This response does not address the core issue. The objection is that the Upper Limit value of UI should not be taken as an estimate of benefit for *all* electricity generated by the project. Also, even if UI is to be used, at the least the average should be used, not the maximum value. The Upper Limit of UI comes into force at special circumstances and is not the 'normal' cost of power paid by the purchasers.

Further, WB Officials have responded:

> *Use of Willingness to Pay Estimates and Unscheduled Interchange Data. On the use of Willingness to Pay (WTP) estimates and the use of Unscheduled Interchange (UI) data to serve as a proxy for valuation of energy generated from the project: Willingness to Pay methods (contingent valuation) are not without potential deficiencies, as is well articulated in professional literature. These methodological deficiencies include: sampling bias; lack of sufficient information or technical knowledge (e.g. on the cost implications of different electricity-generating technologies) on the part of those being interviewed which reduces the relevance of responses; high impact of question formulation on the answers received; possible normative influence of the enumerator on the respondent. With respect to the case you cite, the combination of the abstract nature of the question posed and the potential methodological pitfalls of the contingent valuation method suggest that the data received from the interviewing of pilgrims are not sufficiently robust for use in cost-benefit analysis.*

We accept the difficulties in assessing Willingness to Pay. However, the Project Appraisal document does rely on Willingness to Pay for electricity. The absence of estimates of Willingness to Pay should be managed by undertaking a field survey or using proxy data. In any event, assuming the value of Willingness to Pay for free flow of rivers to be zero does not appear to be correct.

The economic analysis undertaken by WB Staff is violative of following OPs:

Table 14: Violation of OPs

Sl	OP	What OP says	Violation of OP by WB Staff

1	OP 4.00 - Piloting the Use of Borrower Systems to Address Environmental and Social Safeguard Issues in Bank-Supported Projects	1. The Bank's1 environmental and social ("safeguard") policies are designed to avoid, mitigate, or minimize adverse environmental and social impacts of projects supported by the Bank. The Bank encourages its borrowing member countries to adopt and implement systems that meet these objectives while ensuring that development *resources are used transparently and efficiently* to achieve desired outcomes.	The river resource may be used inefficiently because the benefit from free flow may be much greater than the benefit from electricity generation if the latter is valued correctly.
2	OP 4.04 - Natural Habitats	5. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.	A comprehensive analysis will show that the net benefits from VPHEP are much less than those from free flow of river.
3	OP 10.04 - Economic Evaluation of Investment Operations	1. For every investment project, Bank staff conduct economic analysis to determine whether the project creates more net benefits to the economy than other mutually exclusive options for the use of the resources in question.	Ditto
4	OP 10.04 - Economic Evaluation of Investment Operations	2. To be acceptable on economic grounds, a project must meet two conditions: (a) the expected present value of the project's net benefits must not be negative;	Ditto

Concluding Request

We request the World Bank to review this loan and put an immediate stop to diswbursement till the review is completed.

Annexure 1

Impact of Dams on Quality of Waters of River Ganga as Assessed by Pilgrims at Devprayag, Rishikesh and Haridwar: Results from a Field Survey

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Objectives of Study

Uttarakhand Government is making a cascade of Hydro-electric Projects (HEPs) on River Ganga and its tributaries—Bhagirathi and Alaknanda in particular. These dams are going to affect the flow of water at the confluence of Bhagirathi and Alaknanda at Devprayag, Rishikesh, Haridwar and downstream at Prayag, Kashi and Ganga Sagar. The HEP Companies claim that damming the flow of water will provide benefits from generation of power to the people and will *not* reduce the spiritual power of these religious places. The water flowing into Devprayag from Bhagirathi is already affected by the Tehri Dam. Tehri Hydropower Development Corporation (THDC), which has built the Tehri Dam, insists that there is no deterioration of quality of water downstream from Tehri Dam. This study is made to assess the impact of Tehri dam on the spiritual impact of taking bath at Devprayag, Rishikesh and Haridwar as assessed by pilgrims.

The underlying assumption is that if Tehri Dam has affected the quality of waters at these pilgrim centres, then the new hydroelectric projects (HEPs) mentioned below will have a similar effect.

1. Alaknanda, Upstream, two new dams at Srinagar and Devprayag;
2. Bhagirathi, Upstream, two new dams at Muneth and Koteshwar (in addition to existing storage dam at Tehri);
3. Ganga, Downstream, one new dam at Kaudiyala.

This proposition can be challenged since the proposed HEPs are Run-of-River (ROR) in that they do not store water in one season to be discharged in another season as done in Tehri. However, another parallel study of two ROR Dams at Chilla and Maneri Bhali indicates that the quality of water has deteriorated here. Thus we conclude that the proposed ROR dams will also have a negative impact.

The Dam Companies insist that neither Tehri nor the proposed ROR dams will have a negative effect. Thus, the *inter se* difference between the Tehri- and proposed dams is not important. It is more important to assess the negative impact of Tehri irrespective of whether and to what extent it can be extrapolated to the proposed ROR dams.

Methodology

The objective of the study is to assess whether and to what extent the construction of Tehri dam has affected the spiritual power of River Ganga. A questionnaire was made to ask respondents about impact of dam on various aspects of worship. Naresh Chandra Puri, Diploma Pharma, resident of Village Lakshmoli, Dt Tehri, went to these pilgrim centres in December 2007-January 2008 and sought responses from the pilgrims coming to take bath or to collect water for taking home.

No sampling was done. Assistance of any local person was not sought lest the mediator influence the results. The enumerator asked people he met spontaneously about the impacts.

The distribution of visitors by home place was as follows:

Table 1: Distribution of Pilgrims by Home

Sl No	Survey Location	Total Number of Respondents	Uttarakhand	Other States	Local
1	Dev Prayag	55	Dehra Dun (4), Udham Singh Nagar (1), Pauri (2), Tehri (3), Rudraprayag (1), Unknown (3). Total 11	Gujarat (2), Maharashtra (2), WB (6), Delhi (3), Karnataka (1), Haryana (4), UP (2). Total 20	21
2	Rishikesh	93	Dehra Dun (8), Tehri	Bihar (2); Chandigarh	34

			(4), Pauri (3), Roorkee (1), Haridwar (2), Udham Singh Nagar (1), Uttarkashi (1), Unknown (1). Total 20	(3), Delhi (4), Haryana (2), Himachal Pradesh (2), Maharashtra (1), Punjab (2), Rajasthan (2), UP (19), West Bengal (1). Total 38	
3	Haridwar	94	Almora (1), Bageshwar (1), Chamoli (1), Dehra Dun (5), Pauri (5), Udham Singh Nagar (1), Uttarkashi (1). Total 15	Bihar (6); Delhi (11), Gujarat (1), Haryana (10), Maharashtra (2), MP (2), Punjab (2), Rajasthan (3), UP (22), West Bengal (1). Total 60.	19
4	Total	238	46	118	74

The income of respondents was as follows:

Table 2: Income of Visitors

Sl No	Location	Average	Median
1	Dev Prayag, n=27	15,355	10,000
2	Rishikesh, n=37	8,166	5,640
3	Haridwar, n=61	8,473	5,000
4	Average, n=125	10,665	6,880

Table 3: Income of Local Persons

Sl No	Location	Average	Median
1	Dev Prayag, n=21	3,042	2,000
2	Rishikesh, n=21	11,623	6,000
3	Haridwar, n=15	4,720	3,000
4	Average, n=57	6,462	3,667

Nature of Benefit obtained from River Ganga

Question: What is the benefit you have obtained from the blessings of River Ganga? (Number of Respondents replying in affirmative). The total can exceed 100 percent because many pilgrims have derived more than one type of benefit.

Table 4: Percent of Pilgrims deriving a particular type of benefit.

Sl No	Type of Benefit	Unit	Dev Prayag, n=55	Rishikesh, n=93	Haridwar, n=94	Combined, n=242
2	Mental Peace	Percent	75	71	84	77
3	Health	Percent	25	19	33	26
4	Business	Percent	18	5	19	14
5	Child	Percent	18	9	8	12
6	Service	Percent	5	9	23	12
7	Success in Examination	Percent	11	9	8	9
8	Others	Percent	31	13	17	20

77 percent pilgrims obtained mental peace while 26 percent obtained health benefits. The Ganga waters appear to have the power to relax the mind and body of the pilgrim. This gives him mental peace and good health.

Question: How much value do you place on the benefit obtained? In response to this question a large number of pilgrims replied in terms of ‘invaluable’, ‘lacs’ or ‘priceless’. These have been mentioned separately in table below.

Table 5: Value of Benefit obtained

Sl No	Level of Income	Dev Prayag, n=11	Rishikesh, n=6	Haridwar, n=9	Average, n=26
1	Average	29,427	59,041	66,177	51,548

2	Median	1,000	26,500	10,000	12,500
3	Number responding in priceless, invaluable, etc.	25	23	4	52

The average or median values are based on a small number of respondents, 26. Nearly double this numbers have said that the benefit derived is priceless etc. In view of this, we take the higher average value of Rs 51,548 as the value of benefit derived by pilgrims, and not the lower median value.

Benefit from Generation of Electricity

Pilgrims accepted that there would be much benefit to the nation from generation of electricity from waters of River Ganga.

Table 6: Question: What is the benefit to the nation from generation of electricity from waters of Ganga? (Number of Pilgrims Responding in Affirmative)

Sl No	Type of Pilgrim	Small Increase	Big Increase	Small Decrease	Big Decrease	Percent Reporting Increase
1	Dev Prayag, n=53	16	34	2	1	95%
2	Rishikesh n=93	16	72	2	2	95%
3	Haridwar, n=91	17	71	1	2	97%
4	Combined, n=237	49	177	5	5	95%

Conclusion: Pilgrims recognize that there is great benefit to the nation from generation of electricity from waters of the Ganga.

Decline in quality of water due to construction of dams

The question is whether construction of dams also leads to an impact on the pilgrims? The following question was asked to assess this aspect.

Table 7: Question: What is the impact of Tehri Dam on flow of waters of Ganga? (Percent of Pilgrims Responding in Affirmative)

Sl No	Type of Pilgrim	Was Better Previously	Is Better Now	No Difference	Net, Percent Reporting Previously Better
1	Dev Prayag, n=41	88	12	-	76
2	Rishikesh, n=87	47	15	38	32
3	Haridwar, n=78	38	26	36	12

* At Dev Prayag the question was phrased as follows: What will be the change in spiritual power of water after extraction of electricity?

Conclusion: The decline in quality of water is less as we move away from Tehri. This is likely because the water gets a chance to regenerate some qualities like Dissolved Oxygen. Further the term 'flow' focuses more on quantity of water than quality. There is more quantity of flow in winters and summers due to construction of Tehri Dam. This may be a positive aspect that was noted by Pilgrims.

Benefit to pilgrims from removal of Tehri Dam

There can be an impact on pilgrims due to change in quality of waters due to Tehri Dam. The following question was asked to assess this.

Table 8: Question: What will be the benefit to the nation if Tehri Dam is removed and pilgrims are able to take bath in free-flowing waters of the Ganga at the Confluence? (Percent of Pilgrims Responding in Affirmative)

Sl No	Type of Pilgrim	Small Increase	Big Increase	Small Decrease	Big Decrease	Net, Percent Reporting Increase
1	Dev Prayag, n=34	44	47	6	3	82
2	Rishikesh, n=78	36	45	11	8	62

3	Haridwar, n=81	38	32	18	12	40

Conclusion: There is a positive impact on pilgrims if Tehri Dam is removed but the intensity of impact declines as we move downstream.

Pilgrims were further asked to give a percent value to the increase or decrease in the impact. These are tabulated below.

Table 9: Impact of removal of Tehri Dam, Percent, Average

Sl No	Location	Reporting Increase	Reporting Decrease
1	Dev Prayag, n=31, 3	46.3	43.3
2	Rishikesh, n=52, 11	46	30
3	Haridwar, n=42, 17	29.5	42.7
4	Average, n=125, 31	40.6	38.7

Estimate of cost of dam to Pilgrims

We can use these figures to make an estimate of effect of removal of Tehri Dam on pilgrims.

The weighted average is calculated as follows:

(+ (Value increase x 125) - (Value decrease x 31))/156

(+ (40.6x125) - (38.7x31)/156 = + 24.8%

The benefit to pilgrims is increased by 24.8% upon decommissioning of Tehri Dam.

Present benefit per pilgrim: Rs 51,548 (Table 5, above)

Reduction in benefit per pilgrim: +24.8% or Rs 12,784

The author estimates the number of pilgrims as follows: Dev Prayag 200, Rishikesh 1000, Haridwar 2500, other places before Haridwar 1,300, Total 5,000 per day.

Gain to pilgrims from decommissioning of Tehri Dam: 5,000 pilgrims x 365 days x Rs 12,784= Rs 2333 crore per year.

Further losses occur to family members who do not make these pilgrimages. Pilgrims take waters to their homes. The power of that water will also be reduced. Further losses occur to local people residing on the banks of Ganga and non-pilgrim travellers in the area. This is, therefore, an underestimate.

A similar amount may be assessed for pilgrims downstream from Haridwar at Prayag, Kashi, Ganga Sagar, etc. The total loss to the pilgrims from Tehri may be assessed at double this amount at Rs 4,666 crores per year.

Willingness to Pay for Free Flowing waters

The above benefit is to pilgrims who are coming to these holy places for spiritual benefits. These benefits occur to the pilgrims personally. Additional aesthetic and spiritual benefits are obtained by people by allowing the waters of the rivers to flow freely.

An accepted methodology in economic to measure such aesthetic benefits is to ask the people what is the amount they are willing to pay for a desired situation. For example, benefits from national parks are assessed in this way by Planning Division of the Planning Commission, Government of India vide its Working Paper No. 2/2003-PC of November 2003 [084].

In order to assess this benefit, visitor pilgrims were asked:

Table 10: Question: How much are you willing to pay to decommission Tehri Dam and restore free flowing waters of Ganga? (Rupees per year)

Sl No	Location	Average	Median
1	Dev Prayag, n=17	2,083	101
2	Rishikesh, n=18	986	1,000
3	Haridwar, n=19	1,663	1,000
4	Average, n=54	1,577	700

The loss to the pilgrims from deprivation of free flow to the Ganga is assessed, on the lower side, at Rs 700 per person. This is altruistic loss in

contradistinction to the loss from bath in Ganga, which is personal. This loss occurs to all people of this country even though they have not come for pilgrimage. This is likely to be an overestimate because those who have not come are likely to place a lower value on free flowing waters. We account for this effect in two ways. One, we take the lower median value of Rs 700 instead of the higher average value. Second, we reduce this to one-fifth to account for lower willingness to pay by those who have not come for pilgrimage. The loss of aesthetic, emotional and spiritual benefit to the people of the country is calculated as follows:

57 crore adults x Rs 140 per year = Rs 7,980 crore per year.

Loss of benefit to pilgrims from conversion of river into reservoir

NHPC has proposed to build a reservoir-based HEP at Kaudiyala. The tail end of this reservoir will extend up to Dev Prayag confluence. It is proposed by NHPC that level of water at Devprayag Confluence will be maintained at present average monthly levels (Environment Impact Assessment Report, Kotlibhel 2, Page 11). In other words, the confluence will become the tail end of Kotlibhel 2 Reservoir but its level will be maintained as at present. The flow of water at the confluence will be affected. This writer has personally observed the flow of water at the Confluence in 1995 when Tehri Dam was not made. The water level varied from day-to-day and also from morning-to-evening. This 'free' variation will be removed and the confluence will have a fixed level as determined by dam authorities downstream. This is like placing a person in an iron jacket and preventing expansion and contraction of the chest due to breathing. In order to assess the impact of this change from 'free-flowing' to 'regulated reservoir', the pilgrims were asked:

Table 11: Question: Will the impact of the Confluence increase or decrease if the present level of water is maintained but this becomes a tail end of the reservoir? (Number of Pilgrims Responding in Affirmative)

Sl No	Type of Pilgrim	Small Increase	Big Increase	Small Decrease	Big Decrease	Net, Percent Reporting Decrease
1	Dev Prayag, n=35	23	11	20	46	(-) 32%

The above table tells that in pilgrims' assessment, there will be a decline in impact of the Confluence even if the level of water is maintained as at present.

Benefit from free-flowing water compared to electricity generation

In order to assess the pilgrim's view of the relative benefits from generation of electricity and benefits from bath in free-flowing water, they were asked to indicate which was higher.

Table 12: Question: There is benefit to the country from generation of electricity. However, it may have negative effect on the pilgrim. Which of these do you consider more? (Percent Responding in Affirmative)

Sl No	Type of Pilgrim	There will be more benefit from generation of electricity	There will be more benefit from bath by pilgrims in free-flowing waters	No difference	Percent Net Benefit from free-flowing water (Col 3-Col 2)
1	Dev Prayag, n=51	29	49	21	(+) 20%
2	Rishikesh, n=88	50	25	25	(-) 25%
3	Haridwar, n=88	65	18	17	(-) 47%
4	Combined, n=227	48	31	21	(-) 17%

This table places the problem before us squarely. It tells us that downstream pilgrims assess greater benefits from generation of electricity. Pilgrims assess that gains from generation of electricity are greater *in comparison to losses from free flowing waters.* Thus there exists an overall perception in the country that harnessing potential of rivers for generation of electricity is good.

This table does not cancel the costs mentioned above. It only tells us that in the perception of pilgrims the gains from generation of electricity are greater.

These gains can be quantified. Well developed methods are available for the same. This writer has assessed the benefits from Kotlibhel 1B Project at Rs 154 crores. The benefits from various Hydropower projects taken together on the Ganga may be about Rs 4,000 crores per year. In comparison the losses to pilgrims are much greater. There are further losses to environment, forests, coastlands, etc. Thus the leaders must not be deterred by this perception. The assessment of losses made by pilgrims relates to their own life and being hence stands on solid rock. Their assessment of benefits from generation of electricity

appears to be overplayed and it is incumbent upon leaders to correct this misconception.

Annexure 2

August 30, 2011

Critique of

World Bank's Project Appraisal Document for Vishnugad Pipalkoti Hydro Electric Project dated June 10, 2011

By

Dr Bharat Jhunjhunwala, PhD, Food and Resource Economics, University of Florida; Former Professor IIM Bangalore

Introduction

The World Bank has approved a loan to THDC for the Vishnugad-Pipalkoti project. This is a quick comment on the Project Appraisal Document of World Bank

Demand for Electricity

WB proceeds on the basis that 400 million people in the country do not have access to electricity, therefore, it is necessary to increase generation (Para 1). This is not correct. The number of rural households to be electrified in April 2005 was 40,853,584 while those electrified in the period April 2005 to January 2009 was 5,679,143 as per RGGVY statistics. Every month 123,459 new households were provided with electricity in this period. The increase in electricity required every month for supply to these 123,459 households is 7.3 million units per month at the lifeline consumption of 30 Units per month.

Generation of electricity in the country in 2005-06 was 58.1 billion units per month. Generation increased to 65 billion units per month in August 2009. The increase in generation was 168 million units per month. The total requirement of electricity for the 40,853,584 unelectrified households is 1.2 billion units per month. This is only 1.8 percent of the generation already achieved.

Therefore, the so called shortage of electricity is not the reason for not providing electricity to the villages and poor households. Rather the non-provision of electricity to poor households is a ploy to convince the poor people to bear the unaccounted and devastating environmental costs in order to provide electricity to meet the unending demand of the upper classes.

Actually WB policy leads to a result that is opposite to what is claimed. Increased generation imposes huge environmental costs on the poor while benefits are drawn by the rich consumers. The policy of evermore increased generation becomes an instrument to transfer natural resources from poor to the rich.

The correct solution is to make equitable distribution of electricity already available.

Hydropower is not clean

WB proceeds on the basis that hydropower will help control carbon emissions and is ‘clean’ (Para 2-4).

The reservoir of VPHEP will create certain methane emissions. These have not been factored in.

Even if carbon emissions from VPHEP are less, the other environmental costs are huge. These include costs due to:

1 Change in sediment regime

2 Deterioration of quality of river water

3 Methane emissions from reservoir

4 Loss of Forests—carbon sequestration, biodiversity, minor forest produce.

5 Increased incidence of landslides

6 Negative impact on health

7 Loss of biodiversity

8 Extinction of the endangered Cheer Pheasant

9 Loss of sand and fishing to local people

10 Loss of aesthetic value of free-flowing water

11 Loss of soul due to relocation of temples and cremation Ghats

The cost-benefit ratio is negative once these environmental costs are taken into account.

I have examined the cost-benefit analysis filed by THDC before MOEF under the Forest Conservation Act. The figures presented are totally misleading as shown in Table 1 and 2 below.

Table 1: Cost-Benefit Analysis of Vishnugad-Pipalkoti as per THDC and Alternative calculations

Sl No as per THDC statement	Particulars	Amount as stated by THDC (in Rs crore)	Alternative calculations as per Petitioners (in Rs crore). Lifetime	Explanation
1	Total Cost	2096.81	2096.81	Loss of timber Rs 2.96 lacs and Loss of animal husbandry productivity Rs 7.24 lacs is ignored since insignificant as stated by THDC.
2	Power generation	409.74 per year	243.2 lifetime	Total discounted value of power generation is Rs 2027.0 crores. Of this Uttarakhand will get free power of 12%. This is the benefit from the project.
2(B)	Direct Employment of Labourers. Employment generation 2600 man days per days for 5 years.	Not specified	19.5	Benefit is only the additional income from employment. Assuming Rs 50 would be earned by the labourers anyways, the additional income is only Rs 50. 2600 persons x 300 days x 5

				years x Rs 50
2(C)	Employment generation due to other activities. Employment generation 2600 man days per days for 5 years.	Not specified	19.5	Benefit is only the additional income from employment. Assuming Rs 50 would be earned by the labourers anyways, the additional income is only Rs 50. 2600 persons x 300 days x 5 years x Rs 50
	Total Benefit	409.74 crores per year	282.2	
	Cost-Benefit Ratio	Not specified	**0.13**	

THDC has not included certain benefits and costs in its calculation. It has not included the benefits from profits generated from THDC; and also benefits to society from the consumption of electricity. On the other hand, THDC has not included various environmental costs such as drying of water sources, loss of biodiversity, loss of aesthetic value of river, deterioration of water quality etc. These benefits and costs are now included. Then the benefits become negative. The CBR becomes (-) 2.01.

Table 2: Cost-Benefit of Vishnugad-Pipalkoti including items not accounted for by THDC.

Particulars	Amount as stated by THDC (in Rs crore)	Alternative calculations as per Petitioners (in Rs crore), lifetime	Explanation
Items accounted by THDC	409.74 crores per year	282.2	(from table above)

Consumer's benefits from consumption of electricity	Nil	636.9	No benefit in first 4 years. 88% of the 181.3 crore units generation per year is consumed by society. Total benefit to society is assessed at Rs 3.30 per unit (*Economics of Hydropower*, Kalpaz, 2009). Deduct cost of purchase of Rs 2.26 per unit to give net benefit Rs 1.04 per unit. This is discounted to present value.
Profits of THDC	Nil	289.9	No profits in first 4 years. Total project cost is Rs 2091.4 crores. Assuming debt-equity ratio of 1:4; Equity will be Rs 418.3 crores. Assuming rate of profit of 14 percent, annual profit is Rs 58.6 crore. Discounted to present.
Environmental costs	Nil	-5428.8	Environmental costs of Kotlibhel 1B project is assessed at Rs 7.34 per unit (*Economics of Hydropower*, Kalpaz, 2009). That is for a reservoir based project. Assuming the costs to be one-half of that, the environmental cost from Vishnugad Pipalkoti will be Rs 3.67 per unit on 181.3 crore units per year. This is discounted for next 40 years.
Total benefits	409.74 per year	-4219.8	Including items ignored by THDC.
Cost-Benefit Ratio		**(-) 2.01**	Including items ignored by THDC.

WB has made a grave error by looking only at carbon emissions and not at all the environmental costs. The Cost-Benefit ratio becomes negative when these are taken into account.

The project is harmful for the economy of India. However, it provides profits to THDC because the environmental costs are surreptitiously passed on to the poor and not accounted for.

The project will not take India towards a country free of poverty and exclusion (Paras 19-20, 24). On the contrary it will lead to more deprivation and exclusion.

Sensitivity Analysis

WB recognizes that hydropower projects are "capital-intensive, risky and have long payback periods" (Para 6, Item 6). Implication is that a sensitivity analysis is essential. The levelized cost of production is stated to be Rs 4.38/kWh (Para 46). According to a press release by Clinton Foundation, the cost of solar power is likely to become Rs 4/kWh. I understand mega-thermal projects are quoting rates of Rs 2/kWh (for base load). In such event, these projects will become unviable but the country's natural resources would have been committed. It was necessary to undertake a sensitivity analysis of changing economic scenario.

Cumulative Impact Assessment

WB relies on IIT Roorkee study on Cumulative Impact Assessment (Para 14). This study is full of falsehoods. Specifically:

1 World Commission on Dams is reported to have recommended 10% release as Environment Flows while actually the Commission has deprecated this practice.

2 The Zonation classification is passed off as Environment Management Class.

3 Figures for Green House Gas emissions are taken from temperate reservoirs but passed off as applicable for tropical reservoirs.

4 The NEERI study done for a single project is extrapolated to cumulative study.

5 Shri Chandi Prasad Bhatt has been quoted as supporting dams while actually he has opposed them.

A detailed critique of the IITR study is given at Annexure 1 to this critique.

Environment Flows

WB states with approval that the Environment Flows have been revised from 3 to 15.65 cumecs on the basis of IITR study (Para 31, footnote 12). While this increase is welcome, it is woefully inadequate to meet the environmental requirements. Detailed critique of IITR methodology is given at Annexure 1. Main points regarding inadequacy of the recommended Environmental Flows are that IITR has:

1 Not done assessment of EFR on the basis of Cumulative Impact Assessment.

2 Inappropriately taken Mean Annual Flow instead of Mean Seasonal Flow which is more suitable to Indian rivers with their huge seasonal variations.

3 Relied on specific methods adopted in France and England without giving any justification.

4 Quoted World Commission on Dams opposite of WCD is saying.

5 Reduced 'environment' to mere fish.

6 Not calculated the flows required even for the survival of fish.

7 Merely restated the existing practice of Q95 in Uttarakhand without application of mind.

8 The benign alternative of partial obstruction has not been considered.

9 The desired state of the river and social expectations are not taken into account.

The E-flows on the basis of which THDC has made the project have been challenged by me before the National Green tribunal and it is likely that further many-fold increase in the same will be ordered. Consequently the financial projections on which the WB loan has been processed will be rendered meaningless.

Aesthetic and spiritual value of Ganga River

WB has relied on IITR study to assert that the religious and aesthetic needs can be addressed through imposition of higher environmental flows requirement (Para 42). Detailed critique of IITR study is given at Annexure 1. The main flaws in this conclusion are as follows:

1 The NEERI study had concluded that the Tehri dam will not impact the self-purifying capacity of the Bhagirathi River. This conclusion of the NEERI

study is disputed as detailed at Annexure 1. More importantly, the NEERI study was done for a single project, namely, Tehri. IITR has mindlessly extrapolated it to mean that there will be no impact even if a cascade of dams is made on the entire river.

2 IITR has selected key-informants in a biased manner. Views of large number of persons who are opposing these dams on religious and social considerations have been deliberately kept out.

3 IITR has not examined the non-use values of the Ganga River.

4 The Har-ki-Pauri diversion accepted by the Hindus under duress during the colonial period is mindlessly applied without recognizing the change in context.

The conclusion of IIT, and reliance on the same by WB, is unwarranted.

Small HEP on Toe of the project

The small HEP proposed on Toe of the project to use E-flows (Para 46) appears not to have clearance from CEA and Environment- and Forest Clearances. This is an illegal extension that will most likely not survive a legal challenge.

Access to grazing

The loss of access to grazing is not compensated by compensation of Rs 100 per day for 100 days (Para 59).

Mapping of water sources

THDC has given a study to Department of Earth Sciences of IITR to examine impact on water sources (Para 61). The quality of work by IITR is suspect. More specifically, Dr S P Sati of HNB Garhwal University has informed me in a personal communication that "as far we know it is almost impossible to get an alignment through the zone along which fractures/shears/ joints are not found which support the ground water regime. The only source of ground water in the Himalayan terrain is the secondary porosity of the rocks in form of fractures/joints which are practically present everywhere in the Himalayan Rocks."

The study by IITR will most likely be a whitewash operation.

Environmental Impacts

WB has relied on the EIA to state that environmental impacts have been adequately studied and they can be mitigated. The following impacts have not been studied in the EIA:

1 Change in sediment regime

2 Deterioration of quality of river water due to less absorption of beneficent chemicals like Cr, Cu, and Th; and due to harm to wide-spectrum coliphages.

3 Methane emissions from reservoir

4 Increased incidence of landslides

5 Extinction of the endangered Cheer Pheasant

6 Loss of aesthetic value of free-flowing water

7 Loss of soul due to relocation of temples and cremation Ghats

The following impacts have been recognized but these are not truly mitigable:

1 Rehabilitation of aquatic biodiversity is not found to be successful. Best method is in situ conservation.

2 Nanda Devi Forest Conservator says EIA has not examined impact on seasonal migration of fish. He further says EIA is questionable because Grey Wolf and Wild Dog are not found in the area but reported in EIA (Annexure 2).

Annexure 1: Critique of IITR and WII studies

August 19, 2011

Critique of

Study of Cumulative Impacts of Hydropower projects on Ganga River by

AHEC, IIT, Roorkee and WII, Dehradun

By

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Executive Summary

IIT Roorkee

6 The study has been undertaken by Dr Arun Kumar as an individual consultancy assignment. It is not a study by AHEC or IIT. However, Dr Arun Kumar is passing this off as a study by IITR.

7 It is assumed without basis that tunneling can avoid fracturing aquifers.

8 It is assumed without basis that earthquakes can be predicted from surface seismological data.

9 The parameters of water quality showing greatest impact of hydro projects have been deliberately not mentioned.

10 The methods used for assessing Environmental Flows are hydrological or as per existing practice. They are not based on cumulative environmental impacts as required by TOR.

11 World Commission on Dams is reported to have recommended 10% release as Environment Flows while actually the Commission has deprecated this practice.

12 The alternative of partial obstruction is not examined.

13 The Environmental Flows do not take into account the need to upgrade the river to higher state.

14 Building Block Method is endorsed but even a sample calculation is not done. Environmental flows are recommended on hydrological basis contrary to this endorsement.

15 The Zonation classification is passed off as Environment Management Class.

16 Energy Payback Ratio is calculated without accounting for social- and environmental costs and some economic costs.

17 Figures for Green House Gas emissions are taken from temperate reservoirs and not tropical reservoirs.

18 Effectiveness of fish passages is not assessed.

19 Impact of hydro projects on the creation of beneficent sediments is not assessed.

20 The NEERI study done for a single project is extrapolated to cumulative study.

21 Key informants for assessing religious and cultural impacts are not selected on a scientific basis.

22 Shri Chandi Prasad Bhatt has been quoted as supporting dams while actually he has opposed them.

23 Har-ki-pauri precedent made under a foreign power in colonial period is invoked mindlessly and quoted out of context.

24 Cumulative environmental impact is done prophetically without giving any basis.

25 Stakeholder-wise distribution of benefits and costs is not done.

26 Dams more than 20 m height are discouraged yet dams greater than 20 m height are recommended.

27 Gap between hydro projects is suggested but no scientific method to assess the same is given; and problem of 'no gap' between existing projects is not addressed.

28 It is suggested that 70% of the river may be harnessed for generation of hydropower without giving any basis of the same.

WII, Dehradun

1 Environment Flow Requirement should be based on Mean Seasonal Flow, not on Mean Annual Flow. This is welcome.

2 Cumulative impact assessment ignores (1) Change in sediment transport; (2) Deterioration of water quality; (3) More oxygen in water; (4) Carry of drift materials.

3 Impact of existing dams on the low cumulative scores for Vishnugad-Pipalkoti and Kotlibhel 1A are not examined.

4 Conservation importance ignores cultural value of Ganga River; and many places of significance such as Koteshwar and Dhari Devi Temples.

5 Existence of Otter is ignored.

6 Threat to the Cheer Pheasant is not mitigated.

7 Zone of influence is arbitrarily restricted to 500 meters.

8 Classification in Environment Management Class ignores the (1) importance of the river basin; and (2) need to upgrade the river to higher management class.

9 Mitigation measures are not spelled out.

Background

While considering the application of NHPC for diversion of forest lands, the Hon Supreme Court ordered that a study of Cumulative Impacts of hydropower

projects on Rivers Bhagirathi, Alaknanda and Ganga be carried out. The study was given to AHEC, IITR on the basis of this order. A parallel study was given to Wildlife Institute of India (WII).

AHEC, IITR has now submitted the study. WII has submitted its interim report. This representation is made to bring to the notice of MOEF the various glaring shortcomings of, and unfounded conclusions drawn by these studies. It is prayed to MOEF that these studies should not be taken cognizance of till the shortcomings are removed.

The form which submitted by Dr Arun Kumar for getting the approval of Dean, SRIC, IITR shows as follow:

a. Type of Sponsorship: - Govt. Sector

b. Type of Consultancy Project: - Type I, Individual (without use of laboratory facilities)

c. Nature of projects: - Consultancy.

d. Whether MoU/Agreement signed with Agency: Not Signed.

It is clear from above that the study has been given by MOEF to Dr Arun Kumar as an individual consultancy assignment. The study has not been done either by AHEC or IITR. However, MOEF is treating as if the study has been done by IITR.

AHEC, IIT, Roorkee Report

Chapter numbers follow those given in the AHEC report.

1-3: Introduction

These Chapters have been skipped for comments as they are introductory in nature.

4: Geological Studies

AHEC admits that hydro projects will change the downstream sediment regime. Sediment-hungry river waters are likely to increase the erosive power of the river downstream and deprive the aquatic life of nourishing elements (Para 4.2.10.3). However, it only recommends that "sediment load in both upstream and downstream of the dam/barrage be monitored" (Para 4.2.12.6). It is obvious that 'monitoring' will not mitigate the negative impacts of change in the sediment regime. AHEC neither assesses the extent of impact not gives any suggestions to manage this problem.

AHEC admits that "tunnels invariably face the problem of leakage of water from sheared, fractured and jointed rock zones they cut through… Due to this the sources of water… get dried up or the flow is reduced. It is suggested that tunneling as well as adit sites be chosen in such manner that they don't cut through such zones specially the underground water flow regime" (Para 4.2.12.5). AHEC should have done a study of the extent to which such fractures have taken place in the existing or under construction projects. It is not known to me whether techniques to map these underground water sources have been developed and whether this is possible at all. It is also assumed that realignment is possible. None of these assumptions may hold. Dr S P Sati of HNB Garhwal University has informed me in a personal communication that "as far we know it is almost impossible to get an alignment through the zone along which fractures/shears/ joints are not found which support the ground water regime. The only source of ground water in the Himalayan terrain is the secondary porosity of the rocks in form of fractures/joints which are practically present everywhere in the Himalayan Rocks."

AHEC says those only a limited number of hydropower projects in the area have been completed or are under construction. This has happened only in the last decade. On the basis of such limited information, AHEC says that "The information gathered during the present study does not show any effect of one HP on the other HP located downstream in geological parameters." This statement is self-contradictory. The impact of a HP at present would be seen only on the downstream adjacent area—not necessarily on the downstream HP because the downstream HEP may be located at some distance or on other side of the river. This has not been studied. Thus AHEC has concluded that there is no cumulative impact without studying it.

5: Seismological Aspects

AHEC proceeds on the basis that there is no recorded increase in Reservoir Induced Seismicity in the Himalayas. It says no increase in seismic activity is noted around four hydropower reservoirs (Para 5.7.4).

Further, it concludes on the strength of mathematical modeling that Conditional Probability of RIS in projects in the area is about 0.02 which is less than the Critical Probability of 0.2, therefore, the "cumulative risk of occurrence of reservoir induced earthquakes, as a random event, seems to be very unlikely" (Para 5.9).

AHEC also notes that "contemporary deformation styles in the Himalayas are guided by under thrusting of the Indian plate along the detachment surface" (Para 5.5).

I am not very knowledgeable about this science. However, I am somewhat knowledgeable about statistics. The following points may be noted.

One, Conditional Probability of RIS in projects in the area being about 0.02, seems to imply that there is a 2:100 chance of RIS.

Two, probability does not tell us anything about an *individual* happening. Low probability of a person contracting malaria does not mean that that particular person will conclusively *not* contract malaria. Similarly, RIS may yet occur.

Three, no cumulative impact study has been done here. The conclusion that "cumulative risk of occurrence of reservoir induced earthquakes seems to be very unlikely" has been pulled out of the air and lacks any basis. Cumulative impact would examine whether multiple projects in close proximity could increase the chances of RIS.

Four, none of the earthquakes that have taken place in the Himalayas could be predicted by surface measurements of tectonic activity. This is so because the pressures that are getting built up many kilometers below the surface do not get reflected in measurements on the surface. The correct question then is whether the loading of hydropower reservoirs will impact the pressures that are building up deep below. If the Indian Plate continues to thrust against the Tibetan Plate then pressures have to necessarily build up deep below and that pressure may be increased due to the load of reservoirs. This has not been examined.

6: Water Quality, Biodiversity and River Ecology

6.1 Water Quality

AHEC says:

> The water quality of… Tehri… and Vishnu Prayag have been compared with baseline water quality. The impact on DO is negligible; the BOD remains unchanged as the water passes through the tunnels/channels… The other parameters do not show significant change (Page 6-59).

I have extracted the water quality data for u/s and d/s provided by AHEC for Tehri and Vishnu Prayag projects. The change is given in the Tables below:

Tehri

Sl No	HP	Temp	pH	DO	Cond	TDS	Turbidity	NO3-N	TP	BOD	Fecal C
26	Tehri-u/s Chilyanisaur	11.7	7.8	9.43	169.9	80.4	0.71	0.8	0.98	1.87	20
26	Tehri (Outlet)-d/s	14.1	7.9	9.26	113.4	53.6	5.77	0.4	2.66	1.92	240
	Change	-2.4	-0.1	0.17	56.5	26.8	-5.06	0.4	-1.68	-0.05	-220
	Change (%)	-20.51%	-1.28%	1.80%	33.25%	33.33%	-712.68%	50.00%	-171.43%	-2.67%	-1100.00%
	Severe?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes

Vishnu Prayag

Sl No	HP	Temp	pH	DO	Cond	TDS	Turbidity	NO3-N	TP	BOD	Fecal C
5	Vishnu Prayag u/s	6.6	7.6	8.92	81.4	38.3	1.2	2.14	0.93	1.8	39
5	Vishnu Prayag d/s	8.9	7.8	9.04	192.8	94.9	1.1	3.4	5.4	1.6	21
	Change	-2.3	-0.2	-0.12	-111.4	-56.6	0.1	-1.26	-4.47	0.2	18
	Change (%)	-34.8%	-2.6%	-1.3%	-136.8%	-147.8%	8.3%	-58.9%	-480.6%	11.1%	46.1%
	Severe?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes

In both projects, AHEC is correct in stating that impact on DO and BOD is negligible. However, change in the other parameters is severe. Precisely these have not reported by AHEC. The statement that "other parameters do not show significant change" is totally unwarranted. As shown in the case of ROR Vishnu Prayag project, these impacts are severe in ROR projects as well.

AHEC mentions that water quality satisfies CPCB parameters for Class 'A'. This is correct. But CPCB parameters have been developed for drinking water purposes in an urban setting. They have not been developed for ecological assessment. For example, DO may decline from 12 mg/l to 6 mg/l. This will still satisfy CPCB Class 'A' requirement. Yet this hides a huge environmental

impact. Many aquatic lives that require DO above, say, 10 mg/l to survive may die.

AHEC refers to NEERI report. This has been discussed at Chapter 9.2.2 of this comment.

7 Hydrological studies

7.3 Environmental Flow Requirements

AHEC has recommended EFR (Environmental Flow Requirements) at Table 7.17.

The steps used, as per my limited understanding, are as follows:

1 The Mean Annual Flow is calculated. This is the flow above and below which water flows one-half the days (183 days).

2 Percent of MAF required for EFR is calculated as per four different methods: (1) WCD; (2) France; (3) Q95; and (4) EMC-HMD.

3 The Maximum from these 4 methods is taken as the EFR.

4 This is suitably adjusted (mostly increased) during high-flow periods during monsoons (Table 7.18).

My critique of this method is presented below.

MAF Method

The Mean Annual Flow method is unsuitable for India's seasonal rivers. I give below hypothetical figures for a river:

Lean period Oct-May (8 months): 10 cumecs

High period June-Sep (4 months): 400 cumecs

Weighted Average: 140 cumecs

Mean Annual Flow (MAF): 10 cumecs

The average flow is 140 cumecs but MAF is only 10 cumecs. This happens because the huge increases in seasonal flows are ignored in the MAF calculations (This has been noted by EAC in its minutes of 2.6.2011). These flood flows have important ecological functions. Certain riparian vegetation can survive if they get high flows once-in-ten-years. Flood flows are also important for recharging groundwater in the plains. Therefore the correct method should be Average- or Mean Seasonal Flow.

WCD

I am unable to find in the report source of the WCD (World Commission of Dams) figures given at Table 7.17. Plain reading on the Table shows these are invariably 10% of MAF. Himanshu Thakkar has provided me with the following extract from the WCD report:

> 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 (page 239).
>
> Dams should provide for an environmental flow release to meet specific downstream ecosystem and livelihood objectives identified through scientific and participatory processes (p 294).

Clearly AHEC has attributed to WCD 10% MAF that WCD deprecates as arbitrary.

France Method

The freshwater fishing law in France requires that EFR should be 2.5% for existing schemes and 10% for proposed schemes (Page 7-20). EAC in its meeting of 2-3 June, 2011 has rightly noted "It is felt that French conditions may not be applicable for Indian rivers.

Fishing is not the main function of Indian rivers. Objective of the study was to assess 'environmental' impacts. These cannot be reduced to fishing.

Secondly, fishing may have less importance in France than, say, in the United Sates. The Edwards Dam in Maine was removed because the dam owner found it expensive to install fish elevators on an existing dam. Elhwa Dam in Washington is being removed because non-use values (cultural- and recreational values from fishing and kayaking) were deemed to be greater than benefits from irrigation and hydropower. AHEC should have applied its mind to various international precedents and then given justification for using a particular precedent.

It appears AHEC has chosen a country where the EFR are lowest because of less value of fishing. No justification is provided for choosing France. Indian rivers are different in terms of seasonal variations, sediment load, cultural significance, etc.

75% of Q95

Q95 refers to flow which is equaled or exceeded 95% of the time. Thus, Q95 is the flow at the lowest 17 days of the year.

Justification for use of this method given is this: "Q95 is often used in regulating abstraction in Uttarakhand. Figure of Q95 was chosen purely on hydrological grounds" (Page 7-33).

Purpose of the study given to AHEC was to assess EFR on the basis of Cumulative Environmental Impacts so that the existing practice may be modified. Instead of making its own assessment, it has merely dittoed the existing practice in Uttarakhand. There was no need to undertake the study if only the existing practice was to be restated.

Secondly, study was given to AHEC to assess EFR on the basis of Cumulative Environmental Impacts. Instead it has based its assessment on 'hydrological grounds.' Even here, it is not stated why Q95 is chosen on hydrological grounds and not Q50 or Q05.

Then AHEC relies on the stipulation by Environment Agency of England and Wales that 25% of this Q95 can be extracted (Page 7-33). Once again, why AHEC has relied on this Agency is not stated.

EMC-HMD

Fourth basis for assessing EFR is EMC-HMD (Environment Management Class-Hydrological Mean Depth) (Table 7.15). The depth (Hydraulic Mean Depth) and velocity required for certain macro invertebrates are given at Tables 6.22-6.24. No source is given for this data. This is curious because the WII study says:

> There was no information available on the precise hydrological requirements of the organisms dwelling in the habitats of Upper Ganga (Page 72).

Further, it is not clear how these species-specific figures have been correlated with the values of HMD, velocity, cross-section and discharge for *specific projects* given at Table 7.15. No details are given as to how the figures at Table 7.15 have been calculated. These appear to have no relation with the flows required for aquatic life.

Moreover, it is inadequate to assess the flow require for survival of a species. The WII study cautions:

> Considering the minimum hydraulic requirement of various species… the minimum environmental flow was calculated based on mean annual flow. But this does not meet the

> minimum flow required for the various life history traits of a species, because the important activities like breeding, growth, metamorphosis and migration are mainly depending on the seasonal variation in natural flow pattern. Moreover, the flow requirements for the life history stages of many fishes are depending on the seasonal flow. Taking this into account, the environmental flow required for different sector of the river will be calculated from Mean Seasonal Flow (Page 42-43).

The EAC has noted in its meeting of 2-3 June, 2011:

> The minimum hydrological requirements for macro-invertebrates in rhirhthronic zones reported to vary from 15-50 cm with different velocity (25-100 cms^{-1}). The requirements shown in the report for the fish are also similar to that. But the region harbour diverse fish species varying from small sized loaches to mighty mahseers. The loaches are indicators of perennial water bodies as they thrive in shallow sheet of semi-stagnant water, while Mahseer need fast flowing rivers, rivulets and streams for migratory run and shallow side pools for breeding and feeding. Therefore the different life stages and size of the fish should be considered for estimation of environmental flow requirement.

Further, the method is flawed because fish is not the only purpose of the river. Objective of the study was 'Cumulative Environmental Impacts,' which includes various impacts including religious and merely that on fish.

Partial Obstruction

It was suggested in an earlier representation submitted to AHEC in September 2010 by 40 academicians including this writer that AHEC should examine the alternative of making a partial obstruction in the river instead of a barrage across the river. Such partial obstruction would enable upward migration of fish and downward flow of sediments. AHEC has not considered this alternative. It has proceeded on the basis that barrages are the right thing to make.

Desired State of the River

The study was given to AHEC under the umbrella of NGRBA. Objective of NGRBA is 'conservation' of the National Ganga River. Conservation implies rebuilding the river where it may have been excessively damaged. In this context, AHEC favourably quotes Smakhtin: "Environment flow aim(s) to maintain an ecosystem in, or *upgrade it* to, some prescribed or negotiated condition" (Page 7-23).

AHEC recognizes that EFR depends, among others, on the 'desired state of the river' (Page 7-18). It also says that EFR depends upon "what the society expects from the river" (Page 7-63). Yet, there is nothing in the report about the desired state or expectations of the society. Having admitted these, AHEC falls back on routine hydrological methods and ignores these vital observations.

EAC has noted in its meeting of 2-3 June, 2011:

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

Conclusion

AHEC has:

10 Not done assessment of EFR on the basis of Cumulative Impact Assessment.

11 Inappropriately taken Mean Annual Flow instead of Mean Seasonal Flow which is more suitable to Indian rivers with their huge seasonal variations.

12 Relied on specific methods adopted in France and England without giving any justification.

13 Quoted World Commission on Dams opposite of WCD is saying.

14 Reduced 'environment' to mere fish.

15 Not calculated the flows required even for the survival of fish.

16 Merely restated the existing practice of Q95 in Uttarakhand without application of mind.

17 The benign alternative of partial obstruction has not been considered.

18 The desired state of the river and social expectations are not taken into account.

The EFR calculated by AHEC are, therefore, not acceptable.

7.3.4 Building Block Method

AHEC favourably mentions Building Block Method (BBM) for determining EFR:

> The "Building Blocks are different components of flow which, when combined, comprise a regime that facilitates the maintenance of the river in a pre-specified condition. The flow block comprises low flows, as well as high flows, required for channel maintenance and fifer between 'normal years' and 'drought years' (Page 7-22).
>
> Methods, such as the Building Block Method, can use detailed data from different sectors and have provision for consultation among the experts and stakeholders. However application of BBM for a large number of sites requires a lot of time and finances. It is, therefore recommended that the exact values of EFR for implementation in the field may

> be arrived at by conducting specific measurements and field campaigns and consultations with all the stakeholders (Page 7-63ff).

This was seconded by the EAC in its meeting of 2-3 June, 2011:

> 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. Also the methodology used may be different for different attitudes. The assumptions and hypothesis of these models need to be understood thoroughly before taking any decision for environmental flow for various projects.

A study from Zimbabwe (Balancing Water for the Environment, Water for Human Needs and Water for National Economic Purposes: A Case Study from the Rusape River, Save Basin, Zimbabwe, Faith Love, Elisha Madamombe, Brian Marshall and Evans Kaseke) explains how this is done:

> The environmental flow requirements were then determined by … using the building block method. This involves the following steps:
>
> 1. The first building block is the minimum release, taken at 70 % of mean monthly discharge, since a 30 % drop in flow is the generic minimal degradation level…
>
> 2. The second building block is the flushing floods, which maintain the channel by flushing the bed and disposing of poor-quality water at the start of the rainy season.
>
> 3. The third building block is habitat maintenance floods. Release of classes III and IV floods in the middle of the rainy season maintains the physical habitat heterogeneity.
>
> 4. The fourth building block is spawning floods: release of classes I and II floods triggers spawning.
>
> 5. The remaining (so far unallocated) upstream inflow received in any given month is available for storage in the dam or for release and abstraction by downstream users.

BBM entails listing all the ecological and social functions of the river and then determining how much water in each season is required for sustaining them.

AHEC concedes that EFR calculation by BBM is the correct method to use. However, it does not make these calculations because it requires time and money. AHEC could have left the matter here and given no recommendations for EFR. AHEC could have calculated the EFR by BBM for one project and shown how this can be done and the kind of results this gives.

But AHEC gives recommendations for EFR based only on the existing practices, saying these are only ‘indicative’ values (Page 7-63). In the process AHEC surreptitiously passes off the existing practices as ‘calculated’ EFRs.

7.3.6 Environment Management Class

EMC Method used by AHEC

AHEC says that it has three methods to assess EFR. The third method is described as "Environment Management Class (EMC) based Flow Duration Curve (FDC) Approach" (Page 7-33). The description of the EMC class in this section matches with the six-category classification suggested by Smakhtin for IWMI and quoted by AHEC at Table 7.4. This method is *qualitative.* It describes the environmental condition of a river or stretch thereof. A river may be classified as 'A' if it is in natural state and 'F' if it is critically degraded.

However, the EMC used by AHEC at Tables 7.15 and 7.17, is not EMC-FDC of Smakhtin. Instead it is a totally different category of EMC-HMD. This approach is *spatial.* It refers to the aquatic life in different zones or stretches of a river.

The EMC-HMD approach is mentioned by AHEC at Table 6.17 though here only EMC is mentioned lending itself to misinterpretation that it may refer to EMC-FDC while actually it refers to EMC-HMD. Reference is made in this table to study by Illies and Botosaneanu (1963). This study is described as follows:

> The distribution of organisms, resources, and biological processes change along rivers… The first attempt to categorize such discontinuities is the Stream Zone Concept (Illies and Botosaneanu 1963), which defined a series of distinct communities along rivers, separated by major faunal transition zones. (Bruno Maiolini and M Cristina Bruno, *The River Continuum Concept Revisited: Lessons from the Alps,* Museum of Natural Sciences of Trento).

The Illies method is a zonation method. It helps separate the stretches of a river into different zones. It has no connection whatsoever with the EMC suggested by Smakhtin which describes the *different condition of the river in the same zone.*

As mentioned above, AHEC seems to use depth, velocity, cross section and discharge for the survival of aquatic life in developing the figures of EMC-HMD given at Tables 7-15 and 7-17. This is fine from the perspective of zonation. The aquatic life in particular stretches of river may be specified and flow required for their survival may be estimated. But this is not the EMC-FDC approach of Smakhtin that AHEC *claims* to use but uses EMC-HMD instead.

Actually I have not found the term 'EMC' being used in the sense of Zonation at all. It may be that AHEC has deliberately misnamed the zonation concept as EMC to make it appear that the EFR suggested by it are derived from EMC-FDC method of Smakhtin.

EFR values calculated by AHEC

I give below Table extracted from Smakhtin giving the EFR (which is same as EWR) for Ganga at different EMCs:

Estimates of long-term EWR volumes (expressed as % of natural Mean Annual Runoff - MAR) at river basin outlets for different Environmental Management Classes obtained using FDC shifting method

River	Natural MAR (Billion Cubic Meters)	Long-term EWR (% Natural MAR)					
		A	B	C	D	E	F
Ganga	525	67.6	44.2	28.9	20.0	14.9	12.1

These values can be compared with those calculated by AHEC. The AHEC values are given for selected projects on the Ganga below:

Table 7.17: Summary of results obtained for EFR using various EFA methodologies (as percent of MAF).

HEP Site	EFR Minimum	EFR Maximum
Maneri Bhali II	2.25	9.03
Tehri Stage I	2.5	15.09
Vishnugad Pipalkoti	7.62	10.72
Vishnu Prayag	2.5	9.58
Srinagar	10.0	13.40

Comparison of the above two tables indicates that AHEC has recommended EFR mostly *less than that for Class F Rivers*. Against 12.1 suggested by Smakhtin, AHEC has suggested averages that are consistently below this. AHEC has implicitly classified Ganga as *less-than F category*, without stating the same. Category 'F' is defined by Smakhtin as follows:

> Ecosystems in category F are likely to be those which have been modified beyond rehabilitation to anything approaching a natural condition (Page 17).

Clearly Ganga is not in such condition.

7.6.3 Ganga Delta Processes

AHEC says that Alaknanda and Bhagirathi Basins contribute only 4% to the sediments discharge of Ganga hence modification of sediment regime due to HEPs is unlikely to affect coastal erosion.

According to study done by R.J. Wasson)of Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia), out of total 794 million tons/year silt carried by Ganga, 635 million tons/year comes from Higher Himalayas and 159 million tons/year comes from lower Himalayas (A Sediment Budget for the Ganga-Brahmaputra catchment, *Current Science*).

There is a glaring difference between the two figures. AHEC says only 4% comes from Himalayas while Wasson says 100% comes from here. These figures need to be reconciled. AHEC may be underreporting the sediment figures.

7.7 Studies on Groundwater and Springs

Tables 7.41-7.42 of the AHEC Report indicates an average decrease of ground water level in hand pumps at Chamoli District by 7.3 percent and at Uttarkashi District by 0.2 percent. Yet AHEC concludes that "it is expected that there would be a positive impact of project on groundwater recharge and availability" (Page 7-108). No basis for this statement is given. It is not explained how project will recharge groundwater when even monsoons are not doing that. HEPs are built in a valley. The recharge, if at all, will impact only downstream areas. This is unlikely to recharge the hand pumps because the reservoir is located in the valley while habitations are on the hills.

On the other hand, discharge of groundwater due to piercing of aquifers will take place in tunnel-based projects because tunnels are made on higher elevations.

AHEC says "construction of tunnels may have positive as well as negative impacts on the groundwater conditions" (Page 7-130). It is not understood how tunnel-based projects will have positive impact.

AHEC quotes responses of various project authorities to the effect that there is no negative impact on springs. This is methodologically wrong because the project authorities have a vested interest in hiding any such impact. The study

by UJVNL (Cultural and Social Impact of Hydropower Projects by Dr D R Purohit) and ground experience indicates that this negative impact is taking place hugely.

AHEC assumes that aquifers are disconnected and impact of piercing will be local (Page 7-129). No basis is given for making this statement. Purpose of the study was Cumulative Impact Assessment. It was obligatory for AHEC to do such study.

Himanshu Thakkar reports inconsistencies in the data given by AHEC in this regard:

> The report could not assess the impact of projects on springs "due to limitations of data" … the authors … could have easily found from local communities the impact of the projects on the local springs… they 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. The conclusion is certainly known to be wrong in case of Loharinag Pala, Pala Maneri, Phata Byung 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…

8: Hydropower Development

General

This Chapter is beyond the TOR. There is nothing in TOR about hydropower potential, shortages, etc.

Himanshu Thakkar points out that AHEC has failed to do study of performance of hydropower projects:

> … the consultant … should have assessed how the generation per MW has been changing over the years and how the actual generation compares with the promised 90% dependable generation… SANDRP analysis shows that per MW generation of hydropower projects in India has come down by a huge 25% in last 20 years. Secondly, 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.

8.1 Power Scenario

AHEC seems to say there is need to generate more power within the State because it is a net importer of power. However, power purchased appears to be cheaper than the hydro power generated within the state. The average purchase

cost (Excluding THDC and overdrawal) is Rs 2.20 per unit. The present cost of generation will be about Rs 3 per unit. (Cost of generation is Rs 2.37 from Kotlibhel 1B at 2006 prices). Thus it is cheaper for the State to import than to generate hydropower.

8.5 Energy payback ratio

AHEC quotes study by L Gagnon ("Civilization and Energy Payback," *Energy Policy,* 36(9)) to the effect that energy payback ratio for hydropower is in the range of 170-280 against 1.6-3.3 for coal. Thus, it is sought to be established that hydro is the best option for power generation.

The "energy payback ratio" of a power plant is defined as the total energy produced over the lifetime of the plant divided by the energy needed to build, operate, fuel and decommission it.

Plain reading of above statement shows that only the costs incurred to "to build, operate, fuel and decommission" the project are concerned. These are 'private costs'. Costs incurred by the society or 'externalities' are ignored.

Indeed hydropower involves less expenditure in generation than other sources of energy. This is because thermal and nuclear require extraction of fuel; while hydro does not require such fuel. On the other hand, the environmental and social costs of hydro are very high. Thus the correct method is to calculate both the private- and social costs of the various alternatives.

Saying hydro is the best option on the basis of energy payback ratio alone is like saying that the energy payback ratio of the butcher is very high. Ne has to calculate the cost of the animal that is butchered. Similarly AHEC should have calculated both the social and environmental costs of hydropower.

A cost-benefit analysis of Kotlibhel 1B project shows that it is highly negative once environmental costs are included.

Table: Cost-Benefit Analysis of KB1B

Sl No	Item	Benefit	Cost
1	Benefits from generation of power	103.8	
2	12% Free power to State	50.2	

3	Employment	1.5	
4	Environmental Costs		931.8
	Total benefit and cost of Kotlibhel 1B HEP	155.5	931.8
	Net loss		776.3

Source: Economics of Hydropower by Bharat Jhunjhunwala.

The Kotlibhel 1B project has a negative overall cost-benefit ratio. However, it is profitable for hydropower companies to build this because they have to only bear the private costs. The environmental costs are surreptitiously passed on to the society. Implication is that calculation of energy payback ratio should include social and environmental costs.

In addition to the environmental costs included in the above study, AHEC was requested to include the following vide representation of September 2010:

> Loss of value of services provided by nature relying, among others, on Costanza (1997).
>
> Depletion premium of free-flowing rivers. The value of remaining free-flow will increase as large numbers of projects are made.
>
> Costs of decommissioning the projects.
>
> Higher consumer value of power produced during peak hours and lower value of power produced during monsoons.
>
> Sensitivity analysis of the efficacy of projects in view of the expected decline in price of solar power in next few years. Will it be beneficial to make long term commitment of river resources for gains that may not accrue at a later period?

None of these have been included in the study.

8.6 GHG Emissions from Hydropower

AHEC quotes study to the effect that GHG emissions from hydropower are only 4-18 grams CO2 per kWh against 940-1340 grams for coal (Table 8.2). A close reading of the table shows following figures:

Energy Source	**Emission Factor gCO2 equiv/kWh(e)**
Coal	940-1340

Hydro power	4-18
Tropical Reservoirs (Petit-Saut)	~455 (gross)/~327 (net)
Tropical Reservoirs (Brazil)	~6 to 2100 (average ~160)

The high value of GHG emissions from tropical reservoirs is 2100 gCO2/kWh. This is far in excess of high value of GHG emissions from coal at 1340 gCO2/kWh.

A study by International Rivers (Fizzy Science: Loosening the Hydro Industry's Grip on Reservoir Greenhouse Gas Emissions Research) gives an average figure of 2154 gCO2/kWh of net emissions from three hydropower reservoirs from Brazil. This matches with the high value given by AHEC.

The low value of 4-18 gCO2/kWh for hydropower quoted by AHEC apparently relates to *all* hydropower projects—including those in temperate regions. This is wholly inapplicable to India.

In the result, GHG emissions from hydropower in India are about two times those from coal; and not less as indicated by AHEC.

8.7 Barriers for Fish Migration

AHEC recommends that fish passages must be installed on the hydropower projects to mitigate the negative impacts of HEPs. It does not give any assessment of effectiveness of these passages. A report by Himachal Pradesh fisheries department says:

> Regardless of their height, weirs and dams constitute barriers to breeding migration of Mahseer. Further, Mahseer population is also affected by morphological modifications resulting from completion of river valley projects. These include change in slope, river-bed profile, submersion of gravel zones or riffle section as well as destruction of riparian vegetation and changes in tropic regimes. Most of the negative factors affect upper parts of the streams where lacustrine conditions are superimposed on the river. Downstream, the hydrological conditions get severely altered through reduction of water discharge. The adverse conditions of the flow can extend over many kilometers downstream of the obstruction so that fish passages become difficult (Fisheries Growth, HP Government Website, http://himachal.nic.in/fisheries/mahseer.htm).

Many studies are available of the ineffectiveness of fish passages (For example, (Evaluation of Mitigation Effectiveness at Hydropower Projects: Fish Passage,

Division of Hydropower Administration and Compliance, Office of Energy Projects, Federal Energy Regulatory Commission, September 2004).

I have visited few hydropower projects in the United States. My impression is that fish elevators are somewhat effective while fish passages are almost wholly ineffective. AHEC does not dwell into the issue.

AHEC fails to examine the effectiveness of fish passages and passes off mere listing of options as proof of their effectiveness.

8.17 Hydropower Performance

AHEC says that State of Uttarakhand stands to gain from hydropower projects because (1) State will get 12% free power; and (2) About 10% of investment in the projects will flow to state economy. This is correct. However, it is stating only the credit side of the balance sheet. The debit side consists of environmental- and social impacts.

AHEC is ignoring various losses to the state economy from environmental impacts. These include

(1) Deterioration in Quality of river water,

(2) Damage to health and environment due to methane emissions;

(3) Submergence of forests and its impact on biodiversity, grazing and carbon sequestration,

(4) Increased probability of Reservoir Induced Seismicity,

(5) Deterioration of health due to breeding of mosquitoes and development of water borne diseases,

(6) Loss of wildlife such as Mahseer and Smooth Coated Otter,

(7) Los of sand to local people,

(8) Loss of tourism potential due to white water rafting;

(9) Loss of cultural heritage such as lingwas;

(10) Loss of aesthetic value of free flowing river;

(11) Loss of sediments that prevent coastal erosion, that provide nourishment to downstream fisheries and that provides Cu Cr and Th to river water and help generate its special self-purifying capacity;

(12) Migration due to submergence and tectonic disturbance of agricultural lands.

AHEC is only accounting for the benefits and ignoring the costs. Mandate of AHEC was to look at the Cumulative *Environmental* Impacts. Instead of calculating the economic values of the mandated environmental impacts, AHEC has only calculated economic benefits that were not mandated by TOR.

8.18 Conclusions

AHEC concludes that "Based on the analysis of the potential sites, the conclusion emerges that hydropower at identified sites can be harnessed consistent with environment sustainability provided certain measures are taken."

This conclusion is wholly arbitrary and unfounded. There is nothing in the preceding part of the Chapter regarding environment and mitigative steps. Further, the various shortcomings indicate that this conclusion is unwarranted.

9 Impact on Places of Religious and Cultural Importance

9.2.2 Ganga as Goddess and Aviral Dhara

AHEC gives a long narrative of the spiritual and religious significance of Ganga. Then it refers to the NEERI study on "Comment on Self-Purification Capacity of Bhagirathi: Impact of Tehri Dam." AHEC quotes from the NEERI study:

> The uniqueness of river Bhagirathi/ Ganga lies in its sediment content which is more radioactive compared to other river and lake water sediments, can release Cu and Cr which have bactericidal properties and can harbour and cause proliferation (under static condition) of coliphages that reduce and ultimately eliminate coliforms from the overlying water column.

Then AHEC quotes the conclusion of NEERI:

> Tehri dam is not likely to affect the quality or self preservation property of river Bhagirathi/ Ganga, as it mimics a static container which is conducive for conditions responsible to maintain the water quality.

I, along with Dr G D Agarwal, have had a long exchange of views with NEERI on this study. Crux of the matter lies in sediments. It is clear that sediments of the Ganga have special quality in terms of Cu, Cr, U and Th. These elements appear to contribute to the development of wide-spectrum coliphages. NEERI has studied whether making of Tehri Dam is likely to affect the self-purifying quality. It concluded that such negative impact is unlikely because *the*

beneficent sediment is already there. Once the sediment is in place, keeping the water in static condition does not seem to affect the self-purifying capacity of the river water.

It is admitted by NEERI that the wide-spectrum coliphages or the Cu, Cr, U and Th in sediments are not found at Gomukh. The metals are absorbed and coliphages develop during the flow from Gomukh to Tehri due to mechanical weathering.

Building of a cascade of dams on the river will prevent this mechanical weathering and thereby it will deprive the waters of these beneficent chemicals. NEERI has not studied the *creation* of the sediments or the wide-spectrum coliphages. It has only studied whether the quality of water will get affected once these are present.

AHEC should have studied the creation of sediments and coliphages *which has not been studied by NEERI.* This, precisely, is the cumulative impact of dams. The Tehri Dam studied singly assumes that the beneficent sediments are already there. The stand-alone study does not look at the creation of these sediments and coliphages and how this will be affected by making a cascade of dams upstream. Instead of studying the cumulative impact on creation of the sediments and coliphages, AHEC has merely relied on the stand-alone study of Tehri and passed it off as 'cumulative impact of any number of dams."

Key extracts from the exchange between me and G D Agarwal and NEERI are given below:

Comment on "Self-Purification Capacity of Bhagirathi: Impact of Tehri Dam" and Replies received from NEERI

Sl	Issue	What NEERI says	Possible problems as pointed out by Jhunjhunwala and Agarwal	Replies from NEERI
1	Radio-activity	High radioactivity is unique (p 94, 107). Radium kills bacteria (p 95). It may be crucial in the development of wide-spectrum coliphages.	Then wide-spectrum coliphages should develop in laboratory conditions when exposed to radioactivity.	These two are good suggestions and were also in our mind. However, it requires separate project from a suitable sponsor.

Sl	Issue	What NEERI says	Possible problems as pointed out by Jhunjhunwala and Agarwal	Replies from NEERI
2	Cations	A correlation is reported between U, Th and K, and major cations (Na+K+Mg+Ca) (p 94).	Cations will get reduced when the river flow between Gangotri and Rishikesh is mainly diverted into dams. Then cations and U, Th and K will not be produced by weathering as there will be less friction between rocks and water.	This also needs separate project from a suitable sponsor.
3	Metals	Trapping of sediment mimics self-purifying water kept in a container (p 107). Sediment is important for self-purifying capacity (p 74).	Trapping of sediment in Tehri reservoir may keep water in Tehri reservoir clean but the self-purifying property will be hit downstream as there will not remain any sediment for release of the metals.	The studies are being carried out since 2008 in NEERI. It is confirmed that self preservation capacity of Gaga water has been retained in Rishikesh too.
4	Sediment	10% sediment discharge from Tehri + sediment downstream from Tehri + sediment from Alaknanda will be adequate to provide beneficent sediment downstream (p 108).	(1) That 10% sediment will be released from Tehri is not established. (2) Sediment from Alaknanda may be eliminated by making of tunnel-based dams that will prevent weathering.	Whether 10% sediment is actually released will be worked out in future.
5	Special quality of phages	Phages not detected but get triggered when contaminated (p 101). Phages develop, kill coliform then get adsorbed to sediment (p 102). This is crucial in making of the self-purifying capacity of Ganga water. During discussions, NEERI scientists said that phages in Ganga have capability to kill wide-spectrum coliform. No phages were found at Gomukh. Thus they are developed downstream.	No clear explanation is given for the wide-spectrum capacity of these phages. Radioactivity and cations are unlikely as they can be artificially induced. The penance done by the sages; or special flora and fauna may be responsible for this.	

9.2.5 Data Collection

Method adopted by AHEC to assess the cultural and religious impact was that of 'key informants.' To quote AHEC:

> This study… does not rely on large-scale surveys; either random or purposive… the study… aims to capture the spectrum of opinion across a broad range of stakeholders. Accordingly, key informant interviews were conducted…

The results of the study critically are dependent upon the key informants chosen. This was brought to the attention of AHEC during the meeting with Ganga Mahasabha held on 13.9.2010. I quote:

> **Bharat Jhunjhunwala:** How will you select your entry point in the village for interviews? The responses will depend very much on this.
>
> **Prof B K Joshi:** We will not use any contact for entry. We will go ourselves.
>
> **Bharat Jhunjhunwala:** If your perception is of 'Government' then replies will be pro-dam because they would like to extract benefits from you. Secondly, you have to break through the stranglehold of the contractor lobby and be able to meet the poor and meek without their presence.

The study by AHEC is not acceptable because a transparent method of selecting the key informants has not been chosen. There is no mention in the report of the oppositions to the dams in Uttarakhand. Seven persons sat on a hunger strike for 19 days against the Kotlibhel projects. Loharinagpala on Bhagirathi was stopped because of fast undertaken by Dr G D Agarwal. Public hearing of Devsari Dam on Pindar was postponed twice due to opposition from local people. Sushila Bhandari and Jagmohan Jinkwan were jailed for more than two months because they opposed the Singoli-Bhatwari project. There have been many protests against other dams across Uttarakhand. None of these voices are reflected in the AHEC report. Of course, other groups in Uttarakhand have supported the dams. The projects have split the society in two opposing groups. In this circumstance it was essential to undertake a scientifically designed survey so that views of the opposing sections were adequately represented. That said AHEC does record opposition of some local people to the hydropower projects. But this has not been given due importance in the report.

9.5 Economic Development

AHEC nullifies the cultural- and religious opposition to hydropower projects on economic grounds. It holds that local people get economic benefits from the projects and have lesser religious value of the Ganga (Paras 9.5.2-3). On this

basis it says, that not only Ganga may be harnessed for hydropower but also projects such as Loharinagpala that have been cancelled may be revived.

This approach is not acceptable because mandate of AHEC was to assess "Flows necessary for observing religious practices" and "Impact on places of religious and cultural significance" (TOR 1.2(g) and (h)). None of these have been done. Worse, a *cumulative* impact on religious and cultural places has not been done.

AHEC has proceeded on the basis that local natural resources first belong to local people. It notes:

> A related issue… is… who had the first right on the resources of the region… the local communities or the outsiders?

AHEC thus concludes that if local people want hydropower projects for their economic growth, then impacts on places of religious and cultural significance can be ignored. This view of AHEC is contra the view held by the Supreme Court in the Narmada judgment:

> A nature river is not only meant for the people close by but it should be for the benefit of those who can make use of it, being far away from it or nearby… In a democracy, welfare of the people at large, and not merely of a small section of society, has to be the concern of a responsible Government.

Following the Supreme Court judgment, it was necessary for AHEC to undertake a survey of not only those in favour- and opposed to HEPs in the local area but also people of India living faraway and arrive at the level of negative impact on places of cultural and religious significance. Indeed, the TOR restricts AHEC to the area up to Dev Prayag. But the least that AHEC could do was to note this inadequacy in its report. AHEC has not hesitated to transgress this limit by noting the favourable impacts on the economy of the State beyond the study area. AHEC has also applied its mind to coastal erosion. Thus, AHEC has deliberately not studied the cultural and religious impact on the people of the country.

I have undertaken a study of the value attributed by pilgrims to taking bath in the Ganga (*Economics of Hydropower,* Annexure 2). I have found that the value of bath in the Ganga is Rs 51,548 per pilgrim. The pilgrims are willing to pay Rs 700 per year to remove the Tehri Dam and restore free flow of the Ganga. The Elhwa Dam in the United States has been removed on the basis of these 'non-use values.' This methodology has also been accepted by the Planning Commission in relation to economic valuation of Tiger Reserves.

AHEC was requested to include these non-use values in our representation of September 2010:

> The purpose of making hydropower projects is to improve welfare of the people through provision of electricity. But people also obtain some welfare from free flow of rivers. People of Kerala may be willing to pay some amount for maintaining free flow of Ganga River. It is like a person deriving some satisfaction from the knowledge that the tiger survives even though he may never go to a sanctuary to see the tiger. This willingness to pay is an estimate of the welfare they obtain from free flow of the Ganga. It is called non-use value because the person may never use the River Ganga. This contribution of free flows to welfare of the people must be assessed.

These economic benefits of free flow have been ignored by AHEC while those from making hydropower projects have been given much importance.

9.5 Precedence of Har-ki-Pauri

AHEC has pointed out:

> Har-ki-Pauri bathing ghat at Haridwar is actually located on the Upper Ganga Canal and not on the main river. Over the years everyone, including the Sadhu Samaj, have accepted the changed river course and diversion. The water at Har-ki-Pauri is considered as sacred as that of the main Ganga River.

On this basis, AHEC has concluded that water of the Ganga can be diverted into canals without loss of spiritual power and benefits. I have objections to this conclusion.

First objection is that one wrong does not justify another.

Second objection is that the Hindu Community did not willingly accept the Upper Ganga Canal. An agreement was reached with a foreign ruler under duress. This colonial agreement cannot be foisted upon a free India.

Third objection is that the precedence of Loharinagpala points in the direction of negative impact of hydropower. Instead of invoking this contemporary precedent, AHEC has invoked a precedent made under foreign rulers.

Fourth objection is that the need was to assess the impact of diversion into canal upon the spiritual powers and benefits of the Ganga. In this regard I wrote a newspaper article during Kumbh of 2010. Extracts are produced below:

> This power of the Ganga to organize the unconscious arises from the penance undertaken by the Rishis on the banks of that river in the hills of Uttarakhand. The atoms of the mountains get organized and develop a psychic charge due to the penance undertaken there… Researchers at University of Arizona have found that cells have the capacity to carry memory. The memory of the penance is carried by the water off the Ganga as it flows rubbing against the psychically charged mountains. The inner self of the pilgrim

> gets similarly organized when the pilgrim takes bath in the Ganga. The Ganga acts as a channel to connect the inner self of the pilgrim with the penance of the Rishis. The water of the Ganga imbibes the disturbances from the pilgrims' inner self. The water becomes 'disturbed' while the pilgrim becomes peaceful. This disturbance of the water is removed when Rishis take bath in the Ganga.
>
> The Kumbh takes place at Har-ki-Pauri at Haridwar. A barrage has been made upstream to divert water of the Ganga into a canal that runs through Har-ki-Pauri. The water continues flowing through the canal after Har-ki-Pauri. The psychic disturbance imbibed by the water is never removed because Rishis do not take bath in the canal that flows down from Har-ki-Pauri. The psychic give-and-take is converted into 'give only'.
>
> We must make an assessment of all development projects at both conscious- and unconscious levels. Otherwise we will impose a huge harm on ourselves. We will organize the Kumbh in the canal of Haridwar in order to increase agricultural production. We can use the power of the same technology to lift water of the Ganga through pumps and maintain the free flow of the river and conserve its psychic qualities. We are imposing huge inner pain on the people of Kanpur, Allahabad, Varanasi, Patna and Kolkata by building dams, embankments and barrages on the Ganga. Such misuse of technology must be stopped. The Kumbh must be celebrated on free-flowing Ganga, not the canal at Har-ki-Pauri.

Fifth, the diversion of river water in canal at Haridwar is qualitatively different that diverting the river into tunnels or reservoirs. The water has continuous contact with earth, sun and air in a canal. The water continues to flow in the canal and does not ferment as in a reservoir.

In the result, AHEC has invoked a wrong precedence to justify that diversion of Ganga into tunnels does not affect its spiritual powers.

10 Hydropower and Stakeholders

AHEC has relied on a column published in Dainik Jagaran to assess the views of the people (Page 10-2). The fact is that this column was stopped by Dainik Jagaran after two articles against hydropower were published.

At least one key informant has been misquoted. AHEC writes:

> Shri (Chandi Prasad) Bhatt was of the opinion that while developing hydropower projects it should be ensured that the quality of life of the people living in the area is enhanced and the positive effects of the hydropower projects outweigh the negative impacts (if any). (Page 10-6).

I have spoken to Shri Bhatt (Phone No 94107-7-421). He says he has not said anything like above. What is said was as follows:

> If the benefits of the projects were 60% and losses were 40% then they could be considered. In the present mode neither people will survive not the dams. If Government

> yet insists on making the dams then it will have to bear the consequences. I have clearly written in my book that was given to AHEC that I am opposed to these dams.

It is clear that AHEC has misquotes Shri Bhatt.

Moreover, it is well established that people should not only be given a choice, but it should be informed choice. Economist Amartya Sen explains that if one would ask a bonded labour about the Zamindar, he would probably sing praises. But this is false consciousness not based o informed choice. Therefore, AHEC should have made an informed survey regarding impacts of hydropower.

AHEC notes that certain suggestions were received from 40 scientists including this writer (Page 10-6 to 10-8). However, no response is given nor rebuttal is made.

11 Cumulative Impact Analysis

11.6.1 Concept

AHEC defines cumulative impact as follows:

> The impact of… a project… may become significant when evaluated in the context of the combined effect of all the past, present, and reasonably foreseeable future activities that may have or have had an impact on the resource in question.

Focus in this definition is on sustainability or temporal impacts. The past, present and future impacts of an individual project are here defined as 'cumulative impact.' This is contra the mandate. The TOR states:

> Environment impact assessment of isolated projects, on a case to case basis, may not present the true picture of the cumulative impact of all the projects that are proposed/under implementation in due course.

AHEC has turned 'cumulative impact study' into a 'sustainable impact study'.

11.8 Components Studied for Assessment of Impact of Hydropower Projects

AHEC has given tables showing Cumulative Impacts (Tables 11.1 and 11.2). AHEC has marked the impacts in terms of 'C-Cumulative Impact' and 'L-Localized Impact.' It is not clear whether AHEC has here examined the 'cumulative impact' in terms of temporal impacts (as defined above) or spatial impacts (as intended in TOR). No explanations are given for ascribing a particular value to the impact in question.

I give below critique of the values ascribed by AHEC.

Table: Critique of Cumulative Impact Values ascribed by AHEC

Sl No	Feature	Maximum Impact as per AHEC	Critique from spatial cumulative impact angle
5	Seismicity	Nil	Reservoir Induced Seismicity cannot be assessed by local measurements. The cumulative load of many hydropower reservoirs; as well as cumulative impact of destabilization of mountains due to tunneling can add to impact of individual project.
6	Landslides	Local-High	Cumulative impact of destabilization of mountains due to tunneling can add to impact of individual project.
7	Sedimentation	Cumulative-High	OK. This is not remediable.
8	Fish (and aquatic life)	Cumulative-High (Remediable)	OK. But this is not remediable because of ineffectiveness of fish passages. Also aquatic life is much more than fish. Many aquatic lives require fast flowing waters. They will be made extinct. Individual impact may be remediable as aquatic life may migrate to remaining free stretches. Cumulative impact may not be remediable because both upstream and downstream areas may be rendered inhabitable. Fish require particular slope, velocity, etc. for spawning etc. This may not be available if barriers are made both upstream and downstream.
12	Springs and Drinking Water	Negligible	Aquifers can spread across projects. Bleeding of aquifer can impact downstream and upstream areas.
13	Irrigation	Negligible	-

14	Cultural and Religious Places	Negligible	People take the dead bodies downstream to cremate them near flowing waters. Cascade of projects means they will have to go longer distances. There is depletion premium of free-flowing waters. The pressure on the fewer remaining stretches of free-flowing rivers will increase cumulatively. Pilgrims may be willing to bear few small stretches of dry Ganga but they may be negatively impacted by entire, or 70%, stretch of the river being made dry.
15	Tourism	Local-Positive	Impact is both positive- and negative. Negative impact is on river rafting and aesthetic value. This negative cumulative impact will multiply as fewer stretches remain for these activities.
16	Socioeconomic Environment	Positive	Positive impact takes place on contractors and employees. Negative impact takes place on affected villages. This is leading to outmigration from the area. Negative impact has been ignored. The cumulative negative impact is larger because migration of one family affects others in the vicinity.
17	Construction Activities	Local-Medium	-
18	Submergence	Local-Low	-
19	Water Quality	Negligible	Impact is highly negative as explained earlier. The cumulative impact is greater because deterioration of a parameter in one project increases as the depleted water enters another project.
20	Protected/Forest Area	Local-High	Cumulative impact is negative. Forests require mutual support. A lone patch of forest is less likely to survive than the same patch surrounded by other forests.

Additionally, AHEC has ignored and remained silent on the following cumulative impacts:

GHG emissions: Methane laden waters discharged from one reservoir are likely to generate more GHG gasses in downstream reservoir.

Malaria and Health: Mosquitoes breed in hydropower reservoirs. Resistant strains of malaria are developing. This will become cumulatively bad as mosquitoes in different reservoirs will develop synergy.

Biodiversity: Flora and fauna species can migrate to upstream or downstream unaffected areas in individual projects. They will not have any area to migrate in a cascade of dams and cumulative impacts will be greater.

Sand: Local people may get sand from upstream- or downstream areas of an individual project. They will be wholly deprived in a cascade of projects.

It is clear that AHEC has not even recognized various environmental impacts. It has, moreover, not assessed the cumulative impacts. It has treated the few cumulative impacts as remediable when actually they are not so.

11.10.10 Impact on Places of Cultural and Religious Importance

Tables 11.1 and 11.2 state the impact of all the projects on Cultural and Religious Component of Ecosystem is *consistently* negligible. AHEC has not found even a small negative or positive impact in any project.

The Srinagar project is leading to the upliftment of Dhari Devi Temple.

HEPs on the Alaknanda are slated to either submerge or change the flow in all the five Prayags.

None of these are considered negative impacts by AHEC.

12 Conclusions and Recommendations

In this section only those points are mentioned that have not been already discussed above.

12.2.3 Conversion of river into reservoir

AHEC says that "we do not have any study of changes in aquatic life from river to reservoir. Thus at present it is not possible to give any firm assessment on the impact of HP on biodiversity of Alaknanda and Bhagirathi basins" (Page 12-3).

I typed "aquatic conversion river into reservoir" in Google and found a large number of studies on the topic. AHEC has deliberately not done a literature review so that the adverse impacts can be camouflaged.

Elsewhere, AHEC has noted that aquatic life needs specific volumes and velocity of flows to survive. These will necessarily be altered on conversion of river into reservoir and impact aquatic life.

12.3 View of Stakeholders

AHEC rightly notes that people want growth. But AHEC fails to establish that HEPs will lead to sustainable growth. No cost-benefit analysis of HEP is done. I had provided copy of my book *Economics of Hydropower* to AHEC. I have assessed that costs of Kotlibhel 1B project are Rs 931 crores per year while benefits are only Rs 155.5 crores per year.

Actually hydropower is an instrument for transferring resources from poor to rich. I have tried to distribute the above benefits and costs by stakeholders. It transpires that the only beneficiaries are Employees of NHPC and GOUK; and contractors of NHPC. Local people, other than contractors and employees, are negatively affected. HEPs are splitting the society into two sections—the beneficiary contractors and employees; and the affected people. AHEC's 'key informants' appear to be mostly from the employees and contractors of HEPs hence the conclusion that people are in favour of HEPs.

Table: Distribution of Costs and Benefits of KB1B by stakeholders (Rs crore/year)

Sl No	Item	Total	Ratio of Distribution	Employees of NHPC and GOUK; and contractors of NHPC	Affected People	People of Uttarakhand	People of India
1	Benefits from generation of power	(+) 103.8	0-01-11-88	-	(+) 1.0	(+) 11.4	(+) 91.4
2	12% Free power to State	(+) 50.2	48-01-51-0	(+) 24.1	(+) 0.5	(+) 25.6	-
3	Employment	(+) 1.5	0-33-34-33	-	(+) 0.5	(+) 0.5	(+) 0.5
4	Sediment	(-) 98.0	0-0-0-100	-	-	-	(-) 98.0
5	Quality of water	(-) 350.0	0-1-10-89	-	(-) 3.5	(-) 35.0	(-) 311.5
6	Methane emissions	(-) 62.8	0-0-1-99	-	-	(-) 0.6	(-) 62.2

7	Forests	(-) 61.1	0-25-50-25	-	(-) 15.3	(-) 30.5	(-) 15.3
8	Earthquakes	(-) 8.4	0-75-25-0	-	(-) 6.3	(-) 2.1	-
9	Landslides	(-) 2.9	0-100-0-0	-	(-) 2.9	-	-
10	Malaria and health	(-) 6.4	0-50-25-25	-	(-) 3.2	(-) 1.6	(-) 1.6
11	Biodiversity	(-) 11.7	0-1-1-98	-	(-) 0.1	(-) 0.1	(-) 11.5
12	Otters	(-) 20.0	0-1-1-98	-	(-) 0.2	(-) 0.2	(-) 19.6
13	Road accidents	(-) 7.1	0-25-50-25	-	(-) 1.8	(-) 3.5	(-) 1.8
14	Decline in temperatures	(-) 7.0	0-75-25-0	-	(-) 5.2	(-) 1.8	-
15	Sand	(-) 18.2	0-75-25-0	-	(-) 13.6	(-) 4.6	-
16	River Rafting	(-) 8.0	0-50-25-25	-	(-) 4.0	(-) 2.0	(-) 2.0
17	Bridges	(-) 4.9	0-75-25-0	-	(-) 3.7	(-) 1.2	-
18	Aesthetic value of free-flowing water	(-) 60.5	0-1-1-98	-	(-) 0.6	(-) 0.6	(-) 59.3
19	Immersion of ashes	(-) 5.4	0-25-75-0	-	(-) 1.3	(-) 4.1	-
20	Relocation of temples	(-) 4.2	0-25-75-0	-	(-) 1.0	(-) 3.2	-
21	Loss of fishing	(-) 2.5	0-75-25-0	-	(-) 1.9	(-) 0.6	-
22	Memo: Total of costs	(-) 583.6	-	(+) 24.1	(-) 62.6	(-) 54.2	(-) 490.9
23	Cascade effect	(-) 192.7	In ratio as at line 22	-	(-) 19.8	(-) 17.2	(-) 155.7
24	Costs and benefits of KB1B	(-) 776.3	-	(+) 24.1	(-) 82.4	(-) 71.4	(-) 646.6
25	Memo: Benefits to employees of NHPC in generation of electricity	(+) 121.6	100-0-0-0	(+) 121.6	-	-	-
26	Memo: Compensation for land	(+) 1.3	0-100-0-0	-	(+) 1.3	-	-

27	Final Costs and benefits of KB1B	(-) 653.4	-	(+) 145.7	(-) 81.1	(-) 71.4	(-) 646.6

AHEC could have undertaken such a stakeholder-wise analysis.

12.4 Glaciers

AHEC says "Glaciers are much higher altitudes, upstream and distant to be affected by hydropower projects." Himanshu Thakkar points out that this statement is unfounded. I would add that diversion of river into tunnels may reduce evaporation and impact glaciers.

12.6.2.7 Height of dams

AHEC recommends "that reservoir based hydro projects of more than 20 m high, especially close to Main Central Thrust Zone, may be avoided and if constructed; these should be monitored for geo tectonic activity."

There is nothing in the report that correlates tectonic activity with height of dam. The persistent position of AHEC is that there is no danger of RIS; and there is no observed increase in tectonic activity due to HEPs. In that case, the recommendation of avoiding projects of more than 20 m height is unwarranted.

On the other hand, if we assume that this recommendation implies a certain seismic danger to the projects, then how 'monitoring of geo tectonic activity' will remove that danger is not spelled out.

Further, AHEC does not recommend closure of the three Kotlibhel projects—each of which have height of about 60-70 meters—in direct violation of its own recommendation.

12.6.4.13 Flood flows

AHEC says that "recommended variability in environmental flows should be maintained." But the recommendations made by AHEC do not take into account flood flows. Building Block Method has not been used. Certain variation in flows is recommended without disclosing how these have been calculated

12.6.4.16 Gap between HEPs

AHEC says "Gap between two consecutive projects along a stream should be sufficient for the river to recuperate itself." However, AHEC does not disclose any method of assessing the length of river to be left to recuperate.

Further, AHEC recommends that "hydropower at identified sites can be harnessed" (Page 12-6). These sites include Kotlibhel 1A, Kotlibhel 1B, Kotlibhel 2 and Vishnugad-Pipalkoti. There is no gap between Kotlibhel 1A and Kotlibhel 2; between Kotlibhel 1B and Kotlibhel 2; between Srinagar and Kotlibhel 1B; and between Vishnu Prayag and Vishnugad-Pipalkoti. These two observations, therefore, are mutually contradictory.

I give below a table on water quality (for January 2007) based on study done by Dr Pradeep Kumar of IIT Roorkee for THDC. It is seen that 15 out of 19 parameters do not regain earlier levels even after about 60 km of free flow from Tehri to Dev Prayag. Therefore, a clear cut recommendation is required of the term 'recuperation' and length of river to be left free.

Table: Water quality regeneration as per IITR study of Tehri Dam

Sl No	Parameter	Before Reservoir--Chilyanisaur	After crossing Tehri Dam	50 km Downstream of Dam at Dev Prayag	Impact
1	Fe (mg/l)	0.01	0.041	0.063	change not compensated
2	TDS (mg/l)	118	78	76	change not compensated
3	Conductitivity (Mu/cm)	199	125	117	change not compensated
4	pH	7.95	7.63	7.62	change not compensated
5	Total Hardness CaCo3 (mg/l)	90	60	64	change not compensated
6	Ca (mg/l)	24	15.2	16	change not compensated
7	Mg (mg/l)	7.2	5.3	2.4	change not compensated
8	Total Alkalinity CaCO3 (mg/l)	64	45	50	change not compensated
9	Cl (mg/l)	1.2	1	1	change not compensated
10	SO4 (mg/l)	35.9	21.1	19.6	change not compensated
11	Sodium (mg/l)	10	2.1	2.6	change not compensated
12	Potassium (mg/l)	3	2.3	2.2	change not compensated
13	PO4 (mg/l)	0.031	0.036	0.048	change not compensated

14	Silica (mg/l)	8.3	6.2	5.8	change not compensated
15	DO (mg/l)	9.34	8.24	9.25	change not compensated
16	Turbidity	3.91	1.72	4.17	regains earlier characteristic
17	ORP (mV)	92.5	99.8	80.1	regains earlier characteristic
18	NO3 (mg/l)	0.3	0.37	0.26	regains earlier characteristic
19	UV (m-1)	2.7	2	3.5	regains earlier characteristic

The EAC has rightly noted:

> The conclusion that 30% of the river stretch is available as free flow does not seem to be correct. The Committee had… found that there is hardly any free river stretch available between the upper most and lower most projects. The report should clearly indicate the free river stretch available between the various projects.

AHEC should have recommended removal of certain dams to enable this recommendation to be implemented.

12.6.5.18 Percentage of River Length Affected

AHEC says more than 70% of the river length may not be allotted for HEPs. Wherefrom the figure of 70% has been taken is not disclosed. It seems to me that this figure is taken from the length of Bhagirathi already affected. AHEC gives the following figures for affected length of rivers (Table 8.9):

Bhagirathi 70.71%

Alaknanda 48.00%

Perhaps, the figure of 70% of the river to be harnessed has suggested been suggested so that none of the existing or proposed projects are affected.

Even this does not meet AHEC's own prescriptions because there is no gap in the projects on Bhagirathi from Maneri-Bhali 1 to Koteshwar. AHEC should have applied its mind to the restoration of Ganga in this stretch by removal of certain projects.

12.6.24 Biodiversity

The TOR stated: "The safe limits of… biodiversity should be determined on the standard methodologies" (Para 4.8).

AHEC has not determined such safe limits. It has reduced the issue to mere monitoring and making of an 'adaptive management plan.' How mere

monitoring will help restore biodiversity is no clear. Whether an adaptive management plan is feasible at all is unclear. Literature indicates that the best way to preserve biodiversity is *in situ.*

WII, Dehradun Report

1 Positive statements

WII reports makes following positive statements:

1. Environmental Flow Requirements should be based on Mean Seasonal Flow, not Mean Annual Flow (Page 43).
2. Among the Rare, Endangered and Threatened (RET) species in the area, fish are most important. The percentage RET species are given below (Page 45):

Sl	Genre	RET	Total	% RET
1	Plants	20	950	2.1
2	Mammals	6	85	7.0
3	Birds	6	530	1.1
4	Fish	23	57	40.3

Implication is that impact on fishes should be the main consideration while examining the dams.

2 Cumulative Impact Assessment

WII Methodology

WII states that the ecological impact of a single project may be acceptable but combined effect of numerous single developments may be additive and thus cumulatively significant (Page 4). Again:

> The total cumulative effects for any combination of projects are the sum of project-specific effects adjusted for interactions among projects and their effects (Page 39).

It follows that WII is expected to (1) list the project-specific impacts; (2) study interactions among projects; (3) Add the two to arrive at cumulative impacts.

WII recognizes in the text of the report that migration of fish is effected by dams. However, the interactions or cumulative impacts are not given much importance. WII gives the following interactions:

1 Dams prevent brood-stock from reaching their spawning grounds (Page 6).

2 Dams change sediment transport. This alters habitat for fish through changes in turbidity as well as directly (Page 6).

3 Deterioration of water quality in reservoirs or in downstream stretches kills fish (Page 7).

4 Fishes are attracted towards flow for getting more oxygen (Page 72).

5 Flowing water carries drift materials which serves as food for many fishes (Page 72).

It appears, however, that these impacts have not been given due importance in arriving at the conclusions.

The key table for arriving at conclusions is Table 6.8, which is reproduced below.

Sl		Kotlibhel 1A	Kotlibhel 1B	Kotlibhel II	Vishnugad-Pipalkoti	Alaknanda-Badrinath	Source
1	Biodiversity value	18	18	19	8	17	Table 6.1
2	Impact sources	8	13	15	11	7	Table 6.2
3	Impact score	144	234	285	88	119	Line 1 x Line 2
4	Conservation Importance	1	1	2	1	3	No basis given in report
5	Cumulative score	144	234	570	88	357	Line 3 x Line 4

Line 1 of Table 6.8 above is taken from Table 6.1. The factors considered are:

1 RET Species

2 Endemic Species

3 Species in WPA

4 Habitat Specialists

5 Habitat Diversity

6 Species Richness

7 Breeding/Congregational sites

8 Migratory sites

Of these, only No 8 captures cumulative impacts of preventing fish reaching their spawning grounds. Thus, this score is more on single project, and less cumulative.

Line 2 of Table 6.8 above is taken from Table 6.2. The factors considered are:

1 Volume of diverted water
2 Diverted river length
3 Reservoir area
4 Barrier influence of dam
5 Biotic interference (Labour Immigration)
6 Barrier influence due to roads (Area under approach roads)
7 Forest area diversion

Once again, only No 4 captures cumulative impacts. Further this again relates to barrier preventing fish reaching their spawning grounds.

The other cumulative impacts acknowledged by WII (listed above) are not incorporated in these matrices:

2 Change in sediment transport.
3 Deterioration of water quality.
4 More oxygen in water.
5 Carry of drift materials.

In the result, WII has ignored 4 out of 5 cumulative impacts in arriving at conclusions.

Pipalkoti and Kotlibhel 1A

Significance of this omission is in the low cumulative scores for Vishnugad-Pipalkoti and Kotlibhel 1A projects. The river flow in both these projects is already obstructed.

There is a cascade of dams above Kotlibhel 1A site—Koteshwar, Tehri, Maneri Bhali and Pala Maneri.

Flow of the river at Vishnugad-Pipalkoti is obstructed both above- and below. Above is Vishnu Prayag project. Below is Srinagar project (under construction). The coffer dam of this project was operational in the period of study. The score

of 'N' or (1) that is given for 'breeding/congregational sites' for the project may be because these obstructions have prevented the fish from reaching their spawning grounds in the project area. Secondly, the waters at these two projects are already deprived of sediment, water quality, oxygen and drift materials. No wonder the scores are low.

This problem can be solved in two ways:

1 We may allow construction of these projects because the flow is already affected.

2 We may decommission the upstream- and downstream projects and restore the free flow of river at these sites.

The study given to WII was on

> Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity…

Para 2.1 of the TOR states:

> To assess the cumulative impact of existing/proposed/under construction hydropower projects…

WII was required to assess the impacts of existing projects as well. WII has not done this in the interim report relating to the 5 projects. However, it is not acceptable to ignore the impacts of existing projects on *these* five projects.

My conclusion is that the low scores for Kotlibhel 1A and Vishnugad-Pipalkoti are not because these areas are less rich in biodiversity. Instead, the low scores appear to be due to the negative impact of upstream- and downstream dams. This can be rectified by removal of the existing dams.

Conservation Importance

WII report does not give any basis for the scores given for conservation importance in Table 6.8. I presume the value of 2 given to Kotlibhel 2 is due to proximity to Dev Prayag; and the value of 3 given to Alaknanda-Badrinath is due to proximity to Badrinath.

The entire Alaknanda and Bhagirathi Rivers are of 'conservation importance'. They are the National River. Koteshwar temple is located in the Kotlibhel 1A area. Dhari Devi Temple is located on Alaknanda River in the submergence area of Srinagar project. Both rivers are on the pilgrim route to Char Dham Yatra. A scientific basis for arriving at these values of conservation importance is required.

Otter and Cheer Pheasant

WII dismisses the existence of Otter in the area: "The only aquatic mammal reported in the basin was otter but its distribution is doubtful nowadays" (Page 72). The list of mammals at Table 5.1 does not mention Otter.

I live on the banks of Alaknanda between Dev Prayag and Srinagar. I have spotted Otters on my land about once-in-three-years, most recently in July 2011. Ignoring this endangered species is not warranted.

WII recognizes that Vishnugad-Pipalkoti project will lead to extinction of the Cheer Pheasant (Page 76). This species is an "evolutionary relict (meaning that it does not have any close relatives in the evolutionary scale)" (Page 64). It would seem, that threat to this species alone would tilt the scales against the project, but WII fails to take this to its logical conclusion.

Zone of Influence

WII has restricted the zone of influence to 500 meters from the project constructions (Page 35). This is inadequate because of the cumulative impacts of water flows mentioned above. The Zone of Influence should include upstream- as well as downstream areas.

Upstream areas are affected by migration of fishes and by lower levels of evaporation due to diversion of river into tunnel.

Downstream areas are affected by flows of sediments, drift material and changes in water quality.

3 Environment Management Class

WII has adopted the methodology suggested by Smakhtin in his study for IWMI (Page 73). The methodology suggested by Smakhtin involves three components:

1 What is the ecological sensitivity and importance of the river basin?

2 What is the current condition of aquatic ecosystems in the river basin?

3 What is the trend of change?

WII, however, has classified both the rivers in category 'C' only on the basis of Item No 2 relating to current condition. Table 6.11 gives only the present ecological status of the two rivers. This is inadequate. The IWMI methodology is designed not only to assess but also to rebuild and restore damaged ecology. Therefore, classification in EMC should include Items 1 and 3 also.

Further, WII quotes WWF favourably to the effect that EMC, and the EFR flowing from it, is determined on the basis also of 'ecological integrity of rivers' and 'goods/services provided by them' (Page 8). It was necessary to value the services to pilgrims and tourists. This has not been done.

4 Mitigation

WII says that negative impacts of the Vishnugad-Pipalkoti project "on terrestrial and aquatic biodiversity are amenable to mitigation if appropriate measures are put in place." No details of these mitigation measures and their effectiveness are provided.

Abbreviations

AHEC	Alternate Hydro Energy Centre (of IIT Roorkee)
BBM	Building Block Method
BOD	Biological Oxygen Demand
CPCB	Central Pollution Control Board
DO	Dissolved Oxygen
d/s	down stream
EAC	Expert Appraisal Committee (of MOEF)
EFR	Environmental Flow Requirement (Same as EWF)
EMC	Environment Management Class
EWF	Environmental Water Flows (Same as EFR)
HEP	Hydro Electric Project
HMD	Hydraulic Mean Depth
IWMI	International Water Management Institute (Colombo)
KB1B	Kotlibhel Stage 1B (Hydropower project)
MAF	Mean Annual Flow (Same as MAR)
MAR	Mean Annual Runoff (Same as MAF)
MOEF	Ministry of Environment and Forests

MW	Mega Watt
NEERI	National Environment Engineering Research Institute (Nagpur)
NGRBA	National Ganga River Basin Authority
NHPC	National Hydro Power Corporation
Q95	Flow above which water flows 95% of the time
RET	Rare Endangered and Threatened
RIS	Reservoir Induced Seismicity
SANDRP	South Asia Network on Dams, Rivers and People
SRIC	Sponsored Research and Industrial Consultancy
TDS	Total Dissolved Solids
THDC	Tehri Hydro Development Corporation
TOR	Terms of Reference
u/s	up stream
UJVNL	Uttarakhand Jal Vidyut Nigam Limited
WCD	World Commission on Dams
WII	Wildlife Institute of India (Dehradun)
WWF	World Wildlife Fund

Annexure 2: Letter from Nanda Devi Biosphere Reserve

Annexure I

कार्यालय निदेशक / वन संरक्षक, नन्दादेवी बायोस्फियर रिजर्व, गोपेश्वर।
पत्रांक: 3265 /2-1, दिनांक, गोपेश्वर, 25 मई-2007

सेवा में,

जनरल मैनेजर
(कारपोरेट प्लानिंग)
टिहरी हाइड्रो डेवलपमेन्ट कारपोरेशन लि0
ऋषिकेश।

विषयः- **Comments on impact of the Vishnugad Pipalkoti HEP(VPHEP) on Nanda Devi Biosphere Reserve.**

सन्दर्भः- आपका पत्रांक टी.एच.डी.सी. / आर.के.एस.एच / सी.पी / 1172 दिनांक 03-05-07

महोदय,

आपके उपरोक्त सन्दर्भित पत्र के क्रम में अवगत कराना है कि प्रस्तावित परियोजना स्थल की जाँच प्रभागीय वनाधिकारी नन्दादेवी रा0पार्क जोशीमठ से करवाई गयी। उनकी जाँच आख्या के अनुसार प्रस्तावित क्षेत्र में Endemic Flora and Fauna पाये जाते हैं। किन्तु उनका विस्तार उक्त परियोजना प्रस्तावित क्षेत्र में ही सीमित न रहकर अगल-बगल के क्षेत्रों तक भी जाता है, जिससे ये प्रभावित तो होंगे, परन्तु उससे इनका स्टेटस बहुत ज्यादा प्रभावित होना सम्भावित नहीं है। प्रस्तावित योजना के बनने से अलकनन्दा में पाये जाने वाले अनेक मत्स्य प्रजातियां खासकर ऐसी प्रजातियां जो सीजनल माइग्रेशन करती हैं, किस प्रकार प्रभावित होंगी, उसका वर्णन संलग्न E.I.A. रिपोर्ट में नहीं किया गया है तथा इस issue को किस प्रकार address दिया जायेगा, उसका भी वर्णन नहीं है।

E.I.A.प्रोजेक्ट से विदित होता है कि तैयार करने वाली एजेन्सी को E.I.A. कार्य का स्पष्ट जानकारी नहीं है, जैसे कि सारणी-3.22 में GreyWolf को प्रोजेक्ट एरिया में पाया जाना दर्शाया गया है, जबकि यह इस क्षेत्र में नहीं पाया जाता है। इसी प्रकार पैरा 3.5.4 (Fauna) में Wild dog भी पाया जाना बताया गया है, यह भी यहां नहीं मिलते हैं, इस प्रकार की सूचना में दर्शित करना आपके E.I.A. रिपोर्ट पर प्रश्नचिन्ह पैदा करता है।

भवदीय

(वेदपाल सिंह)
निदेशक / वन संरक्षक
नन्दादेवी बायोस्फियर रिजर्व, गोपेश्वर।

दिनांकित।

भागीय वनाधिकारी नन्दादेवी राष्ट्रीय पार्क जोशीमठ को उनके पत्रांक 97 के क्रम में सूचनार्थ प्रेषित।

(वेदपाल सिंह)
निदेशक / वन संरक्षक
नन्दादेवी बायोस्फियर रिजर्व, गोपेश्वर।

cc WAPCOS Gurgaon

Annexure 3

December 19, 2011

Vishnugad Pipalkoti Hydro Electric Project

Rejoinder to "Responses to recent emails from Mr Bharat Jhunjhunwala" dated November 23, 2011.

By
Bharat Jhunjhunwala

A. RESPONSES TO GENERAL POINTS

Power Sector Development and the Role of Hydropower

1. The national development priorities of the Government of India (GOI) provide the context for the discussion of the specific questions you have raised with respect to power sector development in general and hydropower and VPHEP in particular. GOI has estimated that India needs to sustain an 8% to 10% economic growth rate over the next 25 years if it is to eradicate poverty and meet its human development goals. To deliver a sustained growth rate of 8% through 2031-32 and to meet the lifeline energy needs of all citizens, GOI has estimated that India needs, at the very least, to increase its primary energy supply by 3 to 4 times and its electricity generation capacity by 5 to 6 times of their 2003-04 levels (source: Integrated Energy Policy: Report of the Expert Committee). In other words, by 2031-32 power generation capacity must increase to nearly 800 Gigawatts (GW) from the current capacity of around 180 GW.

   Rejoinder: IEP and CEA estimates ignore the declining electricity intensity of GDP in India. The increasing share of services sector enables India to increase GDP without a proportional increase in energy consumption. Please see our attached detailed critique of CEA's projections.

2. As you know, at present, an estimated 350 million Indians are without access to electricity. The average annual per capita consumption of electricity in India was 734 kWh in 2008-09, far below the world average of 2,429 kWh. Moreover, of those who have access to electricity, a large part consumes electricity at a level far below the national average. The Government of India has stated its goal of providing universal access to electricity and of ensuring a minimum annual per capita consumption of 1,000 kWh by 2012. While these goals are unlikely to be achieved by next year, the broader point is that they reflect the aspirations of the GOI to expand access to and availability of electricity.

Rejoinder: Shortage of electricity is not the reason for non-supply of electricity to the poor. The number of rural households to be electrified in April 2005 was 40,853,584 while those electrified in the period April 2005 to January 2009 was 5,679,143. Every month 123,459 new households were provided with electricity in this period. The increase in electricity required every month for supply to these 123,459 households is 7.3 million units per month at the lifeline consumption of 30 Units per month.
Generation of electricity in the country in 2005-06 was 58.1 billion units per month. Generation increased to 65 billion units per month in August 2009. The increase in generation was 6.9 billion units in 41 months or 168 million units per month. Of this, only 7.3 million units or only 4.3 percent was used for rural electrification. The total requirement of electricity for the 40,853,584 unelectrified households is 1.2 billion units per month. This is only 1.8 percent of the generation already achieved. Therefore, the so called shortage of electricity is not the reason for not providing electricity to the villages and poor households.

3. Even in the scenario of highly successful investments in supply- and demand-side efficiency and in loss reduction, the dynamic forces in India (growing population and economy, increasing urbanization and expansion of rural distribution networks) indicate the need for a significant expansion of the country's electricity generation capacity if GOI's development goals are to be met. (For a more detailed consideration of these issues please see the recently published report, "Energy Intensive Sectors of the Indian Economy: Path to Low Carbon Development" which you can find at:

http://www.esmap.org/esmap/sites/esmap.org/files/India_LowCarbon_FullReport.pdf.)

Rejoinder: The need of electricity for growth is much overstated as shown in our critique of 18th EPS. The capacity of earth to produce electricity is limited. GOI is selling electricity cheap, creating high demand due to low price, then trying to generate huge amounts of electricity. This is leading the country into a regressive cycle of more consumption, generation and environment destruction. There is a need to reduce consumption by increasing price of electricity after including the environmental costs. World Bank cannot be a silent spectator to this erroneous policy of GOI.

4. In this context, it is important to keep in mind that planning for power sector development considers all possible forms of meeting demand (present and anticipated future demand), including but not limited to a specific form of generation such as hydropower, and their relative costs and benefits. Given relatively lower endowments of resources such as coal and nuclear fuel, India cannot afford not to focus on all reliable forms of electricity generation including hydropower. India's electricity deficiency has been identified in all investment climate assessments, and in a recent World Bank study, "More and Better Jobs in South Asia", as the single most significant barrier to investments and creation of jobs. The development of energy resources, including hydro, is thus central to India's development and goal of inclusive growth. For more information on "More and Better Jobs in South Asia", please see:

http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:23008605~menuPK:2246552~pagePK:2865106~piPK:2865128~theSitePK:223547,00.html.

Rejoinder: I have seen this report. I have four comments to make.
(1) The combined weight of institutions (corruption, political instability, tax administration, etc.) is much higher than electricity.
(2) The available electricity is being diverted to shopping malls and other ostentatious consumption. Shortage to firms can be mitigated by putting an electricity consumption policy in place.
(3) The reported constraint of electricity does not specify whether it is due to bad administration and corruption or it is due to shortage.
(4) The report only says that the constraint to 'growth' of the formal sector is electricity. There is a big gap between growth and jobs. Between 2000 and 2008 only 11.8 lac jobs were created in the organized sectors (Economic Survey, Annex A52). This amounts to 13.6% increase. The GDP rose by 109% in the same period (Economic Survey Annex A5). Therefore, more electricity is unlikely to lead to jobs even though it may lead to increase in production. This happens because of increasing capital-intensity of production.
(5) Industries are getting electricity without trouble where privatization of distribution has taken place. The report misinforms that 'shortage' is the problem and not distribution.

Distribution of the Consumption of Electricity

5. On the distribution of consumption of electricity: generally, the marginal impact on pro-poor consumption of any given project cannot be calculated as the grid is the same for all generation projects. However, the data on rural electrification point to positive impacts on poor household consumption over the last decade. From 2005 to 2011, about 120,000 additional villages were electrified (source: Central Electricity Authority), in which about 27 million additional rural households were provided an electricity connection out of which 15 million were Below Poverty Line (source: Prayas review of Rajiv Gandhi Gramin Vidyutikaran Yojana). As to whether these villages and households are actually receiving power supply, while data on consumption by rural households are not always clear, it is clear that the average supply of 8 hours of power supply per day to rural areas cannot be segregated across households and, therefore, these connections are receiving 8 hours of power per day. Some states, such as Gujarat, Rajasthan and Haryana, are attempting 24-hour power supply to rural households through their feeder segregation programs. Additionally, domestic consumption across the country has grown at about 7% per annum over the last year including urban and rural areas.

Rejoinder: I am not questioning the benefits to the poor from provision of electricity. I am questioning the fact that negative environmental impacts on the poor are ignored and thereby a lopsided picture of benefits of electricity generation is presented.

6. These two factors indicate that additional power is being made available to households in rural India although much more needs to be done in view of the very large numbers, who still do not have access to electricity,

Rejoinder: Already shown in my reply to Point 2 above that availability of power is not the constraint in providing electricity to the poor.

7. With specific reference to VPHEP it may be noted that all project-affected families will receive 100 kWh/month (equivalent to 1,200 kWh per annum, which is higher the GOI target) for free for 10 years.

Rejoinder: This has to be set off against the many negative environmental impacts.

B. RESPONSES TO SPECIFC POINT IN RECENT COMMUNICATIONS

The numbering below follows the numbering of your email of November 6, 2011 (some of the detail is drawn from our discussion of November 2.)

1. Methodology of the Economic Analysis. On the methodology of the economic analysis that was conducted for the project, we followed widely accepted professional standards for cost-benefit analysis. The economic analysis took into account costs and benefits for which robust estimates were available or could be derived from proxy data. In addition to the quantifiable costs and benefits of any project, one can postulate costs and benefits that cannot be appropriately quantified and are therefore not considered sufficiently robust for inclusion in the cost-benefit analysis. It is important to use only robust data as the results of any analysis can be influenced (in either direction) by inclusion of variables for which no robust data are available. The results of this conservative analysis, including sensitivity analysis, indicate that VPHEP is an economically viable project.

Rejoinder: I have serious objection to this statement. GOI is not interested in developing robust estimates of the negative impacts while robust estimates of positive impacts are calculated. World Bank cannot hide behind this lack of data. Best available estimates must be used.

Specifically as concerns your observations on the aesthetic value of the river, this is an example of a value that can be posited but which is difficult to measure with existing data or contingent valuations methods in general. This value is above (exogenous to) the project level and, therefore, more appropriately reviewed in a higher level decision-making process that examines the relative costs and benefits of river basin development versus non-development.

Rejoinder: The World Bank has its own mandate. It cannot finance a project if the National Government uses wrong estimates and is implementing anti-poor policies. Non-existence of robust estimates is itself because GOI is not interested in making these estimates.
World Bank cannot fund a project that may be against people's welfare even if the National Government is interested in promoting it. This is the precautionary principle.
Ignoring these values due to lack of robust estimates implies that WB is assuming a zero value for these costs. This is totally untenable.
The only solution is to use best available estimates.
Robust methodology for assessing 'non-use values' has been developed and used to decommission the Elhwa Dam in Washington USA. Such estimates are available in studies done by Planning Commission and these are mentioned in my book.

We believe that Government of India has carried out this process in its various deliberations with respect to the Bhagirathi and Alaknanda basins (as reflected in the corpus of studies and consultations carried out and negotiations with the State Government of Uttarakhand), parts of which are being developed for hydropower generation.

Rejoinder: No Sir. This is not being done.

With respect to the stretch of the Alaknanda River in which VPHEP will be built, there is no significant human or animal activity and for most of this stretch the river gorge is very deep, its steep terrain making access to the river impossible or very difficult. In the few places where access to the river is possible, the river water is used by local communities for bathing on religious occasions and for performing last rites. It is expected that the minimum flow requirement of 15.65 cumecs will be adequate to support these occasional human uses of the river.

Rejoinder: Aesthetic value accrues not only to local people but those living downstream as well. The Supreme Court has held in Narmada Judgment that the River belongs to all the people. Loss of aesthetic value has to be assessed for all people, including local people.

Water Quality and Sediment Transport Impacts. Concerning water quality, as a run-of-river project, VPHEP has minimal impact on water quality. In our discussion on November 2, you referred to the self-purifying and bactericidal qualities of Ganga water due to its absorption of chromium and another metal. Metals in the river water are in the sediment. In the monsoon season, when the river carries the maximum sediment concentration, only a part of the total river flows will be diverted through the headrace tunnel for power generation. The major part of the sediment-laden water will be released on the downstream side through the spillway system. Sediments retained in the desilting chambers will also be released into the river immediately downstream of the dam at regular intervals in the operation phase. Therefore, the quantity and characteristics of sediments in the river water should not be impaired. In the non-monsoon season, the concentration of sediment in the river is considerably lower. Any sediment in the water that reaches the power house will be discharged back into the river through the tailrace tunnel. Thus, during this period, the sediment concentration in the river downstream of the project will be unaffected.

Rejoinder: The generation of beneficent sediments will be severely impacted as the river is made to flow through tunnels and friction between stones and water is substantially reduced. You cannot assume that sediment generation and flow will remain unaffected.

Aquatic Biodiversity. On the project level, the anticipated impacts on aquatic and other biodiversity have been comprehensively examined and are considered to be manageable, with mitigation measures as described in the Project Appraisal Document and detailed in the Environmental Impact Assessment/Environmental Management Plan. In addition, the Wildlife Institute of India has reviewed the impact on wildlife of the proposed hydropower development on the Bhagirathi and Alaknanda Rivers and has identified VPHEP as a low negative-impact project.

Rejoinder: WII has not provided any details of mitigative measures. The typical mitigative measure of fish pass is not suitable for the height of VPHEP and also for the slow-moving Mahseer and other fish species.

Potential Impacts on Fishing and Sand Mining. With reference to your concerns about the potential loss of fishing and sand harvesting as economic activities of the local people, please note that these are not activities that are actually carried out in the project area. As described in the Project Appraisal Document, there is no commercial fishing in the Alaknanda in the entire project influence area. Small-scale, year-round fishing takes place in the tributaries downstream of the diversion dam (particularly in the Birahi) and this activity will not be impacted by the project. Sand extraction is impossible due to the depth of the gorge and the absence of flood plains in the project area.

Rejoinder: My point was not about 'commercial' sand harvesting. Local people harvest fish and sand for their use. They will be deprived of this.

Peer Review of Project Economic Analysis. The project economic analysis was peer-reviewed by an economist who is an acknowledged expert on evaluating environmental aspects of economic analysis and who has published widely on this topic, including specifically on costing methodologies.

Rejoinder: I request you to provide me with the report of the economist and also arrange a meeting with him.

2. Cost-benefit Analysis. Cost-benefit analysis is covered in point 1 above.

Rejoinder: At Point No 1 you have dealt only with the environmental and social impacts. You have not examined the false estimates of benefits on which the WB Appraisal is based.
You have not examined the need for a stakeholder-wise Cost-Benefit Analysis. The project, in my assessment, is beneficial for the rich and harmful for the poor. Does WB Charter allow for such funding?

3. Vishnuprayag HEP. This comment refers to the operating Vishnuprayag HEP of which the World Bank has no specific knowledge. However, we note that this project is near the largest population center in the area and the greater population in the vicinity of this project is presumably influencing the values noted for the specific variables. Concerning the reference to the cumulative impact assessment carried out by IIT-Roorkee under commission from the Ministry of Environment and Forests, as this is the subject of a pending National Green Tribunal review matter we are not at liberty to comment on it.

Rejoinder: I have given data for Vishnu Prayag to indicate the kind of impacts that will take place from VPHEP. It is disheartening that WB is willing to ignore this evidence by simply stating that WB 'has no specific knowledge.' But WB is willing to take on board the same IIT Roorkee study where adequacy of enhanced e-flows is concerned. WB cannot take one part of the report and deny another part.

Our appeal before NGT has been dismissed. However, NGT has accepted both our contentions regarding inadequacy of the Cumulative Impact Assessment and Cost-Benefit Analysis (Copy of judgment is attached). We are not approaching the World Bank because Forest Clearance has been set aside. If that were the case there would be no need to approach the Bank. Our plea to WB is that its appraisal note is fallacious as it assumes that environmental impacts are less and economic benefits are large. Both these statements are wrong and need relooking.

4. Use of Willingness to Pay Estimates and Unscheduled Interchange Data. On the use of Willingness to Pay (WTP) estimates and the use of Unscheduled Interchange (UI) data to serve as a proxy for valuation of energy generated from the project: WTP methods (contingent valuation) are not without potential deficiencies, as is well articulated in professional literature. These methodological deficiencies include: sampling bias; lack of sufficient information or technical knowledge (e.g. on the cost implications of different electricity-generating technologies) on the part of those being interviewed which reduces the relevance of responses; high impact of question formulation on the answers received; possible normative influence of the enumerator on the respondent. With respect to the case you cite, the combination of the abstract nature of the question posed and the potential methodological pitfalls of the contingent valuation method suggest that the data received from the interviewing of pilgrims are not sufficiently robust for use in cost-benefit analysis.

Rejoinder: WB cannot assume these costs to be zero in absence of 'robust' estimates.

5. We used the UI as a proxy as this is an observable value that the Northern region of India will pay for additional capacity from the grid. The 2010 CERC regulations caps the upper bound for UI at Rs 8.73/kWh (that is, the rate cannot "spike") which has been used to value the energy in the dry season. The UI rate associated with average frequency during the same period is Rs 5.7/kWh which has been used to value the energy in the wet season. Ninety percent of the energy expected to be generated from the VPHEP will be generated in the wet season, and this energy is valued at Rs 5.7/kWh.

Rejoinder: If I understand correctly the UI for lean season used in WB appraisal is Rs 12.3 (not Rs 8.73) as stated by you above.
Secondly, these are, as you yourself say, upper bounds. The value of all the electricity produced by VPHEP cannot be assumed to provide this upper bound benefit. The average UI of Rs 4.50 as purchased by UPPCL is a much better estimate.
You have also not considered that the WTP for electricity is only Rs 6. How can WB justify using the upper band of UI and ignoring the WTP?

6. Analysis of Emissions. The different levels of emissions of CO2 from different forms of electricity generation are considered in a static scenario in order to allow for a meaningful comparison. Obviously in the dynamic context of a growing population and a growing economy, as in India today, consumption of electricity (and other commodities) will increase, but this is exogenous to the analysis of emissions and does not alter the basic point that, for a given level of development, if hydropower is removed from the generation mix, then some other form of electricity generation would have to be developed to compensate for the

loss of hydropower. Given India's resource endowment, this is most likely to be coal-fired generation, which has its own costs and benefits. Of the renewable sources of power, hydropower is the least expensive and in addition to energy offers critical services for grid operation.

Rejoinder: I am not asking for 'removal' of hydropower. I am asking for redesigning of the project to allow for 67% E-Flows and to make a partial obstruction instead of barrage to enable free flow of fish and sediments. The question is whether the increase in cost of electricity due to this modification is to be imposed on the consumers.
It is also not correct that less hydropower means more thermal. Capacity of earth to produce electricity is limited. Ultimately man will have to reduce consumption.
GOI may embark on a self-destruct policy of maintaining artificially low price of electricity and increasing demand of the same. But WB has to apply its own mind.
It is not correct that hydropower is the cheapest of the renewable sources of energy. It only appears so because the environmental costs are surreptitiously ignored under the pretext of absence of robust estimates.

7. GHG Emissions. On GHG emissions, your comment about rotting vegetation on the bottom of reservoirs and the consequent emission of methane may apply to shallow reservoirs in tropical and sub-tropical conditions, which are not the conditions of VPHEP. The project pondage is small, with a capacity to hold a maximum of a few hours' of average flow; the water is deep; the project area is at a high altitude in a cool climate; the areas to be submerged on the banks of the gorge are sparsely covered with vegetation.

Rejoinder: Once again you are making assumptions without data. NEERI has recently undertaken a study of Tehri and found large CO2 emissions. The retention of water during lean periods will be much more that few hours. The point is that WB cannot assume these to be zero as you have done.

The carbon sequestration process is the absorption of CO2 by trees, plants and other "carbon sinks". Most of the project infrastructure work (e.g. tunnelling) consists of underground activities that have no impact on trees and the related carbon sequestration process. The openings of the tunnels are on sparsely vegetated land that is not used by people in the project area. As detailed in the Project Appraisal Document, the project will undertake compensatory afforestation of 201 ha of degraded forest land at a cost of INR 64 million through the State Forest Department. Further, the project will plant more than 12,000 trees as part of the larger green belt development and plantation along the approach roads to compensate for the trees felled. A detailed Catchment Area Treatment plan has been prepared to conserve and enhance the degraded patches of the treatable catchment, at a cost of INR 470 million. These activities will contribute to an increase of the carbon sink in the project area.

Rejoinder: The track record of Green Belt and Compensatory Afforestation is dismal. These monies are mostly used by the Forest Department for cosmetic works. WB must make an assessment of efficacy

of these expenditures. It is standard policy of bureaucracy to flaunt figures of expenditures as a self-evident proof of their effectiveness.

8. "Free Power" Policy. The "free power" policy calls for provision of 12% of the electricity actually generated by a project to the home state. In addition to this, the National Hydro Power Policy (2008) recommends provision of an additional 1% free power from projects to be earmarked for a Local Area Development Fund in order to ensure a regular revenue stream for welfare schemes, creation of additional infrastructure and common facilities. It also recommends that state governments contribute a matching 1% from the 12% free power that is provided to the home state. This is described on page 4 of the Project Appraisal Document. The additional 1% of free power would be a transfer and would not affect the economic analysis.

Rejoinder: The additional 1%, it seems to me, would not be a 'transfer'. It will not be paid to THDC by State Government. Kindly check on this.

9. Performance of THDC Limited. On THDC India Limited (THDCIL): (i) the tariff at which THDCIL sells power from the Tehri Dam Project is subject to regulation by the Central Electricity Regulatory Commission (CERC) and THDCIL's output from this project is fully booked by willing buyers;

Rejoinder: The CERC has used cost-plus method to give a price of Rs 6 per KWH to THDC. That does not justify WB using the same figure. WB Appraisal must recognize that THDC is producing electricity at much higher price than produced by others.

(ii) In our close work with THDCIL over the last five years, we have found the company to be highly committed to strengthening its capacity in all aspects of hydropower development, including technical, social and environmental aspects. Over this period, the company has made significant efforts to follow good practice in resettlement and rehabilitation, benefits-sharing, local area development, and so on, in the process engaging the help of national and international experts. Good practices and innovations of THDCIL in the course of the preparation of VPHEP are described in the attached note which was prepared by the World Bank. The VPHEP loan includes a component for capacity-building and institutional strengthening which reflects the commitment of THDCIL's management to further building capacity for the design and operation of sustainable, environmentally and socially responsible hydropower projects.

Rejoinder: These are your perceptions based on information provided by THDC or agents appointed by it. Please undertake a site visit with us to other projects of THDC to get a real picture.

10. Concerning the small hydroelectric plant (HEP) of capacity 5 MW that is proposed to be placed at the toe of the diversion dam, THDCIL has confirmed its intention to treat the small HEP as a separate project for which a separate detailed project report is under preparation. THDCIL will seek separate clearances from the State of Uttarakhand (in view of the small size of the project, the clearance authority rests with the State of Uttarakhand).

Rejoinder: The toe project is not independent of the larger project. If that were the case then WB should have done a separate appraisal and sanctioned a separate loan. This is patently illegal activity on part of THDC that WB must not become a party to.

11. Project Costs Estimates. You note that the project costs estimates are higher than the standard benchmark of Rs 5 crores/MW. Please note that this benchmark is from some years ago and is primarily for coal-based power projects. Given the highly site specific nature of hydropower projects, the concept of a benchmark is of limited utility. The estimates for VPHEP that may be higher than the standard benchmark reflect the good practice followed in the project preparation of internalizing costs that in some projects have been left out of the cost estimation.

Rejoinder: Please examine the benchmark for hydro today. I do not think it is Rs 10 crores/MW as stated by THDC. There is a lot of commission and underhand dealing going on right below your eyes.

12. Environmental Flow Requirements. In addition to these points that were given in your email of November 6, 2011the Bank would like to respond to the comment in your email of October 16, 2011, that the environmental flow requirement for the project re-states the existing practices.

Rejoinder: This comment was made with respect to the IIT Roorkee study.

In fact, as described in the Project Appraisal Document, the Ministry of Forests and Environment (MOEF) of the Government of India issued a revised environmental clearance for the Project in June 2011. The revised environmental clearance increased the environmental flow requirement of the project from the 3 cumecs as stipulated in the original MOEF environmental clearance (August 2007) to 15.65 cumecs. Expressed as a percentage of the average recorded low flow (typically recorded in the month of February), the revised environmental flow requirement is about 50% (15.65 / 31.8). The common practice for hydropower projects in India has been to stipulate an environmental flow requirement in the range of 10-15% of the average low flow. At this higher level of environmental flow requirement the project remains economically attractive.

Rejoinder: Increase of e-flow from 3 to 15.65 cumecs is not adequate as outlined in our note. WB is accepting contentions of THDC without application of mind.

Annexure 4

August 31, 2011

Critique of

Study of Cumulative Impacts of Hydropower projects on Ganga River by

AHEC, IIT, Roorkee and WII, Dehradun

By

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Executive Summary

IIT Roorkee

29 The study has been undertaken by Dr Arun Kumar as an individual consultancy assignment. It is not a study by AHEC or IIT. However, Dr Arun Kumar is passing this off as a study by IITR.

30 It is assumed without basis that tunneling can avoid fracturing aquifers.

31 It is assumed without basis that earthquakes can be predicted from surface seismological data.

32 The parameters of water quality showing greatest impact of hydro projects have been deliberately not mentioned.

33 The methods used for assessing Environmental Flows are hydrological or as per existing practice. They are not based on cumulative environmental impacts as required by TOR.

34 World Commission on Dams is reported to have recommended 10% release as Environment Flows while actually the Commission has deprecated this practice.

35 The alternative of partial obstruction is not examined.

36 The Environmental Flows do not take into account the need to upgrade the river to higher state.

37 Building Block Method is endorsed but even a sample calculation is not done. Environmental flows are recommended on hydrological basis contrary to this endorsement.

38 The Zonation classification is passed off as Environment Management Class.

39 Energy Payback Ratio is calculated without accounting for social- and environmental costs and some economic costs.

40 Figures for Green House Gas emissions are taken from temperate reservoirs and not tropical reservoirs.

41 Effectiveness of fish passages is not assessed.

42 Impact of hydro projects on the creation of beneficent sediments is not assessed.

43 The NEERI study done for a single project is extrapolated to cumulative study.

44 Key informants for assessing religious and cultural impacts are not selected on a scientific basis.

45 Shri Chandi Prasad Bhatt has been quoted as supporting dams while actually he has opposed them.

46 Har-ki-pauri precedent made under a foreign power in colonial period is invoked mindlessly and quoted out of context.

47 Cumulative environmental impact is done prophetically without giving any basis.

48 Stakeholder-wise distribution of benefits and costs is not done.

49 Dams more than 20 m height are discouraged yet dams greater than 20 m height are recommended.

50 Gap between hydro projects is suggested but no scientific method to assess the same is given; and problem of 'no gap' between existing projects is not addressed.

51 It is suggested that 70% of the river may be harnessed for generation of hydropower without giving any basis of the same.

WII, Dehradun

10 Environment Flow Requirement should be based on Mean Seasonal Flow, not on Mean Annual Flow. This is welcome.

11 Cumulative impact assessment ignores (1) Change in sediment transport; (2) Deterioration of water quality; (3) More oxygen in water; (4) Carry of drift materials.

12 Impact of existing dams on the low cumulative scores for Vishnugad-Pipalkoti and Kotlibhel 1A are not examined.

13 Conservation importance ignores cultural value of Ganga River; and many places of significance such as Koteshwar and Dhari Devi Temples.

14 Existence of Otter is ignored.

15 Threat to the Cheer Pheasant is not mitigated.

16 Zone of influence is arbitrarily restricted to 500 meters.

17 Classification in Environment Management Class ignores the (1) importance of the river basin; and (2) need to upgrade the river to higher management class.

18 Mitigation measures are not spelled out.

Background

While considering the application of NHPC for diversion of forest lands, the Hon Supreme Court ordered that a study of Cumulative Impacts of hydropower projects on Rivers Bhagirathi, Alaknanda and Ganga be carried out. The study was given to AHEC, IITR on the basis of this order. A parallel study was given to Wildlife Institute of India (WII).

AHEC, IITR has now submitted the study. WII has submitted its interim report. This representation is made to bring to the notice of MOEF the various glaring shortcomings of, and unfounded conclusions drawn by these studies. It is prayed to MOEF that these studies should not be taken cognizance of till the shortcomings are removed.

The form which submitted by Dr Arun Kumar for getting the approval of Dean, SRIC, IITR shows as follow:

a. Type of Sponsorship: - Govt. Sector

b. Type of Consultancy Project: - Type I, Individual (without use of laboratory facilities)

c. Nature of projects: - Consultancy.

d. Whether MoU/Agreement signed with Agency: Not Signed.

It is clear from above that the study has been given by MOEF to Dr Arun Kumar as an individual consultancy assignment. The study has not been done either by AHEC or IITR. However, MOEF is treating as if the study has been done by IITR.

The report can be found on MOEF website at the following link:

moef.nic.in/modules/others/?f=bhagirathi-study

AHEC, IIT, Roorkee Report

Chapter numbers follow those given in the AHEC report.

1-3: Introduction

These Chapters have been skipped for comments as they are introductory in nature.

4: Geological Studies

AHEC admits that hydro projects will change the downstream sediment regime. Sediment-hungry river waters are likely to increase the erosive power of the river downstream and deprive the aquatic life of nourishing elements (Para 4.2.10.3). However, it only recommends that "sediment load in both upstream and downstream of the dam/barrage be monitored" (Para 4.2.12.6). It is obvious that 'monitoring' will not mitigate the negative impacts of change in the sediment regime. AHEC neither assesses the extent of impact not gives any suggestions to manage this problem.

AHEC admits that "tunnels invariably face the problem of leakage of water from sheared, fractured and jointed rock zones they cut through… Due to this the sources of water… get dried up or the flow is reduced. It is suggested that tunneling as well as adit sites be chosen in such manner that they don't cut through such zones specially the underground water flow regime" (Para 4.2.12.5). AHEC should have done a study of the extent to which such fractures have taken place in the existing or under construction projects. It is not known to me whether techniques to map these underground water sources have been developed and whether this is possible at all. It is also assumed that realignment is possible. None of these assumptions may hold. Dr S P Sati of HNB Garhwal University has informed me in a personal communication that "as far we know it is almost impossible to get an alignment through the zone along which fractures/shears/ joints are not found which support the ground water regime. The only source of ground water in the Himalayan terrain is the secondary porosity of the rocks in form of fractures/joints which are practically present everywhere in the Himalayan Rocks."

AHEC says those only a limited number of hydropower projects in the area have been completed or are under construction. This has happened only in the last decade. On the basis of such limited information, AHEC says that "The information gathered during the present study does not show any effect of one HP on the other HP located downstream in geological parameters." This statement is self-contradictory. The impact of a HP at present would be seen

only on the downstream adjacent area—not necessarily on the downstream HP because the downstream HEP may be located at some distance or on other side of the river. This has not been studied. Thus AHEC has concluded that there is no cumulative impact without studying it.

5: Seismological Aspects

AHEC proceeds on the basis that there is no recorded increase in Reservoir Induced Seismicity in the Himalayas. It says no increase in seismic activity is noted around four hydropower reservoirs (Para 5.7.4).

Further, it concludes on the strength of mathematical modeling that Conditional Probability of RIS in projects in the area is about 0.02 which is less than the Critical Probability of 0.2, therefore, the "cumulative risk of occurrence of reservoir induced earthquakes, as a random event, seems to be very unlikely" (Para 5.9).

AHEC also notes that "contemporary deformation styles in the Himalayas are guided by under thrusting of the Indian plate along the detachment surface" (Para 5.5).

I am not very knowledgeable about this science. However, I am somewhat knowledgeable about statistics. The following points may be noted.

One, Conditional Probability of RIS in projects in the area being about 0.02, seems to imply that there is a 2:100 chance of RIS.

Two, probability does not tell us anything about an *individual* happening. Low probability of a person contracting malaria does not mean that that particular person will conclusively *not* contract malaria. Similarly, RIS may yet occur.

Three, no cumulative impact study has been done here. The conclusion that "cumulative risk of occurrence of reservoir induced earthquakes seems to be very unlikely" has been pulled out of the air and lacks any basis. Cumulative impact would examine whether multiple projects in close proximity could increase the chances of RIS.

Four, none of the earthquakes that have taken place in the Himalayas could be predicted by surface measurements of tectonic activity. This is so because the pressures that are getting built up many kilometers below the surface do not get reflected in measurements on the surface. The correct question then is whether the loading of hydropower reservoirs will impact the pressures that are building

up deep below. If the Indian Plate continues to thrust against the Tibetan Plate then pressures have to necessarily build up deep below and that pressure may be increased due to the load of reservoirs. This has not been examined.

6: Water Quality, Biodiversity and River Ecology

6.1 Water Quality

AHEC says:

> The water quality of… Tehri… and Vishnu Prayag have been compared with baseline water quality. The impact on DO is negligible; the BOD remains unchanged as the water passes through the tunnels/channels… The other parameters do not show significant change (Page 6-59).

I have extracted the water quality data for u/s and d/s provided by AHEC for Tehri and Vishnu Prayag projects. The change is given in the Tables below:

Tehri

Sl No	HP	Temp	pH	DO	Cond	TDS	Turbidity	NO3-N	TP	BOD	Fecal C
26	Tehri-u/s Chilyanisaur	11.7	7.8	9.43	169.9	80.4	0.71	0.8	0.98	1.87	20
26	Tehri (Outlet)-d/s	14.1	7.9	9.26	113.4	53.6	5.77	0.4	2.66	1.92	240
	Change	-2.4	-0.1	0.17	56.5	26.8	-5.06	0.4	-1.68	-0.05	-220
	Change (%)	-20.51%	-1.28%	1.80%	33.25%	33.33%	-712.68%	50.00%	-171.43%	-2.67%	-1100.00%
	Severe?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes

Vishnu Prayag

Sl No	HP	Temp	pH	DO	Cond	TDS	Turbidity	NO3-N	TP	BOD	Fecal C
5	Vishnu Prayag u/s	6.6	7.6	8.92	81.4	38.3	1.2	2.14	0.93	1.8	39
5	Vishnu Prayag d/s	8.9	7.8	9.04	192.8	94.9	1.1	3.4	5.4	1.6	21
	Change	-2.3	-0.2	-0.12	-111.4	-56.6	0.1	-1.26	-4.47	0.2	18
	Change (%)	-34.8%	-2.6%	-1.3%	-136.8%	-147.8%	8.3%	-58.9%	-480.6%	11.1%	46.1%
	Severe?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes

In both projects, AHEC is correct in stating that impact on DO and BOD is negligible. However, change in the other parameters is severe. Precisely these have not reported by AHEC. The statement that "other parameters do not show significant change" is totally unwarranted. As shown in the case of ROR Vishnu Prayag project, these impacts are severe in ROR projects as well.

AHEC mentions that water quality satisfies CPCB parameters for Class 'A'. This is correct. But CPCB parameters have been developed for drinking water purposes in an urban setting. They have not been developed for ecological assessment. For example, DO may decline from 12 mg/l to 6 mg/l. This will still satisfy CPCB Class 'A' requirement. Yet this hides a huge environmental impact. Many aquatic lives that require DO above, say, 10 mg/l to survive may die.

AHEC refers to NEERI report. This has been discussed at Chapter 9.2.2 of this comment.

7 Hydrological studies

7.3 Environmental Flow Requirements

AHEC has recommended EFR (Environmental Flow Requirements) at Table 7.17.

The steps used, as per my limited understanding, are as follows:

5 The Mean Annual Flow is calculated. This is the flow above and below which water flows one-half the days (183 days).

6 Percent of MAF required for EFR is calculated as per four different methods: (1) WCD; (2) France; (3) Q95; and (4) EMC-HMD.

7 The Maximum from these 4 methods is taken as the EFR.

8 This is suitably adjusted (mostly increased) during high-flow periods during monsoons (Table 7.18).

My critique of this method is presented below.

MAF Method

The Mean Annual Flow method is unsuitable for India's seasonal rivers. I give below hypothetical figures for a river:

Lean period Oct-May (8 months): 10 cumecs

High period June-Sep (4 months): 400 cumecs

Weighted Average: 140 cumecs

Mean Annual Flow (MAF): 10 cumecs

The average flow is 140 cumecs but MAF is only 10 cumecs. This happens because the huge increases in seasonal flows are ignored in the MAF calculations (This has been noted by EAC in its minutes of 2.6.2011). These flood flows have important ecological functions. Certain riparian vegetation can survive if they get high flows once-in-ten-years. Flood flows are also important for recharging groundwater in the plains. Therefore the correct method should be Average- or Mean Seasonal Flow.

WCD

I am unable to find in the report source of the WCD (World Commission of Dams) figures given at Table 7.17. Plain reading on the Table shows these are invariably 10% of MAF. Himanshu Thakkar has provided me with the following extract from the WCD report:

> 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 (page 239).
>
> Dams should provide for an environmental flow release to meet specific downstream ecosystem and livelihood objectives identified through scientific and participatory processes (p 294).

Clearly AHEC has attributed to WCD 10% MAF that WCD deprecates as arbitrary.

France Method

The freshwater fishing law in France requires that EFR should be 2.5% for existing schemes and 10% for proposed schemes (Page 7-20). EAC in its meeting of 2-3 June, 2011 has rightly noted "It is felt that French conditions may not be applicable for Indian rivers.

Fishing is not the main function of Indian rivers. Objective of the study was to assess 'environmental' impacts. These cannot be reduced to fishing.

Secondly, fishing may have less importance in France than, say, in the United Sates. The Edwards Dam in Maine was removed because the dam owner found it expensive to install fish elevators on an existing dam. Elhwa Dam in Washington is being removed because non-use values (cultural- and recreational values from fishing and kayaking) were deemed to be greater than benefits from irrigation and hydropower. AHEC should have applied its mind to various international precedents and then given justification for using a particular precedent.

It appears AHEC has chosen a country where the EFR are lowest because of less value of fishing. No justification is provided for choosing France. Indian rivers are different in terms of seasonal variations, sediment load, cultural significance, etc.

75% of Q95

Q95 refers to flow which is equaled or exceeded 95% of the time. Thus, Q95 is the flow at the lowest 17 days of the year.

Justification for use of this method given is this: "Q95 is often used in regulating abstraction in Uttarakhand. Figure of Q95 was chosen purely on hydrological grounds" (Page 7-33).

Purpose of the study given to AHEC was to assess EFR on the basis of Cumulative Environmental Impacts so that the existing practice may be modified. Instead of making its own assessment, it has merely dittoed the existing practice in Uttarakhand. There was no need to undertake the study if only the existing practice was to be restated.

Secondly, study was given to AHEC to assess EFR on the basis of Cumulative Environmental Impacts. Instead it has based its assessment on 'hydrological grounds.' Even here, it is not stated why Q95 is chosen on hydrological grounds and not Q50 or Q05.

Then AHEC relies on the stipulation by Environment Agency of England and Wales that 25% of this Q95 can be extracted (Page 7-33). Once again, why AHEC has relied on this Agency is not stated.

EMC-HMD

Fourth basis for assessing EFR is EMC-HMD (Environment Management Class-Hydrological Mean Depth) (Table 7.15). The depth (Hydraulic Mean Depth) and velocity required for certain macro invertebrates are given at Tables 6.22-6.24. No source is given for this data. This is curious because the WII study says:

> There was no information available on the precise hydrological requirements of the organisms dwelling in the habitats of Upper Ganga (Page 72).

Further, it is not clear how these species-specific figures have been correlated with the values of HMD, velocity, cross-section and discharge for *specific projects* given at Table 7.15. No details are given as to how the figures at Table 7.15 have been calculated. These appear to have no relation with the flows required for aquatic life.

Moreover, it is inadequate to assess the flow require for survival of a species. The WII study cautions:

> Considering the minimum hydraulic requirement of various species… the minimum environmental flow was calculated based on mean annual flow. But this does not meet the minimum flow required for the various life history traits of a species, because the important activities like breeding, growth, metamorphosis and migration are mainly depending on the seasonal variation in natural flow pattern. Moreover, the flow requirements for the life history stages of many fishes are depending on the seasonal flow. Taking this into account, the environmental flow required for different sector of the river will be calculated from Mean Seasonal Flow (Page 42-43).

The EAC has noted in its meeting of 2-3 June, 2011:

> The minimum hydrological requirements for macro-invertebrates in rhirhthronic zones reported to vary from 15-50 cm with different velocity (25-100 cms^{-1}). The requirements shown in the report for the fish are also similar to that. But the region harbour diverse fish species varying from small sized loaches to mighty mahseers. The loaches are indicators of perennial water bodies as they thrive in shallow sheet of semi-stagnant water, while Mahseer need fast flowing rivers, rivulets and streams for migratory run and shallow side

> pools for breeding and feeding. Therefore the different life stages and size of the fish should be considered for estimation of environmental flow requirement.

Further, the method is flawed because fish is not the only purpose of the river. Objective of the study was 'Cumulative Environmental Impacts,' which includes various impacts including religious and merely that on fish.

Partial Obstruction

It was suggested in an earlier representation submitted to AHEC in September 2010 by 40 academicians including this writer that AHEC should examine the alternative of making a partial obstruction in the river instead of a barrage across the river. Such partial obstruction would enable upward migration of fish and downward flow of sediments. AHEC has not considered this alternative. It has proceeded on the basis that barrages are the right thing to make.

Desired State of the River

The study was given to AHEC under the umbrella of NGRBA. Objective of NGRBA is 'conservation' of the National Ganga River. Conservation implies rebuilding the river where it may have been excessively damaged. In this context, AHEC favourably quotes Smakhtin: "Environment flow aim(s) to maintain an ecosystem in, or *upgrade it* to, some prescribed or negotiated condition" (Page 7-23).

AHEC recognizes that EFR depends, among others, on the 'desired state of the river' (Page 7-18). It also says that EFR depends upon "what the society expects from the river" (Page 7-63). Yet, there is nothing in the report about the desired state or expectations of the society. Having admitted these, AHEC falls back on routine hydrological methods and ignores these vital observations.

EAC has noted in its meeting of 2-3 June, 2011:

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

Conclusion

AHEC has:

19 Not done assessment of EFR on the basis of Cumulative Impact Assessment.

20 Inappropriately taken Mean Annual Flow instead of Mean Seasonal Flow which is more suitable to Indian rivers with their huge seasonal variations.

21 Relied on specific methods adopted in France and England without giving any justification.

22 Quoted World Commission on Dams opposite of WCD is saying.

23 Reduced 'environment' to mere fish.

24 Not calculated the flows required even for the survival of fish.

25 Merely restated the existing practice of Q95 in Uttarakhand without application of mind.

26 The benign alternative of partial obstruction has not been considered.

27 The desired state of the river and social expectations are not taken into account.

The EFR calculated by AHEC are, therefore, not acceptable.

7.3.4 Building Block Method

AHEC favourably mentions Building Block Method (BBM) for determining EFR:

> The "Building Blocks are different components of flow which, when combined, comprise a regime that facilitates the maintenance of the river in a pre-specified condition. The flow block comprise low flows, as well as high flows, required for channel maintenance and fifer between 'normal years' and 'drought years' (Page 7-22).
>
> Methods, such as the Building Block Method, can use detailed data from different sectors and have provision for consultation among the experts and stakeholders. However application of BBM for a large number of sites requires a lot of time and finances. It is, therefore recommended that the exact values of EFR for implementation in the field may be arrived at by conducting specific measurements and field campaigns and consultations with all the stakeholders (Page 7-63ff).

This was seconded by the EAC in its meeting of 2-3 June, 2011:

> 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. Also the methodology used may be different for different attitudes. The assumptions and hypothesis of these models need to be understood thoroughly before taking any decision for environmental flow for various projects.

A study from Zimbabwe (Balancing Water for the Environment, Water for Human Needs and Water for National Economic Purposes: A Case Study from

the Rusape River, Save Basin, Zimbabwe, Faith Love, Elisha Madamombe, Brian Marshall and Evans Kaseke) explains how this is done:

> The environmental flow requirements were then determined by … using the building block method. This involves the following steps:
>
> 1. The first building block is the minimum release, taken at 70 % of mean monthly discharge, since a 30 % drop in flow is the generic minimal degradation level…
>
> 2. The second building block is the flushing floods, which maintain the channel by flushing the bed and disposing of poor-quality water at the start of the rainy season.
>
> 3. The third building block is habitat maintenance floods. Release of classes III and IV floods in the middle of the rainy season maintains the physical habitat heterogeneity.
>
> 4. The fourth building block is spawning floods: release of classes I and II floods triggers spawning.
>
> 5. The remaining (so far unallocated) upstream inflow received in any given month is available for storage in the dam or for release and abstraction by downstream users.

BBM entails listing all the ecological and social functions of the river and then determining how much water in each season is required for sustaining them.

AHEC concedes that EFR calculation by BBM is the correct method to use. However, it does not make these calculations because it requires time and money. AHEC could have left the matter here and given no recommendations for EFR. AHEC could have calculated the EFR by BBM for one project and shown how this can be done and the kind of results this gives.

But AHEC gives recommendations for EFR based only on the existing practices, saying these are only 'indicative' values (Page 7-63). In the process AHEC surreptitiously passes off the existing practices as 'calculated' EFRs.

7.3.6 Environment Management Class

EMC Method used by AHEC

AHEC says that it has three methods to assess EFR. The third method is described as "Environment Management Class (EMC) based Flow Duration Curve (FDC) Approach" (Page 7-33). The description of the EMC class in this section matches with the six-category classification suggested by Smakhtin for IWMI and quoted by AHEC at Table 7.4. This method is *qualitative.* It describes the environmental condition of a river or stretch thereof. A river may be classified as 'A' if it is in natural state and 'F' if it is critically degraded.

However, the EMC used by AHEC at Tables 7.15 and 7.17, is not EMC-FDC of Smakhtin. Instead it is a totally different category of EMC-HMD. This approach is *spatial.* It refers to the aquatic life in different zones or stretches of a river.

The EMC-HMD approach is mentioned by AHEC at Table 6.17 though here only EMC is mentioned lending itself to misinterpretation that it may refer to EMC-FDC while actually it refers to EMC-HMD. Reference is made in this table to study by Illies and Botosaneanu (1963). This study is described as follows:

> The distribution of organisms, resources, and biological processes change along rivers… The first attempt to categorize such discontinuities is the Stream Zone Concept (Illies and Botosaneanu 1963), which defined a series of distinct communities along rivers, separated by major faunal transition zones. (Bruno Maiolini and M Cristina Bruno, *The River Continuum Concept Revisited: Lessons from the Alps,* Museum of Natural Sciences of Trento).

The Illies method is a zonation method. It helps separate the stretches of a river into different zones. It has no connection whatsoever with the EMC suggested by Smakhtin which describes the *different condition of the river in the same zone.*

As mentioned above, AHEC seems to use depth, velocity, cross section and discharge for the survival of aquatic life in developing the figures of EMC-HMD given at Tables 7-15 and 7-17. This is fine from the perspective of zonation. The aquatic life in particular stretches of river may be specified and flow required for their survival may be estimated. But this is not the EMC-FDC approach of Smakhtin that AHEC *claims* to use but uses EMC-HMD instead.

Actually I have not found the term 'EMC' being used in the sense of Zonation at all. It may be that AHEC has deliberately misnamed the zonation concept as EMC to make it appear that the EFR suggested by it are derived from EMC-FDC method of Smakhtin.

EFR values calculated by AHEC

I give below Table extracted from Smakhtin giving the EFR (which is same as EWR) for Ganga at different EMCs:

Estimates of long-term EWR volumes (expressed as % of natural Mean Annual Runoff - MAR) at river basin outlets for different Environmental Management Classes obtained using FDC shifting method

River	Natural MAR (Billion	Long-term EWR (% Natural MAR)					
		A	B	C	D	E	F

	Cubic Meters)						
Ganga	525	67.6	44.2	28.9	20.0	14.9	12.1

These values can be compared with those calculated by AHEC. The AHEC values are given for selected projects on the Ganga below:

Table 7.17: Summary of results obtained for EFR using various EFA methodologies (as percent of MAF).

HEP Site	EFR Minimum	EFR Maximum
Maneri Bhali II	2.25	9.03
Tehri Stage I	2.5	15.09
Vishnugad Pipalkoti	7.62	10.72
Vishnu Prayag	2.5	9.58
Srinagar	10.0	13.40

Comparison of the above two tables indicates that AHEC has recommended EFR mostly *less than that for Class F Rivers*. Against 12.1 suggested by Smakhtin, AHEC has suggested averages that are consistently below this. AHEC has implicitly classified Ganga as *less-than F category*, without stating the same. Category 'F' is defined by Smakhtin as follows:

> Ecosystems in category F are likely to be those which have been modified beyond rehabilitation to anything approaching a natural condition (Page 17).

Clearly Ganga is not in such condition.

7.6.3 Ganga Delta Processes

AHEC says that Alaknanda and Bhagirathi Basins contribute only 4% to the sediments discharge of Ganga hence modification of sediment regime due to HEPs is unlikely to affect coastal erosion.

According to study done by R.J. Wasson)of Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia), out of total 794 million tons/year silt carried by Ganga, 635 million tons/year comes from Higher Himalayas and 159 million tons/year comes from lower

Himalayas (A Sediment Budget for the Ganga-Brahmaputra catchment, *Current Science*).

There is a glaring difference between the two figures. AHEC says only 4% comes from Himalayas while Wasson says 100% comes from here. These figures need to be reconciled. AHEC may be underreporting the sediment figures.

7.7 Studies on Groundwater and Springs

Tables 7.41-7.42 of the AHEC Report indicates an average decrease of ground water level in hand pumps at Chamoli District by 7.3 percent and at Uttarkashi District by 0.2 percent. Yet AHEC concludes that "it is expected that there would be a positive impact of project on groundwater recharge and availability" (Page 7-108). No basis for this statement is given. It is not explained how project will recharge groundwater when even monsoons are not doing that. HEPs are built in a valley. The recharge, if at all, will impact only downstream areas. This is unlikely to recharge the hand pumps because the reservoir is located in the valley while habitations are on the hills.

On the other hand, discharge of groundwater due to piercing of aquifers will take place in tunnel-based projects because tunnels are made on higher elevations.

AHEC says "construction of tunnels may have positive as well as negative impacts on the groundwater conditions" (Page 7-130). It is not understood how tunnel-based projects will have positive impact.

AHEC quotes responses of various project authorities to the effect that there is no negative impact on springs. This is methodologically wrong because the project authorities have a vested interest in hiding any such impact. The study by UJVNL (Cultural and Social Impact of Hydropower Projects by Dr D R Purohit) and ground experience indicates that this negative impact is taking place hugely.

AHEC assumes that aquifers are disconnected and impact of piercing will be local (Page 7-129). No basis is given for making this statement. Purpose of the study was Cumulative Impact Assessment. It was obligatory for AHEC to do such study.

Himanshu Thakkar reports inconsistencies in the data given by AHEC in this regard:

> The report could not assess the impact of projects on springs "due to limitations of data" … the authors … could have easily found from local communities the impact of the projects on the local springs… they 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. The conclusion is certainly known to be wrong in case of Loharinag Pala, Pala Maneri, Phata Byung 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…

8: Hydropower Development

General

This Chapter is beyond the TOR. There is nothing in TOR about hydropower potential, shortages, etc.

Himanshu Thakkar points out that AHEC has failed to do study of performance of hydropower projects:

> … the consultant … should have assessed how the generation per MW has been changing over the years and how the actual generation compares with the promised 90% dependable generation… SANDRP analysis shows that per MW generation of hydropower projects in India has come down by a huge 25% in last 20 years. Secondly, 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.

8.1 Power Scenario

AHEC seems to say there is need to generate more power within the State because it is a net importer of power. However, power purchased appears to be cheaper than the hydro power generated within the state. The average purchase cost (Excluding THDC and overdrawal) is Rs 2.20 per unit. The present cost of generation will be about Rs 3 per unit. (Cost of generation is Rs 2.37 from Kotlibhel 1B at 2006 prices). Thus it is cheaper for the State to import than to generate hydropower.

8.5 Energy payback ratio

AHEC quotes study by L Gagnon ("Civilization and Energy Payback," *Energy Policy,* 36(9)) to the effect that energy payback ratio for hydropower is in the

range of 170-280 against 1.6-3.3 for coal. Thus, it is sought to be established that hydro is the best option for power generation.

The "energy payback ratio" of a power plant is defined as the total energy produced over the lifetime of the plant divided by the energy needed to build, operate, fuel and decommission it.

Plain reading of above statement shows that only the costs incurred to "to build, operate, fuel and decommission" the project are concerned. These are 'private costs'. Costs incurred by the society or 'externalities' are ignored.

Indeed hydropower involves less expenditure in generation than other sources of energy. This is because thermal and nuclear require extraction of fuel; while hydro does not require such fuel. On the other hand, the environmental and social costs of hydro are very high. Thus the correct method is to calculate both the private- and social costs of the various alternatives.

Saying hydro is the best option on the basis of energy payback ratio alone is like saying that the energy payback ratio of the butcher is very high. Ne has to calculate the cost of the animal that is butchered. Similarly AHEC should have calculated both the social and environmental costs of hydropower.

A cost-benefit analysis of Kotlibhel 1B project shows that it is highly negative once environmental costs are included.

Table: Cost-Benefit Analysis of KB1B

Sl No	Item	Benefit	Cost
1	Benefits from generation of power	103.8	
2	12% Free power to State	50.2	
3	Employment	1.5	
4	Environmental Costs		931.8
	Total benefit and cost of Kotlibhel 1B HEP	155.5	931.8
	Net loss		776.3

Source: Economics of Hydropower by Bharat Jhunjhunwala.

The Kotlibhel 1B project has a negative overall cost-benefit ratio. However, it is profitable for hydropower companies to build this because they have to only bear the private costs. The environmental costs are surreptitiously passed on to the society. Implication is that calculation of energy payback ratio should include social and environmental costs.

In addition to the environmental costs included in the above study, AHEC was requested to include the following vide representation of September 2010:

Loss of value of services provided by nature relying, among others, on Costanza (1997).

Depletion premium of free-flowing rivers. The value of remaining free-flow will increase as large numbers of projects are made.

Costs of decommissioning the projects.

Higher consumer value of power produced during peak hours and lower value of power produced during monsoons.

Sensitivity analysis of the efficacy of projects in view of the expected decline in price of solar power in next few years. Will it be beneficial to make long term commitment of river resources for gains that may not accrue at a later period?

None of these have been included in the study.

8.6 GHG Emissions from Hydropower

AHEC quotes study to the effect that GHG emissions from hydropower are only 4-18 grams CO2 per kWh against 940-1340 grams for coal (Table 8.2). A close reading of the table shows following figures:

Energy Source	**Emission Factor gCO2 equiv/kWh(e)**
Coal	940-1340
Hydro power	4-18
Tropical Reservoirs (Petit-Saut)	~455 (gross)/~327 (net)
Tropical Reservoirs (Brazil)	~6 to 2100 (average ~160)

The high value of GHG emissions from tropical reservoirs is 2100 gCO2/kWh. This is far in excess of high value of GHG emissions from coal at 1340 gCO2/kWh.

A study by International Rivers (Fizzy Science: Loosening the Hydro Industry's Grip on Reservoir Greenhouse Gas Emissions Research) gives an average figure of 2154 gCO2/kWh of net emissions from three hydropower reservoirs from Brazil. This matches with the high value given by AHEC.

The low value of 4-18 gCO2/kWh for hydropower quoted by AHEC apparently relates to *all* hydropower projects—including those in temperate regions. This is wholly inapplicable to India.

In the result, GHG emissions from hydropower in India are about two times those from coal; and not less as indicated by AHEC.

8.7 Barriers for Fish Migration

AHEC recommends that fish passages must be installed on the hydropower projects to mitigate the negative impacts of HEPs. It does not give any assessment of effectiveness of these passages. A report by Himachal Pradesh fisheries department says:

> Regardless of their height, weirs and dams constitute barriers to breeding migration of Mahseer. Further, Mahseer population is also affected by morphological modifications resulting from completion of river valley projects. These include change in slope, river-bed profile, submersion of gravel zones or riffle section as well as destruction of riparian vegetation and changes in tropic regimes. Most of the negative factors affect upper parts of the streams where lacustrine conditions are superimposed on the river. Downstream, the hydrological conditions get severely altered through reduction of water discharge. The adverse conditions of the flow can extend over many kilometers downstream of the obstruction so that fish passages become difficult (Fisheries Growth, HP Government Website, http://himachal.nic.in/fisheries/mahseer.htm).

Many studies are available of the ineffectiveness of fish passages (For example, (Evaluation of Mitigation Effectiveness at Hydropower Projects: Fish Passage, Division of Hydropower Administration and Compliance, Office of Energy Projects, Federal Energy Regulatory Commission, September 2004).

I have visited few hydropower projects in the United States. My impression is that fish elevators are somewhat effective while fish passages are almost wholly ineffective. AHEC does not dwell into the issue.

AHEC fails to examine the effectiveness of fish passages and passes off mere listing of options as proof of their effectiveness.

8.17 Hydropower Performance

AHEC says that State of Uttarakhand stands to gain from hydropower projects because (1) State will get 12% free power; and (2) About 10% of investment in the projects will flow to state economy. This is correct. However, it is stating only the credit side of the balance sheet. The debit side consists of environmental- and social impacts.

AHEC is ignoring various losses to the state economy from environmental impacts. These include

(1) Deterioration in Quality of river water,

(2) Damage to health and environment due to methane emissions;

(3) Submergence of forests and its impact on biodiversity, grazing and carbon sequestration,

(4) Increased probability of Reservoir Induced Seismicity,

(5) Deterioration of health due to breeding of mosquitoes and development of water borne diseases,

(6) Loss of wildlife such as Mahseer and Smooth Coated Otter,

(7) Los of sand to local people,

(8) Loss of tourism potential due to white water rafting;

(9) Loss of cultural heritage such as lingwas;

(10) Loss of aesthetic value of free flowing river;

(11) Loss of sediments that prevent coastal erosion, that provide nourishment to downstream fisheries and that provides Cu Cr and Th to river water and help generate its special self-purifying capacity;

(12) Migration due to submergence and tectonic disturbance of agricultural lands.

AHEC is only accounting for the benefits and ignoring the costs. Mandate of AHEC was to look at the Cumulative *Environmental* Impacts. Instead of calculating the economic values of the mandated environmental impacts, AHEC has only calculated economic benefits that were not mandated by TOR.

8.18 Conclusions

AHEC concludes that "Based on the analysis of the potential sites, the conclusion emerges that hydropower at identified sites can be harnessed consistent with environment sustainability provided certain measures are taken."

This conclusion is wholly arbitrary and unfounded. There is nothing in the preceding part of the Chapter regarding environment and mitigative steps. Further, the various shortcomings indicate that this conclusion is unwarranted.

9 Impact on Places of Religious and Cultural Importance

9.2.2 Ganga as Goddess and Aviral Dhara

AHEC gives a long narrative of the spiritual and religious significance of Ganga. Then it refers to the NEERI study on "Comment on Self-Purification Capacity of Bhagirathi: Impact of Tehri Dam." AHEC quotes from the NEERI study:

> The uniqueness of river Bhagirathi/ Ganga lies in its sediment content which is more radioactive compared to other river and lake water sediments, can release Cu and Cr which have bactericidal properties and can harbour and cause proliferation (under static condition) of coliphages that reduce and ultimately eliminate coliforms from the overlying water column.

Then AHEC quotes the conclusion of NEERI:

> Tehri dam is not likely to affect the quality or self preservation property of river Bhagirathi/ Ganga, as it mimics a static container which is conducive for conditions responsible to maintain the water quality.

I, along with Dr G D Agarwal, have had a long exchange of views with NEERI on this study. Crux of the matter lies in sediments. It is clear that sediments of the Ganga have special quality in terms of Cu, Cr, U and Th. These elements appear to contribute to the development of wide-spectrum coliphages. NEERI has studied whether making of Tehri Dam is likely to affect the self-purifying quality. It concluded that such negative impact is unlikely because *the beneficent sediment is already there.* Once the sediment is in place, keeping the water in static condition does not seem to affect the self-purifying capacity of the river water.

It is admitted by NEERI that the wide-spectrum coliphages or the Cu, Cr, U and Th in sediments are not found at Gomukh. The metals are absorbed and coliphages develop during the flow from Gomukh to Tehri due to mechanical weathering.

Building of a cascade of dams on the river will prevent this mechanical weathering and thereby it will deprive the waters of these beneficent chemicals. NEERI has not studied the *creation* of the sediments or the wide-spectrum coliphages. It has only studied whether the quality of water will get affected once these are present.

AHEC should have studied the creation of sediments and coliphages *which has not been studied by NEERI.* This, precisely, is the cumulative impact of dams. The Tehri Dam studied singly assumes that the beneficent sediments are already there. The stand-alone study does not look at the creation of these sediments and coliphages and how this will be affected by making a cascade of dams upstream. Instead of studying the cumulative impact on creation of the sediments and coliphages, AHEC has merely relied on the stand-alone study of Tehri and passed it off as 'cumulative impact of any number of dams."

Key extracts from the exchange between me and G D Agarwal and NEERI are given below:

Comment on "Self-Purification Capacity of Bhagirathi: Impact of Tehri Dam" and Replies received from NEERI

Sl	Issue	What NEERI says	Possible problems as pointed out by Jhunjhunwala and Agarwal	Replies from NEERI
1	Radio-activity	High radioactivity is unique (p 94, 107). Radium kills bacteria (p 95). It may be crucial in the development of wide-spectrum coliphages.	Then wide-spectrum coliphages should develop in laboratory conditions when exposed to radioactivity.	These two are good suggestions and were also in our mind. However, it requires separate project from a suitable sponsor.
2	Cations	A correlation is reported between U, Th and K, and major cations (Na+K+Mg+Ca) (p 94).	Cations will get reduced when the river flow between Gangotri and Rishikesh is mainly diverted into dams. Then cations and U, Th and K will not be produced by weathering as there will be less friction between rocks and water.	This also needs separate project from a suitable sponsor.
3	Metals	Trapping of sediment mimics self-purifying water kept in a container (p 107). Sediment is important for self-purifying capacity (p 74).	Trapping of sediment in Tehri reservoir may keep water in Tehri reservoir clean but the self-purifying property will be hit downstream as there will not remain any sediment for release of the metals.	The studies are being carried out since 2008 in NEERI. It is confirmed that self preservation capacity of Gaga water has been retained in Rishikesh too.
4	Sediment	10% sediment discharge from Tehri + sediment downstream from Tehri + sediment from Alaknanda will be adequate to provide beneficent sediment downstream (p 108).	(1) That 10% sediment will be released from Tehri is not established. (2) Sediment from Alaknanda may be eliminated by making of tunnel-based dams that will prevent weathering.	Whether 10% sediment is actually released will be worked out in future.

Sl	Issue	What NEERI says	Possible problems as pointed out by Jhunjhunwala and Agarwal	Replies from NEERI
5	Special quality of phages	Phages not detected but get triggered when contaminated (p 101). Phages develop, kill coliform then get adsorbed to sediment (p 102). This is crucial in making of the self-purifying capacity of Ganga water. During discussions, NEERI scientists said that phages in Ganga have capability to kill wide-spectrum coliform. No phages were found at Gomukh. Thus they are developed downstream.	No clear explanation is given for the wide-spectrum capacity of these phages. Radioactivity and cations are unlikely as they can be artificially induced. The penance done by the sages; or special flora and fauna may be responsible for this.	

9.2.5 Data Collection

Method adopted by AHEC to assess the cultural and religious impact was that of 'key informants.' To quote AHEC:

> This study… does not rely on large-scale surveys; either random or purposive… the study… aims to capture the spectrum of opinion across a broad range of stakeholders. Accordingly, key informant interviews were conducted…

The results of the study critically are dependent upon the key informants chosen. This was brought to the attention of AHEC during the meeting with Ganga Mahasabha held on 13.9.2010. I quote:

> **Bharat Jhunjhunwala:** How will you select your entry point in the village for interviews? The responses will depend very much on this.
>
> **Prof B K Joshi:** We will not use any contact for entry. We will go ourselves.
>
> **Bharat Jhunjhunwala:** If your perception is of 'Government' then replies will be pro-dam because they would like to extract benefits from you. Secondly, you have to break through the stranglehold of the contractor lobby and be able to meet the poor and meek without their presence.

The study by AHEC is not acceptable because a transparent method of selecting the key informants has not been chosen. There is no mention in the report of the oppositions to the dams in Uttarakhand. Seven persons sat on a hunger strike for 19 days against the Kotlibhel projects. Loharinagpala on Bhagirathi was stopped because of fast undertaken by Dr G D Agarwal. Public hearing of Devsari Dam on Pindar was postponed twice due to opposition from local people. Sushila Bhandari and Jagmohan Jinkwan were jailed for more than two months because they opposed the Singoli-Bhatwari project. There have been many protests

against other dams across Uttarakhand. None of these voices are reflected in the AHEC report. Of course, other groups in Uttarakhand have supported the dams. The projects have split the society in two opposing groups. In this circumstance it was essential to undertake a scientifically designed survey so that views of the opposing sections were adequately represented. That said AHEC does record opposition of some local people to the hydropower projects. But this has not been given due importance in the report.

9.5 Economic Development

AHEC nullifies the cultural- and religious opposition to hydropower projects on economic grounds. It holds that local people get economic benefits from the projects and have lesser religious value of the Ganga (Paras 9.5.2-3). On this basis it says, that not only Ganga may be harnessed for hydropower but also projects such as Loharinagpala that have been cancelled may be revived.

This approach is not acceptable because mandate of AHEC was to assess "Flows necessary for observing religious practices" and "Impact on places of religious and cultural significance" (TOR 1.2(g) and (h)). None of these have been done. Worse, a *cumulative* impact on religious and cultural places has not been done.

AHEC has proceeded on the basis that local natural resources first belong to local people. It notes:

> A related issue… is… who had the first right on the resources of the region… the local communities or the outsiders?

AHEC thus concludes that if local people want hydropower projects for their economic growth, then impacts on places of religious and cultural significance can be ignored. This view of AHEC is contra the view held by the Supreme Court in the Narmada judgment:

> A nature river is not only meant for the people close by but it should be for the benefit of those who can make use of it, being far away from it or nearby… In a democracy, welfare of the people at large, and not merely of a small section of society, has to be the concern of a responsible Government.

Following the Supreme Court judgment, it was necessary for AHEC to undertake a survey of not only those in favour- and opposed to HEPs in the local area but also people of India living faraway and arrive at the level of negative impact on places of cultural and religious significance. Indeed, the TOR restricts AHEC to the area up to Dev Prayag. But the least that AHEC

could do was to note this inadequacy in its report. AHEC has not hesitated to transgress this limit by noting the favourable impacts on the economy of the State beyond the study area. AHEC has also applied its mind to coastal erosion. Thus, AHEC has deliberately not studied the cultural and religious impact on the people of the country.

I have undertaken a study of the value attributed by pilgrims to taking bath in the Ganga (*Economics of Hydropower*, Annexure 2). I have found that the value of bath in the Ganga is Rs 51,548 per pilgrim. The pilgrims are willing to pay Rs 700 per year to remove the Tehri Dam and restore free flow of the Ganga. The Elhwa Dam in the United States has been removed on the basis of these 'non-use values.' This methodology has also been accepted by the Planning Commission in relation to economic valuation of Tiger Reserves.

AHEC was requested to include these non-use values in our representation of September 2010:

> The purpose of making hydropower projects is to improve welfare of the people through provision of electricity. But people also obtain some welfare from free flow of rivers. People of Kerala may be willing to pay some amount for maintaining free flow of Ganga River. It is like a person deriving some satisfaction from the knowledge that the tiger survives even though he may never go to a sanctuary to see the tiger. This willingness to pay is an estimate of the welfare they obtain from free flow of the Ganga. It is called non-use value because the person may never use the River Ganga. This contribution of free flows to welfare of the people must be assessed.

These economic benefits of free flow have been ignored by AHEC while those from making hydropower projects have been given much importance.

9.5 Precedence of Har-ki-Pauri

AHEC has pointed out:

> Har-ki-Pauri bathing ghat at Haridwar is actually located on the Upper Ganga Canal and not on the main river. Over the years everyone, including the Sadhu Samaj, have accepted the changed river course and diversion. The water at Har-ki-Pauri is considered as sacred as that of the main Ganga River.

On this basis, AHEC has concluded that water of the Ganga can be diverted into canals without loss of spiritual power and benefits. I have objections to this conclusion.

First objection is that one wrong does not justify another.

Second objection is that the Hindu Community did not willingly accept the Upper Ganga Canal. An agreement was reached with a foreign ruler under duress. This colonial agreement cannot be foisted upon a free India.

Third objection is that the precedence of Loharinagpala points in the direction of negative impact of hydropower. Instead of invoking this contemporary precedent, AHEC has invoked a precedent made under foreign rulers.

Fourth objection is that the need was to assess the impact of diversion into canal upon the spiritual powers and benefits of the Ganga. In this regard I wrote a newspaper article during Kumbh of 2010. Extracts are produced below:

> This power of the Ganga to organize the unconscious arises from the penance undertaken by the Rishis on the banks of that river in the hills of Uttarakhand. The atoms of the mountains get organized and develop a psychic charge due to the penance undertaken there… Researchers at University of Arizona have found that cells have the capacity to carry memory. The memory of the penance is carried by the water off the Ganga as it flows rubbing against the psychically charged mountains. The inner self of the pilgrim gets similarly organized when the pilgrim takes bath in the Ganga. The Ganga acts as a channel to connect the inner self of the pilgrim with the penance of the Rishis. The water of the Ganga imbibes the disturbances from the pilgrims' inner self. The water becomes 'disturbed' while the pilgrim becomes peaceful. This disturbance of the water is removed when Rishis take bath in the Ganga.
>
> The Kumbh takes place at Har-ki-Pauri at Haridwar. A barrage has been made upstream to divert water of the Ganga into a canal that runs through Har-ki-Pauri. The water continues flowing through the canal after Har-ki-Pauri. The psychic disturbance imbibed by the water is never removed because Rishis do not take bath in the canal that flows down from Har-ki-Pauri. The psychic give-and-take is converted into 'give only'.
>
> We must make an assessment of all development projects at both conscious- and unconscious levels. Otherwise we will impose a huge harm on ourselves. We will organize the Kumbh in the canal of Haridwar in order to increase agricultural production. We can use the power of the same technology to lift water of the Ganga through pumps and maintain the free flow of the river and conserve its psychic qualities. We are imposing huge inner pain on the people of Kanpur, Allahabad, Varanasi, Patna and Kolkata by building dams, embankments and barrages on the Ganga. Such misuse of technology must be stopped. The Kumbh must be celebrated on free-flowing Ganga, not the canal at Har-ki-Pauri.

Fifth, the diversion of river water in canal at Haridwar is qualitatively different that diverting the river into tunnels or reservoirs. The water has continuous contact with earth, sun and air in a canal. The water continues to flow in the canal and does not ferment as in a reservoir.

In the result, AHEC has invoked a wrong precedence to justify that diversion of Ganga into tunnels does not affect its spiritual powers.

10 Hydropower and Stakeholders

AHEC has relied on a column published in Dainik Jagaran to assess the views of the people (Page 10-2). The fact is that this column was stopped by Dainik Jagaran after two articles against hydropower were published.

At least one key informant has been misquoted. AHEC writes:

> Shri (Chandi Prasad) Bhatt was of the opinion that while developing hydropower projects it should be ensured that the quality of life of the people living in the area is enhanced and the positive effects of the hydropower projects outweigh the negative impacts (if any). (Page 10-6).

I have spoken to Shri Bhatt (Phone No 94107-70421). He says he has not said anything like above. What is said was as follows:

> If the benefits of the projects were 60% and losses were 40% then they could be considered. In the present mode neither people will survive not the dams. If Government yet insists on making the dams then it will have to bear the consequences. I have clearly written in my book that was given to AHEC that I am opposed to these dams.

It is clear that AHEC has misquotes Shri Bhatt.

Moreover, it is well established that people should not only be given a choice, but it should be informed choice. Economist Amartya Sen explains that if one would ask a bonded labour about the Zamindar, he would probably sing praises. But this is false consciousness not based o informed choice. Therefore, AHEC should have made an informed survey regarding impacts of hydropower.

AHEC notes that certain suggestions were received from 40 scientists including this writer (Page 10-6 to 10-8). However, no response is given nor rebuttal is made.

11 Cumulative Impact Analysis

11.6.1 Concept

AHEC defines cumulative impact as follows:

> The impact of… a project… may become significant when evaluated in the context of the combined effect of all the past, present, and reasonably foreseeable future activities that may have or have had an impact on the resource in question.

Focus in this definition is on sustainability or temporal impacts. The past, present and future impacts of an individual project are here defined as ‘cumulative impact.’ This is contra the mandate. The TOR states:

> Environment impact assessment of isolated projects, on a case to case basis, may not present the true picture of the cumulative impact of all the projects that are proposed/under implementation in due course.

AHEC has turned 'cumulative impact study' into a 'sustainable impact study'.

11.8 Components Studied for Assessment of Impact of Hydropower Projects

AHEC has given tables showing Cumulative Impacts (Tables 11.1 and 11.2). AHEC has marked the impacts in terms of 'C-Cumulative Impact' and 'L-Localized Impact.' It is not clear whether AHEC has here examined the 'cumulative impact' in terms of temporal impacts (as defined above) or spatial impacts (as intended in TOR). No explanations are given for ascribing a particular value to the impact in question.

I give below critique of the values ascribed by AHEC.

Table: Critique of Cumulative Impact Values ascribed by AHEC

Sl No	Feature	Maximum Impact as per AHEC	Critique from spatial cumulative impact angle
5	Seismicity	Nil	Reservoir Induced Seismicity cannot be assessed by local measurements. The cumulative load of many hydropower reservoirs; as well as cumulative impact of destabilization of mountains due to tunneling can add to impact of individual project.
6	Landslides	Local-High	Cumulative impact of destabilization of mountains due to tunneling can add to impact of individual project.
7	Sedimentation	Cumulative-High	OK. This is not remediable.

8	Fish (and aquatic life)	Cumulative-High (Remediable)	OK. But this is not remediable because of ineffectiveness of fish passages. Also aquatic life is much more than fish. Many aquatic lives require fast flowing waters. They will be made extinct. Individual impact may be remediable as aquatic life may migrate to remaining free stretches. Cumulative impact may not be remediable because both upstream and downstream areas may be rendered inhabitable. Fish require particular slope, velocity, etc. for spawning etc. This may not be available if barriers are made both upstream and downstream.
12	Springs and Drinking Water	Negligible	Aquifers can spread across projects. Bleeding of aquifer can impact downstream and upstream areas.
13	Irrigation	Negligible	-
14	Cultural and Religious Places	Negligible	People take the dead bodies downstream to cremate them near flowing waters. Cascade of projects means they will have to go longer distances. There is depletion premium of free-flowing waters. The pressure on the fewer remaining stretches of free-flowing rivers will increase cumulatively. Pilgrims may be willing to bear few small stretches of dry Ganga but they may be negatively impacted by entire, or 70%, stretch of the river being made dry.
15	Tourism	Local-Positive	Impact is both positive- and negative. Negative impact is on river rafting and aesthetic value. This negative cumulative impact will multiply as fewer stretches remain for these activities.
16	Socioeconomic Environment	Positive	Positive impact takes place on contractors and employees. Negative impact takes place on affected villages. This is leading to outmigration from the area. Negative impact has been ignored. The cumulative negative impact is larger because migration of one family affects others in the vicinity.
17	Construction Activities	Local-Medium	-

18	Submergence	Local-Low	-
19	Water Quality	Negligible	Impact is highly negative as explained earlier. The cumulative impact is greater because deterioration of a parameter in one project increases as the depleted water enters another project.
20	Protected/Forest Area	Local-High	Cumulative impact is negative. Forests require mutual support. A lone patch of forest is less likely to survive than the same patch surrounded by other forests.

Additionally, AHEC has ignored and remained silent on the following cumulative impacts:

GHG emissions: Methane laden waters discharged from one reservoir are likely to generate more GHG gasses in downstream reservoir.

Malaria and Health: Mosquitoes breed in hydropower reservoirs. Resistant strains of malaria are developing. This will become cumulatively bad as mosquitoes in different reservoirs will develop synergy.

Biodiversity: Flora and fauna species can migrate to upstream or downstream unaffected areas in individual projects. They will not have any area to migrate in a cascade of dams and cumulative impacts will be greater.

Sand: Local people may get sand from upstream- or downstream areas of an individual project. They will be wholly deprived in a cascade of projects.

It is clear that AHEC has not even recognized various environmental impacts. It has, moreover, not assessed the cumulative impacts. It has treated the few cumulative impacts as remediable when actually they are not so.

11.10.10 Impact on Places of Cultural and Religious Importance

Tables 11.1 and 11.2 state the impact of all the projects on Cultural and Religious Component of Ecosystem is *consistently* negligible. AHEC has not found even a small negative or positive impact in any project.

The Srinagar project is leading to the upliftment of Dhari Devi Temple.

HEPs on the Alaknanda are slated to either submerge or change the flow in all the five Prayags.

None of these are considered negative impacts by AHEC.

12 Conclusions and Recommendations

In this section only those points are mentioned that have not been already discussed above.

12.2.3 Conversion of river into reservoir

AHEC says that "we do not have any study of changes in aquatic life from river to reservoir. Thus at present it is not possible to give any firm assessment on the impact of HP on biodiversity of Alaknanda and Bhagirathi basins" (Page 12-3).

I typed "aquatic conversion river into reservoir" in Google and found a large number of studies on the topic. AHEC has deliberately not done a literature review so that the adverse impacts can be camouflaged.

Elsewhere, AHEC has noted that aquatic life needs specific volumes and velocity of flows to survive. These will necessarily be altered on conversion of river into reservoir and impact aquatic life.

12.3 View of Stakeholders

AHEC rightly notes that people want growth. But AHEC fails to establish that HEPs will lead to sustainable growth. No cost-benefit analysis of HEP is done. I had provided copy of my book *Economics of Hydropower* to AHEC. I have assessed that costs of Kotlibhel 1B project are Rs 931 crores per year while benefits are only Rs 155.5 crores per year.

Actually hydropower is an instrument for transferring resources from poor to rich. I have tried to distribute the above benefits and costs by stakeholders. It transpires that the only beneficiaries are Employees of NHPC and GOUK; and contractors of NHPC. Local people, other than contractors and employees, are negatively affected. HEPs are splitting the society into two sections—the beneficiary contractors and employees; and the affected people. AHEC's 'key informants' appear to be mostly from the employees and contractors of HEPs hence the conclusion that people are in favour of HEPs.

Table: Distribution of Costs and Benefits of KB1B by stakeholders (Rs crore/year)

Sl No	Item	Total	Ratio of Distribution	Employees of NHPC and GOUK; and contractors of NHPC	Affected People	People of Uttarakhand	People of India
1	Benefits from generation of power	(+) 103.8	0-01-11-88	-	(+) 1.0	(+) 11.4	(+) 91.4
2	12% Free power to State	(+) 50.2	48-01-51-0	(+) 24.1	(+) 0.5	(+) 25.6	-
3	Employment	(+) 1.5	0-33-34-33	-	(+) 0.5	(+) 0.5	(+) 0.5
4	Sediment	(-) 98.0	0-0-0-100	-	-	-	(-) 98.0
5	Quality of water	(-) 350.0	0-1-10-89	-	(-) 3.5	(-) 35.0	(-) 311.5
6	Methane emissions	(-) 62.8	0-0-1-99	-	-	(-) 0.6	(-) 62.2
7	Forests	(-) 61.1	0-25-50-25	-	(-) 15.3	(-) 30.5	(-) 15.3
8	Earthquakes	(-) 8.4	0-75-25-0	-	(-) 6.3	(-) 2.1	-
9	Landslides	(-) 2.9	0-100-0-0	-	(-) 2.9	-	-
10	Malaria and health	(-) 6.4	0-50-25-25	-	(-) 3.2	(-) 1.6	(-) 1.6
11	Biodiversity	(-) 11.7	0-1-1-98	-	(-) 0.1	(-) 0.1	(-) 11.5
12	Otters	(-) 20.0	0-1-1-98	-	(-) 0.2	(-) 0.2	(-) 19.6
13	Road accidents	(-) 7.1	0-25-50-25	-	(-) 1.8	(-) 3.5	(-) 1.8
14	Decline in temperatures	(-) 7.0	0-75-25-0	-	(-) 5.2	(-) 1.8	-
15	Sand	(-) 18.2	0-75-25-0	-	(-) 13.6	(-) 4.6	-
16	River Rafting	(-) 8.0	0-50-25-25	-	(-) 4.0	(-) 2.0	(-) 2.0
17	Bridges	(-) 4.9	0-75-25-0	-	(-) 3.7	(-) 1.2	-
18	Aesthetic value of free-flowing water	(-) 60.5	0-1-1-98	-	(-) 0.6	(-) 0.6	(-) 59.3

19	Immersion of ashes	(-) 5.4	0-25-75-0	-	(-) 1.3	(-) 4.1	-
20	Relocation of temples	(-) 4.2	0-25-75-0	-	(-) 1.0	(-) 3.2	-
21	Loss of fishing	(-) 2.5	0-75-25-0	-	(-) 1.9	(-) 0.6	-
22	Memo: Total of costs	(-) 583.6	-	(+) 24.1	(-) 62.6	(-) 54.2	(-) 490.9
23	Cascade effect	(-) 192.7	In ratio as at line 22	-	(-) 19.8	(-) 17.2	(-) 155.7
24	Costs and benefits of KB1B	(-) 776.3	-	(+) 24.1	(-) 82.4	(-) 71.4	(-) 646.6
25	Memo: Benefits to employees of NHPC in generation of electricity	(+) 121.6	100-0-0-0	(+) 121.6	-	-	-
26	Memo: Compensation for land	(+) 1.3	0-100-0-0	-	(+) 1.3	-	-
27	Final Costs and benefits of KB1B	(-) 653.4	-	(+) 145.7	(-) 81.1	(-) 71.4	(-) 646.6

AHEC could have undertaken such a stakeholder-wise analysis.

12.4 Glaciers

AHEC says “Glaciers are much higher altitudes, upstream and distant to be affected by hydropower projects.” Himanshu Thakkar points out that this statement is unfounded. I would add that diversion of river into tunnels may reduce evaporation and impact glaciers.

12.6.2.7 Height of dams

AHEC recommends “that reservoir based hydro projects of more than 20 m high, especially close to Main Central Thrust Zone, may be avoided and if constructed; these should be monitored for geo tectonic activity.”

There is nothing in the report that correlates tectonic activity with height of dam. The persistent position of AHEC is that there is no danger of RIS; and there is no observed increase in tectonic activity due to HEPs. In that case, the recommendation of avoiding projects of more than 20 m height is unwarranted.

On the other hand, if we assume that this recommendation implies a certain seismic danger to the projects, then how 'monitoring of geo tectonic activity' will remove that danger is not spelled out.

Further, AHEC does not recommend closure of the three Kotlibhel projects—each of which have height of about 60-70 meters—in direct violation of its own recommendation.

12.6.4.13 Flood flows

AHEC says that "recommended variability in environmental flows should be maintained." But the recommendations made by AHEC do not take into account flood flows. Building Block Method has not been used. Certain variation in flows is recommended without disclosing how these have been calculated

12.6.4.16 Gap between HEPs

AHEC says "Gap between two consecutive projects along a stream should be sufficient for the river to recuperate itself" (Para 12.6.4.16). However, AHEC does not disclose any method of assessing the length of river to be left to recuperate.

Further, AHEC recommends that "hydropower at identified sites can be harnessed" (Page 12-6). These sites include Kotlibhel 1A, Kotlibhel 1B, Kotlibhel 2 and Vishnugad-Pipalkoti. There is no gap between Kotlibhel 1A and Kotlibhel 2; between Kotlibhel 1B and Kotlibhel 2; between Srinagar and Kotlibhel 1B; and between Vishnu Prayag and Vishnugad-Pipalkoti. These two observations, therefore, are mutually contradictory.

I give below a table on water quality (for January 2007) based on study done by Dr Pradeep Kumar of IIT Roorkee for THDC. It is seen that 15 out of 19 parameters do not regain earlier levels even after about 60 km of free flow from Tehri to Dev Prayag. Therefore, a clear cut recommendation is required of the term 'recuperation' and length of river to be left free.

Table: Water quality regeneration as per IITR study of Tehri Dam

Sl No	Parameter	Before Reservoir--Chilyanisaur	After crossing Tehri Dam	50 km Downstream of Dam at Dev Prayag	Impact
1	Fe (mg/l)	0.01	0.041	0.063	change not compensated
2	TDS (mg/l)	118	78	76	change not compensated

3	Conductitivity (Mu/cm)	199	125	117	change not compensated
4	pH	7.95	7.63	7.62	change not compensated
5	Total Hardness CaCo3 (mg/l)	90	60	64	change not compensated
6	Ca (mg/l)	24	15.2	16	change not compensated
7	Mg (mg/l)	7.2	5.3	2.4	change not compensated
8	Total Alkalinity CaCO3 (mg/l)	64	45	50	change not compensated
9	Cl (mg/l)	1.2	1	1	change not compensated
10	SO4 (mg/l)	35.9	21.1	19.6	change not compensated
11	Sodium (mg/l)	10	2.1	2.6	change not compensated
12	Potassium (mg/l)	3	2.3	2.2	change not compensated
13	PO4 (mg/l)	0.031	0.036	0.048	change not compensated
14	Silica (mg/l)	8.3	6.2	5.8	change not compensated
15	DO (mg/l)	9.34	8.24	9.25	change not compensated
16	Turbidity	3.91	1.72	4.17	regains earlier characteristic
17	ORP (mV)	92.5	99.8	80.1	regains earlier characteristic
18	NO3 (mg/l)	0.3	0.37	0.26	regains earlier characteristic
19	UV (m-1)	2.7	2	3.5	regains earlier characteristic

The EAC has rightly noted:

> The conclusion that 30% of the river stretch is available as free flow does not seem to be correct. The Committee had… found that there is hardly any free river stretch available between the upper most and lower most projects. The report should clearly indicate the free river stretch available between the various projects.

AHEC should have recommended removal of certain dams to enable this recommendation to be implemented.

12.6.5.18 Percentage of River Length Affected

AHEC says more than 70% of the river length may not be allotted for HEPs. Wherefrom the figure of 70% has been taken is not disclosed. It seems to me that this figure is taken from the length of Bhagirathi already affected. AHEC gives the following figures for affected length of rivers (Table 8.9):

Bhagirathi 70.71%

Alaknanda 48.00%

Perhaps, the figure of 70% of the river to be harnessed has suggested been suggested so that none of the existing or proposed projects are affected.

Even this does not meet AHEC's own prescriptions because there is no gap in the projects on Bhagirathi from Maneri-Bhali 1 to Koteshwar. AHEC should have applied its mind to the restoration of Ganga in this stretch by removal of certain projects.

12.6.24 Biodiversity

The TOR stated: "The safe limits of… biodiversity should be determined on the standard methodologies" (Para 4.8).

AHEC has not determined such safe limits. It has reduced the issue to mere monitoring and making of an 'adaptive management plan.' How mere monitoring will help restore biodiversity is no clear. Whether an adaptive management plan is feasible at all is unclear. Literature indicates that the best way to preserve biodiversity is *in situ.*

WII, Dehradun Report

1 Positive statements

WII reports makes following positive statements:

3. Environmental Flow Requirements should be based on Mean Seasonal Flow, not Mean Annual Flow (Page 43).
4. Among the Rare, Endangered and Threatened (RET) species in the area, fish are most important. The percentage RET species are given below (Page 45):

Sl	Genre	RET	Total	% RET
1	Plants	20	950	2.1
2	Mammals	6	85	7.0
3	Birds	6	530	1.1
4	Fish	23	57	40.3

Implication is that impact on fishes should be the main consideration while examining the dams.

2 Cumulative Impact Assessment

WII Methodology

WII states that the ecological impact of a single project may be acceptable but combined effect of numerous single developments may be additive and thus cumulatively significant (Page 4). Again:

> The total cumulative effects for any combination of projects are the sum of project-specific effects adjusted for interactions among projects and their effects (Page 39).

It follows that WII is expected to (1) list the project-specific impacts; (2) study interactions among projects; (3) Add the two to arrive at cumulative impacts.

WII recognizes in the text of the report that migration of fish is effected by dams. However, the interactions or cumulative impacts are not given much importance. WII gives the following interactions:

6 Dams prevent brood-stock from reaching their spawning grounds (Page 6).

7 Dams change sediment transport. This alters habitat for fish through changes in turbidity as well as directly (Page 6).

8 Deterioration of water quality in reservoirs or in downstream stretches kills fish (Page 7).

9 Fishes are attracted towards flow for getting more oxygen (Page 72).

10 Flowing water carries drift materials which serves as food for many fishes (Page 72).

It appears, however, that these impacts have not been given due importance in arriving at the conclusions.

The key table for arriving at conclusions is Table 6.8, which is reproduced below.

Sl		Kotlibhel 1A	Kotlibhel 1B	Kotlibhel II	Vishnugad-Pipalkoti	Alaknanda-Badrinath	Source
1	Biodiversity value	18	18	19	8	17	Table 6.1
2	Impact sources	8	13	15	11	7	Table 6.2
3	Impact score	144	234	285	88	119	Line 1 x Line 2
4	Conservation Importance	1	1	2	1	3	No basis given in report
5	Cumulative score	144	234	570	88	357	Line 3 x Line 4

Line 1 of Table 6.8 above is taken from Table 6.1. The factors considered are:

9 RET Species

10 Endemic Species

11 Species in WPA

12 Habitat Specialists

13 Habitat Diversity

14 Species Richness

15 Breeding/Congregational sites

16 Migratory sites

Of these, only No 8 captures cumulative impacts of preventing fish reaching their spawning grounds. Thus, this score is more on single project, and less cumulative.

Line 2 of Table 6.8 above is taken from Table 6.2. The factors considered are:

8 Volume of diverted water

9 Diverted river length

10 Reservoir area

11 Barrier influence of dam

12 Biotic interference (Labour Immigration)

13 Barrier influence due to roads (Area under approach roads)

14 Forest area diversion

Once again, only No 4 captures cumulative impacts. Further this again relates to barrier preventing fish reaching their spawning grounds.

The other cumulative impacts acknowledged by WII (listed above) are not incorporated in these matrices:

6 Change in sediment transport.

7 Deterioration of water quality.

8 More oxygen in water.

9 Carry of drift materials.

In the result, WII has ignored 4 out of 5 cumulative impacts in arriving at conclusions.

Pipalkoti and Kotlibhel 1A

Significance of this omission is in the low cumulative scores for Vishnugad-Pipalkoti and Kotlibhel 1A projects. The river flow in both these projects is already obstructed.

There is a cascade of dams above Kotlibhel 1A site—Koteshwar, Tehri, Maneri Bhali and Pala Maneri.

Flow of the river at Vishnugad-Pipalkoti is obstructed both above- and below. Above is Vishnu Prayag project. Below is Srinagar project (under construction). The coffer dam of this project was operational in the period of study. The score of 'N' or (1) that is given for 'breeding/congregational sites' for the project may be because these obstructions have prevented the fish from reaching their spawning grounds in the project area. Secondly, the waters at these two projects are already deprived of sediment, water quality, oxygen and drift materials. No wonder the scores are low.

This problem can be solved in two ways:

3 We may allow construction of these projects because the flow is already affected.

4 We may decommission the upstream- and downstream projects and restore the free flow of river at these sites.

The study given to WII was on

> Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity…

Para 2.1 of the TOR states:

> To assess the cumulative impact of existing/proposed/under construction hydropower projects…

WII was required to assess the impacts of existing projects as well. WII has not done this in the interim report relating to the 5 projects. However, it is not acceptable to ignore the impacts of existing projects on *these* five projects.

My conclusion is that the low scores for Kotlibhel 1A and Vishnugad-Pipalkoti are not because these areas are less rich in biodiversity. Instead, the low scores appear to be due to the negative impact of upstream- and downstream dams. This can be rectified by removal of the existing dams.

Conservation Importance

WII report does not give any basis for the scores given for conservation importance in Table 6.8. I presume the value of 2 given to Kotlibhel 2 is due to proximity to Dev Prayag; and the value of 3 given to Alaknanda-Badrinath is due to proximity to Badrinath.

The entire Alaknanda and Bhagirathi Rivers are of 'conservation importance'. They are the National River. Koteshwar temple is located in the Kotlibhel 1A area. Dhari Devi Temple is located on Alaknanda River in the submergence area of Srinagar project. Both rivers are on the pilgrim route to Char Dham Yatra. A scientific basis for arriving at these values of conservation importance is required.

Otter and Cheer Pheasant

WII dismisses the existence of Otter in the area: "The only aquatic mammal reported in the basin was otter but its distribution is doubtful nowadays" (Page 72). The list of mammals at Table 5.1 does not mention Otter.

I live on the banks of Alaknanda between Dev Prayag and Srinagar. I have spotted Otters on my land about once-in-three-years, most recently in July 2011. Ignoring this endangered species is not warranted.

WII recognizes that Vishnugad-Pipalkoti project will lead to extinction of the Cheer Pheasant (Page 76). This species is an "evolutionary relict (meaning that

it does not have any close relatives in the evolutionary scale)" (Page 64). It would seem, that threat to this species alone would tilt the scales against the project, but WII fails to take this to its logical conclusion.

Zone of Influence

WII has restricted the zone of influence to 500 meters from the project constructions (Page 35). This is inadequate because of the cumulative impacts of water flows mentioned above. The Zone of Influence should include upstream- as well as downstream areas.

Upstream areas are affected by migration of fishes and by lower levels of evaporation due to diversion of river into tunnel.

Downstream areas are affected by flows of sediments, drift material and changes in water quality.

3 Environment Management Class

WII has adopted the methodology suggested by Smakhtin in his study for IWMI (Page 73). The methodology suggested by Smakhtin involves three components:

4 What is the ecological sensitivity and importance of the river basin?

5 What is the current condition of aquatic ecosystems in the river basin?

6 What is the trend of change?

WII, however, has classified both the rivers in category 'C' only on the basis of Item No 2 relating to current condition. Table 6.11 gives only the present ecological status of the two rivers. This is inadequate. The IWMI methodology is designed not only to assess but also to rebuild and restore damaged ecology. Therefore, classification in EMC should include Items 1 and 3 also.

Further, WII quotes WWF favourably to the effect that EMC, and the EFR flowing from it, is determined on the basis also of 'ecological integrity of rivers' and 'goods/services provided by them' (Page 8). It was necessary to value the services to pilgrims and tourists. This has not been done.

4 Mitigation

WII says that negative impacts of the Vishnugad-Pipalkoti project "on terrestrial and aquatic biodiversity are amenable to mitigation if appropriate measures are put in place." No details of these mitigation measures and their effectiveness are provided.

Abbreviations

AHEC	Alternate Hydro Energy Centre (of IIT Roorkee)
BBM	Building Block Method
BOD	Biological Oxygen Demand
CPCB	Central Pollution Control Board
DO	Dissolved Oxygen
d/s	down stream
EAC	Expert Appraisal Committee (of MOEF)
EFR	Environmental Flow Requirement (Same as EWF)
EMC	Environment Management Class
EWF	Environmental Water Flows (Same as EFR)
HEP	Hydro Electric Project
HMD	Hydraulic Mean Depth
IWMI	International Water Management Institute (Colombo)
KB1B	Kotlibhel Stage 1B (Hydropower project)
MAF	Mean Annual Flow (Same as MAR)
MAR	Mean Annual Runoff (Same as MAF)
MOEF	Ministry of Environment and Forests
MW	Mega Watt
NEERI	National Environment Engineering Research Institute (Nagpur)
NGRBA	National Ganga River Basin Authority
NHPC	National Hydro Power Corporation
Q95	Flow above which water flows 95% of the time
RET	Rare Endangered and Threatened
RIS	Reservoir Induced Seismicity
SANDRP	South Asia Network on Dams, Rivers and People

SRIC	Sponsored Research and Industrial Consultancy
TDS	Total Dissolved Solids
THDC	Tehri Hydro Development Corporation
TOR	Terms of Reference
u/s	up stream
UJVNL	Uttarakhand Jal Vidyut Nigam Limited
WCD	World Commission on Dams
WII	Wildlife Institute of India (Dehradun)
WWF	World Wildlife Fund

Annexure 5

Comprehensive assessment of environmental and economic costs of electricity generation is necessary

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Abstract

It is agreed that we need to provide more electricity to the people in order to improve their standard of living. It is also agreed that we must use the cleanest available technologies for the generation of the same. But the 'cleanest' available technologies may still impose huge environmental costs on the people in excess of the gains and may yet lead to ill-fare. The optimum level- and mode of electricity generation should be determined by undertaking a comprehensive evaluation of Costs and Benefits.

Optimum level of electricity generation

The correct or 'efficient' price and quantity of a good in the market is determined by equilibrium of supply and demand. Production higher- or lower than this level leads to inefficiency. Many environmental costs may be borne by future generations. Carbon emissions made today may put the existence of human civilization at risk in future. It is necessary, therefore, to account for the true total costs of electricity.

The task before us is to determine the correct requirement of electricity; and then produce that much power—neither more nor less.

The demand and supply of electricity on the basis of private costs is shown at 'Commercial Equilibrium' in Fig 1 below. The private producers are willing to supply increasing quantities of power as the price increases. The consumers will consume less quantity of electricity as the price increases. Equilibrium is reached at price P_2 and quantity Q_2. This quantity of power sold at this price will eliminate all shortages in the market and lead to highest short-term growth rate.

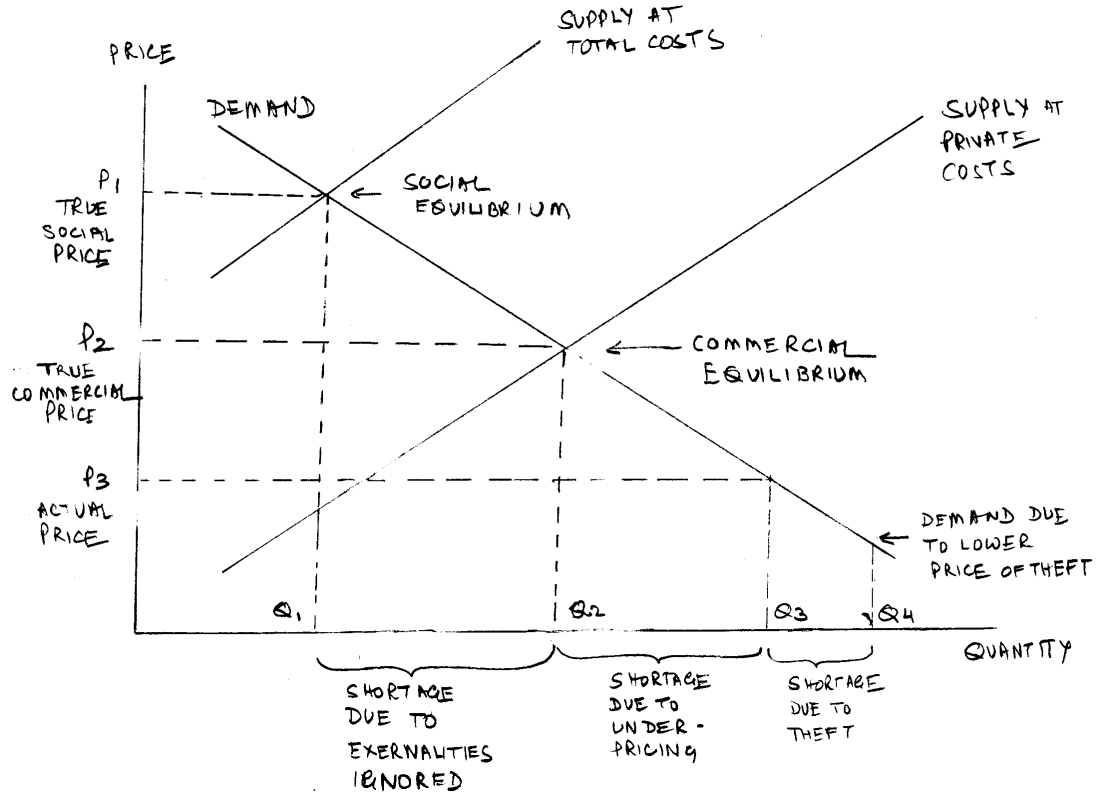

Fig 1: Equilibrium of supply and demand

The present political arrangement, however, does not allow electricity to be priced at P_2. The actual price charged from the consumer is lower, say P_3. In consequence, the demand for power is more, say Q_3. This leads to creation of shortage. The demand at this price is Q_3 but supply is only Q_2. In turn, the State Electricity Boards have to buy electricity at higher price and they incur huge losses. It will be obvious that producing electricity at the level of Q_3 is inefficient. We are using more electricity than is best for economic growth.

The situation is made worse by the pervasive theft. The price paid by the thief-user is a fraction of the already low official price of say Rs 2 per KwH. The cost to the thief-user may be only Rs 0.50 per KwH being the amount he has to pay to the lineman etc. Thus the demand of power is further increased to Q_4. Accordingly the shortage is increased.

Equilibrium of total supply and demand

The social costs of generation of power are ignored thus far. We can include these costs by drawing another supply curve by including social costs.

Each of the sources of power has some externalities or social costs. Nuclear power has problem of storage of nuclear waste, risk of accidents and dependence on uranium imports. Thermal has the problem of carbon emissions, displacement during mining of coal etc. Hydro has problems of deterioration of water quality, methane emissions, submergence of forests, loss of biodiversity, reservoir induced seismicity, increased landslides, creation of virulent strains of malaria in reservoirs and loss of aesthetic and cultural values of free-flowing waters. A new supply curve of electricity is drawn after taking these various costs into account.

The social equilibrium of supply and demand of electricity is now attained at level Q_1. Long term economic growth is attained only of we produce electricity at this level and sell to the consumer at price of P_1. The 'shortage'—or the demand in excess of the social optimum is now increased to $Q_4 – Q_1$.

CEA's approach of meeting 'shortages'

The 17th Electric Power Survey published by the Central Electricity Authority sets the aim of meeting and eliminating all shortage of power by 2012. This assumes that the demand of power as it exists today is 'true' or 'genuine' and has to be met for the purpose of economic growth. This is clearly not the case. The long term economic growth requires production of electricity to the level of Q_1 only. Production in excess of this is not efficient. Production of electricity to meet all current demand at the level Q_4 will hit at our long term economic growth.

Political compulsions may not permit pricing of electricity at P_1, however. In this situation, the correct policy would be to actually produce power only at the level of Q_1 and allocate it between the rural and urban consumers and agriculture and industry administratively. In other words, the inefficiency must be limited to allocation between different users but not allowed to extend to the long term economic growth.

Case study of Kotlibhel 1B

The hidden environmental costs of electricity generation may be huge. In this section we provide a cost-benefit analysis of electricity generation by the one hydro project, namely Kotlibhel 1B proposed to be built by National Hydro Power Corporation (NHPC) on the Alaknanda River in Uttarakhand.

Benefits 1: Electricity

The main benefit from a ROR project is generation of electricity. NHPC has shown the following in its filing before Ministry of Environment and Forests under the Forest Conservation Act:

'Increase in productivity attributable to the specific project' is shown as (+) Rs 300.6 crores per year (1268 MU energy @ 2.37 per unit)

This is actually the cost of production of energy. This is not increase in productivity as shown by NHPC.

The true benefit from the project is the difference between the cost of production of electricity by the project and the cost of production from alternative sources. If the power produced from KB1B costs Rs 2.37 per unit while the next cheapest source of power is, say, Rs 5.00 per unit, then the benefit to the society from KB1B will be Rs 2.63 per unit (5.00 – 2.37).

We assess the price of power from the next cheapest source at Rs 3.30 per unit.[6] This is marginal product is for the average of peak and non-peak power. The benefits from Kotlibhel 1B are calculated in table below, based on above value of power.

Table 1: Benefits of electricity generated from Kotlibhel 1B

Sl	Item	Amount	Basis

[6] The calculation is made on the following basis. (1) The average sale price of peak power in 2004 by NTPC Vidyut Vyapar was Rs 2.65 per unit. This is a good proxy of marginal product. This works out to Rs 2.87 per unit at 2006 prices. Against this, we have assumed Rs 3.30 per unit. (2) The sale price of base power at present is about Rs 2. The sale price of peak power is Rs 5 to Rs 6 at present. The average price realized by the project is a mix of base- and peak power. This is likely to be somewhere in the middle.

No			
1	Total sale of electric power	111.6 crore units	Detailed Project Report-Executive Summary (DPR-ES). This excludes free power to state, benefits from which are calculated separately in the next section.
2	Cost of production	Rs 2.37 per unit	DPR-ES
3	Marginal product	Rs 3.30 per unit	Author's estimate as above.
4	Social Benefit per unit	Rs 0.93 per unit	Line 3 – Line 2.
4	Social Benefit, total	Rs 103.8 crore per year	111.6 Crore units x Rs 0.93 per unit.

It must be stressed that the above calculation takes the profits of NHPC to be synonymous with social benefits. This is done because NHPC is a public sector unit. The profits belong to the nation. The calculation would be different for private players. In that case the benefits would exclude the profits.

Benefits 2: Free power to host state

NHPC is to supply 12 percent free power to the host state. The benefits to Uttarakhand from this are estimated in table below.

Table 2: Benefits of free power to the State

Sl No	Item	Value	Basis
1	Free peak power to state	15.2 crore units	Table above
2	Marginal product or total benefit	Rs 3.30 per unit	Cost is assumed as zero since this is supplied free.
3	Total benefit to state	Rs 50.2 crore per year	

Benefits 3: Employment

NHPC has stated that 1200 jobs will be created (Annexure 2, line 4) of DPR-ES. The question is how much 'benefit' does this translate into? NHPC does not

give any assessment of the money value of the benefit that could be incorporated in the CBA.

The figure of 1200 appears to be exaggerated. ROR projects do not generate direct employment in such numbers. Perhaps NHPC has included ‘indirect’ employment vide shops, taxis, truck, etc. This indirect employment should not be included in benefits because much loss of indirect employment also takes place—from submergence of agricultural- and forest land, in particular. Hence to include indirect gain of employment while ignoring indirect loss of employment is fallacious. Therefore, this writer relies on his best estimate that direct employment of 150 persons will be generated from KB1B. The benefit from this employment is given in Table below.

Table 3: Benefit from employment due to KB1B.

Sl No	Item	Amount	Basis
1	Number of direct employees	150 numbers	Author's best estimate.
2	Average wages of NHPC employees	Rs 1.33 lacs per year per employee	NHPC Balance Sheet 2005-06 gives number of employees at 13,118 at Page 6. Sales are Rs 1614 crores of which 10.84% are employee's remuneration (Page 23).
3	Opportunity cost or income lost in alternative employment by local employees	(-) Rs 36,000 per year per employees	The 'benefit' from Kotlibhel 1B would be equal to the total salary paid, less incomes obtained by the same persons in absence of Kotlibhel 1B. The Author's best estimate of this opportunity income is Rs 36,000 per year.
4	Net income added due to Kotlibhel 1B HEP	Rs 0.97 lacs per year per employee	Line 1 – Line 2
5	Benefits or the additional wages paid by KB1B to local employees	Rs 145.5 lacs per year or Rs 22.8 crore on lifetime of project.	For 150 employees.

Other costs

NHPC ignores many environmental costs. These costs are borne by the society. These have been calculated by this author (Jhunjhunwala 2009). A summary of these costs is given at Table below.

Table 4: Environmental costs on which NHPC is silent in its calculations

Sl No	Item	Total Cost
1	Sediment	98.0
2	Quality of river water	350.0
3	Methane emissions	62.8
4	Forests	61.1
5	Earthquakes	8.4
6	Landslides	2.9
7	Malaria and health	6.4
8	Biodiversity	11.7
9	Otters	20.0
10	Road accidents	7.1
11	Decline in temperatures	7.0
12	Sand	18.2
13	River Rafting	8.0
14	Bridges	4.9
15	Aesthetic value of free-flowing water	60.5
16	Immersion of ashes	5.4
17	Relocation of temples	4.2
18	Loss of fishing	2.5
19	Cascade effect	192.7
20	Total cost of KB1B	931.8

This writer recognizes that many of these estimates may be challenged and alternatives suggested. This writer welcomes such intervention. The point is that all these costs are wholly ignored in the CBA filed by NHPC.

Cost Benefit Analysis

A perusal of above tables gives us a CBA.

Table 5: Cost-Benefit Analysis of KB1B

Sl No	Item	Benefit	Cost
1	Benefits from generation of power	103.8	
2	12% Free power to State	50.2	
3	Employment	1.5	
4	Costs as at Table 4 above		931.8
	Total benefit and cost of Kotlibhel 1B HEP	155.5	931.8
	Net loss		776.3

Political economy of hydropower

The puzzle before us is this: Why are such projects made when costs are larger than benefits. This mystery is unraveled when we examine the distribution of benefits and costs between different stakeholders.

The share of salaries and wages in the total turnover of NHPC are much higher than private hydropower companies. This is clear from comparison of Balance Sheet of NHPC and Jaiprakash Hydropower.

Table 6: Share of salaries and wages in cost of power, 2006-07

Sl No	Item	Jaiprakash Hydropower (Rediff 2007)	NHPC (2007)
1	Total sales	Rs 335.8 crore	Rs 1882.9 crore
2	Salaries and wages (amount)	Rs 5.9 crore	Rs 236.0 crore
3	Salaries and wages (percent)	1.8%	12.5%

Salaries and wages constitute 12.5 percent of NHPC's turnover against 1.8 percent for Jaiprakash Hydropower. NHPC has contented that the figures for a small company like Jaiprakash Hydropower are not comparable to those of a

large company like NHPC hence higher share of salaries and wages is justified. Indeed this much is true that the figures are not exactly comparable. But the relationship is exactly opposite of the claim by NHPC. The share of employee cost should *reduce* in a large company because it gains from economies of scale. Thus the share should be lower, rather than higher.

On pro-rata basis, a sale of Rs 973.1 crores projected from Kotlibhel 1B will provide for salaries of Rs 121.6 crores for the employees of NHPC (NHPC 2005:1.6).[7]

The share of employees of Government of Uttarakhand in the free power to be supplied by NHPC from Kotlibhel 1B is now assessed. The Author has been able to access three studies which give figures of share of state income appropriated by the employees.

Table 7: Share of salaries in State Government Expenditures

Sl No	State (Year)	Salary	Pension	Study Link
1	Kerala (2004-05)	31%	15%	Kerala Public Expenditure Review Committee, First Report, May 2006 (Kerala 2006)
2	Tamil Nadu (2000-01)	39%	13%	White Paper On Tamil Nadu Government's Finances (TN 2007)
3	All India (1999-2001)	32.1%	NA	MOF (2003)
	Average	34.0%	14%	

Based on these studies we may assume that 48% of the revenues of the Government of Uttarakhand will be spent towards Salaries and Pensions of the government employees. Thus, out of the Rs 50.2 crore received by Government of Uttarakhand, the State Government employees may get an additional Rs 24.1 crores and the people may get Rs 26.1 crores.

Local people get huge compensation for the land. This cost is built into the cost of production of power. The additional benefit to local people is assumed to be

[7] This figure should not be confused with the benefits from additional employment generated in Kotlibhel 1B, which take into account only employees at the field level.

equal to the R&R package of Rs 13.2 crores made by NHPC. This is one-time cost hence the annualized benefit is taken at 10% of Rs 1.3 crores per year. Now we can assess the distribution of benefits and costs from Kotlibhel 1B.

Table 8: Distribution of Benefits (-) and Costs (+) (Rupees crore per year)

Chapter No	Item	Total	Employees of NHPC and Government of Uttarakhand	People of India
1	Benefits from generation of power	(+) 103.8	-	(+) 103.8
2	12% Free power to State	(+) 50.2	(+) 24.1	(+) 26.1
3	Employment	(+) 1.5	-	(+) 1.5
4	Costs	(-) 931.8	-	(-) 931.8
	Total	(-) 776.3	(+) 24.1	(-) 800.4
5	Memo: Benefits to employees of NHPC in generation of electricity	-	(+) 121.6	-
6	Memo: Compensation for land	-		(+) 1.3
7	Total, including memo items		(+) 145.7	(-) 799.1

The above chart gives us an indication of the gainers and losers.

Gainers: NHPC and State Government Employees to the tune of Rs 145.7 crores.

Losers: People of the country to the tune of Rs 799.1 crores.

Kotlibhel 1B HEP is a loss proposition for the nation. Yet it is being implemented because it imposes hidden costs on the people and provides direct benefits to employees of NHPC and government of Uttarakhand.

Benefits to the people of Uttarakhand

A possibility is that KB1B is beneficial for the people of Uttarakhand even if it is harmful for the people of India. The objective of GOUK is to secure benefit

of people of Uttarakhand hence it would be justified in pushing the project even if harmful for the country.

In order to assess this, it is instructive to break-up the benefits and costs by stakeholders—(1) Employees of NHPC and GOUK, (2) affected people, (3) people of Uttarakhand and (4) people of India. This is done in Table below by distributing the costs and benefits shown in Table 8 between the four stakeholders as per best estimates of the author. The reader is welcome to make his own assessment of the distribution and the same would be accepted by this author with respect. The main point is of methodology. It is imperative that we look at the distribution of costs and benefits over different stakeholders.

Table 9: Distribution of Costs and Benefits of KB1B by stakeholders (Rs crore/year)

Sl No	Item	Total	Ratio of Distribution	Employees of NHPC and GOUK	Affected People	People of Uttarakhand	People of India
1	Benefits from generation of power	(+) 103.8	0-01-11-88	-	(+) 1.0	(+) 11.4	(+) 91.4
2	12% Free power to State	(+) 50.2	48-01-51-0	(+) 24.1	(+) 0.5	(+) 25.6	-
3	Employment	(+) 1.5	0-33-34-33	-	(+) 0.5	(+) 0.5	(+) 0.5
4	Sediment	(-) 98.0	0-0-0-100	-	-	-	(-) 98.0
5	Quality of water	(-) 350.0	0-1-10-89	-	(-) 3.5	(-) 35.0	(-) 311.5
6	Methane emissions	(-) 62.8	0-0-1-99	-	-	(-) 0.6	(-) 62.2
7	Forests	(-) 61.1	0-25-50-25	-	(-) 15.3	(-) 30.5	(-) 15.3
8	Earthquakes	(-) 8.4	0-75-25-0	-	(-) 6.3	(-) 2.1	-
9	Landslides	(-) 2.9	0-100-0-0	-	(-) 2.9	-	-
10	Malaria and health	(-) 6.4	0-50-25-25	-	(-) 3.2	(-) 1.6	(-) 1.6
11	Biodiversity	(-) 11.7	0-1-1-98	-	(-) 0.1	(-) 0.1	(-) 11.5
12	Otters	(-) 20.0	0-1-1-98	-	(-) 0.2	(-) 0.2	(-) 19.6
13	Road accidents	(-) 7.1	0-25-50-25	-	(-) 1.8	(-) 3.5	(-) 1.8
14	Decline in temperatures	(-) 7.0	0-75-25-0	-	(-) 5.2	(-) 1.8	-
15	Sand	(-) 18.2	0-75-25-0	-	(-) 13.6	(-) 4.6	-
16	River Rafting	(-) 8.0	0-50-25-25	-	(-) 4.0	(-) 2.0	(-) 2.0

17	Bridges	(-) 4.9	0-75-25-0	-	(-) 3.7	(-) 1.2	-
18	Aesthetic value of free-flowing water	(-) 60.5	0-1-1-98	-	(-) 0.6	(-) 0.6	(-) 59.3
19	Immersion of ashes	(-) 5.4	0-25-75-0	-	(-) 1.3	(-) 4.1	-
20	Relocation of temples	(-) 4.2	0-25-75-0	-	(-) 1.0	(-) 3.2	-
21	Loss of fishing	(-) 2.5	0-75-25-0	-	(-) 1.9	(-) 0.6	-
22	Memo: Total of costs	(-) 583.6	-	(+) 24.1	(-) 62.6	(-) 54.2	(-) 490.9
23	Cascade effect	(-) 192.7	In ratio as at line 22	-	(-) 19.8	(-) 17.2	(-) 155.7
24	Costs and benefits of KB1B	(-) 776.3	-	(+) 24.1	(-) 82.4	(-) 71.4	(-) 646.6
25	Memo: Benefits to employees of NHPC in generation of electricity	(+) 121.6	100-0-0-0	(+) 121.6	-	-	-
26	Memo: Compensation for land	(+) 1.3	0-100-0-0	-	(+) 1.3	-	-
27	Final Costs and benefits of KB1B	(-) 653.4	-	(+) 145.7	(-) 81.1	(-) 71.4	(-) 646.6

The break-up of costs and benefits is as follows:

Gainers: NHPC and State Government Employees to the tune of Rs 145.7 crores.

Losers 1: Affected people to the tune of Rs 81.1 crores.

Losers 2: People of Uttarakhand to the tune of Rs 71.4 crores.

Losers 3: People of India to the tune of Rs 646.6 crores.

This writer welcomes alternative analysis of costs, benefits and their distribution and the same being put to public scrutiny. But it is unacceptable not to undertake such stakeholder analysis.

The Kotlibhel 1B project is not justified on overall- or local economic considerations. It is being pushed to provide benefits to the rich by presenting presumed false gains to the people from generation of more electricity.

The cycle of long-term destruction

The present policy of generating more electricity for meeting existing shortages involves a regressive cycle of long term economic destruction. The steps are as follows:

1. Present demand is taken as final demand. The under-pricing of power that is leading to the generation of this huge demand is ignored. The long-term economic costs via externalities and destruction of environment are ignored.
2. Production of electricity is sought to be increased to meet this demand.
3. Yet more long-term economic costs are imposed on the society in the increased production of electricity.

In this way ignoring social costs becomes a gateway to the imposition of yet more long-term social costs leading to a regressive cycle.

Our objective is to supply electricity to the people—especially the poor—in order to raise their standard of living. The answer to this is to produce electricity equal to Q_1 and provide to consumer at price P_1. Impose taxes on generation equal to the environmental costs. The demand will become less and long-term economic development will also be secured.

The second-level solution is to produce electricity equal to Q_1 so that long term economic development is secured. Then administratively allocate the power between competing users as best as possible. This will lead to sub-optimal economic growth but still ensure long term economic sustainability.

Impact on the poor

Counterargument is that the policy of pricing power at price P_1 will impose huge burden on the poor who do not have the capacity to pay.

The solution is to enhance the capacity of the poor to pay higher price of power by putting in place economic policies that generate employment and that increase price of agricultural produce suitably.

The impediment in implementing this scheme is the middle class which will have to pay higher price of electricity, higher wages to the maid and higher prices of food.

Thermal-Hydro-Nuclear Mix

We can extend this framework to determine the most suitable mix of thermal, hydro and nuclear which are the main sources of electricity at present. The Developed Countries are putting huge pressure on India to reduce production of thermal power and increase that of nuclear and hydro. The political economy of this pressure is made clear if we examine the different impact of these sources of energy on India and the Developed Countries. This has been done in table below. The impacts are reckoned on a scale of ±5. The assessments are made subjectively by the author. The purpose is to make the methodology clear. More thoroughly researched numbers can be placed by the learned reader.

Source	India	Developed Countries
Thermal	Carbon emissions (-) 1 (Only a small part of the cost is borne by India) Local Environment Costs (-) 1 (Mined land can be reclaimed and reforested) Import Dependence (+) 2 (India has relatively large reserves of coal) Total (+) 1	Carbon emissions (-) 3 (Large part of the cost is borne by rest of the world) Local Environment Costs (0) Import Dependence (0) Total (-) 3
Hydro	Local Environment Costs (-)5 Import Dependence (+) 2 Total (-) 3	Local Environment Costs (0) Import Dependence (0) Total (0)
Nuclear	Radiation (-) 1 (A part of the cost is borne by India) Local Environment Costs (-)1 (Costs due to radiation threat and impact on water resources) Import Dependence (-) 3	Radiation (-) 1 (A part of the cost is borne by rest of the world) Local Environment Costs (-) 1 (Environmental costs of mining uranium fuel) Import Dependence (+) 3

	Total (-) 4	Total (+) 1
Result	Thermal	Nuclear (and hydro)

The figures in the above table are indicative. A more thorough assessment of these costs must be made comprehensively before arriving at a recommendation. A similar analysis can be done for impact on rich and poor.

Conclusions

Optimum level of generation

Mainstream view: On a per capita basis, power generation capacity of a country should be matched with other that of countries. There is a need to increase generation capacity to average regional- or global levels.

Suggestion: This logic is flawed because on the average other countries are under-pricing and creating an artificial demand for power. The correct method is to examine the true costs of power to the country and determine the optimal level of generation. The cost of generation is different in various countries hence the optimal level will also be different.

Mainstream view: Developing countries need more energy and cleaner energy to overcome poverty and to set them on strong and sustainable growth paths.

Suggestion: The optimum level of energy should be determined by an assessment of marginal costs and marginal benefits. Cheap energy is pricing out many labour-intensive industries like handloom weaving and is poverty-generating.

Greenhouse Gas Emissions

Mainstream view: Generation of energy with low lifecycle greenhouse gas emissions is necessary to meet future energy needs in a sustainable manner.

Suggestion: The need to factor in GHG emissions is accepted. But this puts a lopsided focus on GHG emissions. India is aiming to increase generation of hydropower to reduce GHG emissions from thermal plants. In the process much larger local environmental costs are being incurred by the country. The correct

approach is to minimize total environmental costs, including those due to GHG emissions.

Secondly, there is a need to undertake authoritative and reliable study of methane emissions by hydro plants. Some calculations show these may be more than those by thermal plants.

Mainstream view: Developing countries should shift to a more environmentally sustainable energy development path.

Suggestion: Environmentally sustainable energy development by the developing countries will entail a higher cost of production. The beneficiaries of this development will be the whole world, including the developed countries. There is a need to undertake cost-benefit analysis of use of clean technologies by Developing Countries disaggregated by impacts on Developed- and Developing countries. It is possible that developing countries stand to loose by adopting clean technologies at higher cost; while developed countries stand to gain by low GHG emissions from the same clean technologies. Such trade-offs should be explicitly spelled out for the policy makers to be able to make an informed decision.

Mainstream view: The developing countries should join in the global effort to reduce GHG emissions by recognizing a trade-off between meeting the local energy needs of individual countries and reducing global greenhouse gas emissions.

Suggestion: A disaggregated cost-benefit analysis of *total* environmental costs should be undertaken. Every country should then be persuaded to move to its local optimum. The global optimum should build on local optimums.

Reaching electricity to the poor

Mainstream view: It is necessary to increase generation for reaching electricity to the poor.

Suggestion: The requirements of the poor can be met by diverting a small 2% of the electricity supplied to the rich. This genuine need is used as a camouflage to generate more electricity for the rich. The steps are as follows: (1) Supply available electricity to the rich and keep the poor deprived; (2) Create a political consensus for yet more generation; (3) Supply this increased generation to the rich and keep the poor deprived so that consensus can be built for yet more

generation which is again supplied to the rich. Instead we must work out priorities in allocation of currently available electricity to the poor.

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Annexure 6

1

ITEM NO.1 COURT NO.9 SECTION X

S U P R E M E C O U R T O F I N D I A
RECORD OF PROCEEDINGS

Petition(s) for Special Leave to Appeal (Civil) No(s).22894/2005

(From the judgement and order dated 29/10/2005 in Misc.
Application No. 7124 of 2004 in PIL No.1287/2003 of The HIGH
COURT OF UTTARAKHAND AT NAINITAL)

N.D.JAYAL & ANR. Petitioner(s)

VERSUS

UNION OF INIDA & ORS. Respondent(s)

(With appln(s) for directions, exemption from filing O.T. and with prayer for interim relief and office report)
[FOR FINAL DISPOSAL]

WITH SLP(C) NO. 22895 of 2005
(With appln(s) for directions, with prayer for interim relief and office report)
[FOR FINAL DISPOSAL]
SLP(C) NO. 26034 of 2005
(With appln.(s) for permission and substitution of deceased petitioner, c/delay in filing substitution appln. and with prayer for interim relief and office report)

Date: 03/11/2011 These Petitions were called on for hearing today.

CORAM :
HON'BLE MR. JUSTICE R.M. LODHA
HON'BLE MR. JUSTICE H.L. GOKHALE

For Petitioner(s) Dr. Rajiv Dhawan,Sr. Adv. (A.C.)

Mr. Sanjay Parikh, Adv.
Ms. Mamta Saxena, Adv.
Mr. Pranav RAina, Adv.
Mr. A.N. Singh, Adv.
Ms. Anitha Shenoy,Adv.

SLP (C) 22895/05 Mr. Colin Gonsalves, Sr. Adv.
Ms. Jayshree Satpule, Adv.
Ms. Jyoti Mehdiratta, Adv.

SLP(C)No.26034/05 Mr. Arun Kumar Beriwal, Adv.

For Respondent(s)
THDCIL Mr. H.P. Raval, ASG
2

Ms. Binu Tamta, Adv.

MOEF Mr. S. Wasim A. Qadri, Adv.
Ms. Sadhana Sandhu, Adv.
Mrs. Shweta Garg, Adv.
Mr. S.N. Terdal, Adv.
Ms. Sweta Garg, Adv.
Ms. Sadhana Sandhu, Adv.

Mr. S.N. Terdal, Adv.

Mr. Naresh Kaushik, Adv.
Mr. Aditya Sharma, Adv.
Mr. A.K. Sharma, Adv.

Mr. V.K. Verma,Adv.

State Uttrakhand Ms. Rachana Srivastava ,Adv
Mr. Ramesh Deege, Adv.
Mr. Kritul Joshi, Adv.

State of U.P. Mr. S.K. Dwivedi, Adv.
Mr. Pradeep Misra, Adv.
Ms. Malvika Trivedi, Adv.
Mr. Suraj Singh, Adv.
Mr. Kamlendra Mishra ,Adv

Mr. Vijay K. Jain, Adv.

Mr. Virendra Rawat, Adv.
Mr. Alok Singh, Adv.

UPON hearing counsel the Court made the following

O R D E R
It is brought to our notice by Mr. H.P. Raval, learned Additional Solicitor General for THDCIL that the State Government of Uttrakhand, vide its letter dated October 25, 2011, had communicated to grant permission to raise the water level of Tehri Dam Reservoir up to R.L. 825M subject to the condition that an amount of ` 102.99 crores is paid immediately.

2. Mr. Raval submits that within two weeks from today, the said amount (` 102.99 crores) shall be paid to the State Government.

3. Let these matters come up for consideration after four weeks on a non-miscellaneous day.

(Pardeep Kumar) (Renu Divan)
Court Master Court Master

Annexure 7

Pipalkoti

विष्णुगाड बॉध प्रभावित पुर्नवास संर्घष समिति

जोशीमठ, दशोली , चमोली

पता– ग्राम –स्यूंण पो0 बैमरू पीपलकोटी

पत्रांक–मेमो/डैम/01 दिनांक – 6/8/2011

सेवा में,

श्रीमान जिलाधिकारी महोदय
जिला चमोली

माध्यम :– उपजिलाधिकारी चगोली ।

विषय :– विष्णुगाड पीपलकोटी जल विद्युत परियोजना के प्रभावित गावं हेतु दिनांक 29 जुलाई 2009 को हुयी सहमति के सम्बन्ध में –

महोदय,

उपरोक्त विषयक के सम्बन्ध में हुयी त्रिपक्षिय वार्ता के सहमति के अनुसार कम्पनी एवं राज्य सरकार द्वारा शर्ते पूरी न करने पर निम्नवत अनुरोध किया जाता है।

1. टी0एच0डी0सी0 द्वारा दूसरी परियोजनाओ के प्रभावित गांवो की सूची नहीं दी गयी है।(बिन्दु नं0 02)
2. भवनो तथा जल श्रोतो की विडियोंग्राफी नहीं की गयी। (बिन्दु नं0 02)
3. मकानों का बीमा नहीं कराया गया है।(बिन्दु नं0 02)
4. मैना नदी भूगर्भीय सर्वेक्षण की प्रतिलिपि नहीं दी गयी है।(बिन्दु नं0 03)
5. मैना नदी के नीचे टनल में स्टील प्लेटो के उपयोग की डिजायन नहीं दी गयी है। (बिन्दु नं0 03)
6. बैमरू की कितनी वन भूमि ली गयी है। जिसका विवरण नहीं दिया गया है। (बिन्दु नं0 04)
7. प्रभावित गांवो की अन्तिम सूची उपलब्ध नहीं करायी गयी है। जिला प्रशासन ने यह सूची किस आधार पर बनायी है। यह स्पष्ट नहीं किया गया है। (बिन्दु नं0 05)
8. पुर्नवास नीति के अन्तर्गत मिलने वाले लाभ नहीं बताये गये है। (बिन्दु नं0 06)
9. राज्य सरकार द्वारा नयी पुर्नवास नीति नहीं बनायी गयी है। (बिन्दु नं0 07)

उपरोक्त से स्पष्ट है कि 29 जुलाई 2009 के हुये समझोते का अनुपालन टी0एच0डी0सी एवं राज्य सरकार द्वारा नहीं किया गया है।

अतः संज्ञान लेने की कृपा करे कि 15 दिन के अन्दर समझोते का अनुपाल किया जाय। अन्यथा समिति उक्त समझोते को रद् करेगी । जिसकी पूरी जिम्मेदा टी0एच0डी0सी0 एवं राज्य सरकार की होगी।

सधन्यवाद

भवदीय

(बहादुर सिंह रावत)
संयोजक

(भगवती प्रसाद सेमवाल)
अध्यक्ष

विष्णु गाड ... प्रभावित
पुर्नवास संघर्ष
दशोली–च

प्रतिलिपि:– 1. सेवा में, श्रीमान सा0पर्य0प्रबन्धक टी0एच0डी0सी0 पीपलकोटी
2. सेवा में ,माननीय मुख्यमंत्री उत्तराखण्ड सरकार देहरादून

भवदीप
(भगवती प्रसाद सेमवाल)

बहादुर सिंह रावत
संयोजक

अध्यक्ष Bhagwati
विष्णु गाड ... प्रभावित
पुर्नवास संघर्ष ...
दशोली–चमोली

Annexure 8

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Clinton Foundation mulls world's largest solar project in Gujarat

Maulik Pathak & Ashish Amin / Ahmedabad August 8, 2008, 0:59 IST

US-based foundation to set up Rs 20,000-crore Integrated SolarCity.

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Cast Your Vote

Will the GDP growth fall further?

Yes No

Submit

This could well be the world's largest solar power project at a single location if all goes as planned.

The US-based Clinton Foundation is in talks with the Gujarat government to set up an 'Integrated Solar City' project with a capacity to generate a 5,000 Mw over a period of time.

The project, tagged as one of the largest foreign direct investment (FDI) into the state, will also be a landmark project as the cost of power generation is likely to be 70 per cent less — around Rs 20,000 crore — than the conventional cost of generation, say sources close to the development.

The project envisages an integrated solar city wherein all the raw materials including glass and panels will be produced by them, bringing down the cost substantially, said a senior government official.

The cost of generation for thermal energy is about Rs 10-11 per unit. However, according to estimates of Clinton Foundation, the power produced in the solar city will cost around Rs 4 per unit, going by the scale of the project and technology advancement they have on hand.

The Gujarat government has roped in US-based Nobel Laureate John Byrne for charting the state's solar roadmap and is considering Kutch and Banaskantha as favourable locations for the mega project.

"The Foundation, supported by the likes of GE Energy and Microsoft, already has a war chest of $12 billion which it wants to utilise for green energy initiatives," sources said.

The world's largest solar power plant is currently in Mojave Desert of California with a capacity that will go up to 900 Mw in few years.

The Clinton Foundation is also in talks with governments of Andhra Pradesh and Rajasthan for setting up solar power projects.

A number of corporates including Essar, Indiabulls, Reliance, ADAG, Tata Power, Suryachakra and Euro Group have also lined up solar projects in the state.

The Mukesh Ambani-controlled Reliance and Euro Solar have already been given letters of intent of 5 Mw each from the 10 Mw quota allotted by the Centre to each state.

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nitin_ph on 10-AUG-08

I hope that this would be a Concentrating Solar Power (CSP) Plant. India has a tremendous potential for CSP. A 5x5 sqkm solar collector grid can easily generate 1000MW of clean power. India is \"blessed\" with a desert - Thar desert in Rajasthan. Thar desert area is around 0.23 million sqkm so one can imagine the potential! For details please visit: www.desertec-india.org.in

ajithsrn on 08-AUG-08

Electricity produced from Solar Energy is more favorable than Electricity produced by burning fossil fuels. Government should provide option to consumers for purchasing electricity manufactured through ecology friendly procedures rather than ecology destructive procedures. Readers are invited to check their ecological footprint at www.myfootprint.org

Annexure 9

Uttarakhand Power Corporation Ltd., Dehradun Ann-I

Power Purchase Cost for FY 2009-10 (April- March-10) Total

Source of Power	Gross Units Purchased	Net Energy received by UPCL	Total Cost	Avg. Cost
Stations	**MU**	**MU**	**Rs. Cr.**	**Rs./Kwh**
UJVNL				
Main HEP	2,416.39	2,355.98	294.61	1.2505
Maneri Bhall-II	1,187.47	1,157.78	330.03	2.8505
Small HEP	145.04	145.04	38.71	2.6691
Sub Total	**3,748.89**	**3,658.80**	**663.35**	**1.8130**
NHPC				
Salal	36.50	34.16	2.50	0.7318
Tanakpur	17.00	15.91	2.10	1.3170
Chamera-1	72.65	68.00	10.05	1.4784
Chamera-2	5.07	4.74	2.76	5.8223
Uri	93.13	87.17	12.76	1.4633
Dhauliganga	49.01	45.87	10.94	2.3850
Dulhasti	99.59	93.22	97.24	10.4309
FreePower to GOU (D)	135.09	126.44	24.45	1.9338
FreePower to GOU (T)	49.30	46.15	8.92	1.9338
Sub Total	**557.33**	**521.66**	**171.72**	**3.2917**
SJVNL				
NJHEP	11.32	10.59	4.39	4.1443
Sub Total	**11.32**	**10.59**	**4.39**	**4.1443**
THDC				
Tehri HEP - I	65.08	60.92	38.01	6.2394
FreePower to GOU(Te)	251.09	235.02	45.45	1.9338
Sub Total	**316.17**	**295.94**	**83.46**	**2.8200**
NTPC				
Anta(L)/Anta(G)	119.19	111.57	33.58	3.0102
Auraiya(L)/Auraiya(G)	179.20	167.73	44.62	2.6603
Dadri(L)/Dadri(G)	188.82	176.73	53.89	3.0490
Unchahar-I	288.58	270.11	68.05	2.5193
Unchahar-II	133.74	125.18	34.12	2.7255
Unchahar-III	117.69	110.15	32.86	2.9827
Dadri Thermal	-	-	(0.00)	#DIV/0!
Rihand-1 STPS	362.11	338.93	64.53	1.9039
Rihand-2 STPS	301.71	282.40	65.43	2.3169
Singrauli STPS	812.71	760.70	112.20	1.4750
Kahalgaon-II	102.65	96.08	26.48	2.7556
NCTPS_1A	-	-	(0.04)	#DIV/0!
Sub Total	**2,606.39**	**2,439.58**	**535.71**	**2.1959**
NPCIL				
Narora APP	28.03	26.24	5.89	2.2462
Rajasthan APP	10.96	10.26	3.28	3.1970
Sub Total	**38.99**	**36.50**	**9.17**	**2.5135**
Power Grid				
Transmission Charges	-	-	88.77	#DIV/0!
ULDC Charges	-	-	2.16	#DIV/0!
NRLDC Charges	-	-	-	#DIV/0!
Sub Total	-	-	**90.93**	**3.5536**
IPP				
Him Urja SHP	20.44	20.44	5.11	2.5000
Hanuman Ganga SHP	17.13	17.13	4.54	2.6485
Vishnuprayag SHP	214.08	200.38	38.75	1.9338
Debal	18.94	18.94	5.30	2.8000
LoharKhet	18.60	18.60	5.21	2.8000
UREDA	0.16	0.16	0.04	2.5500
RBNS Cogen Plant	28.89	28.17	10.01	3.5541
Agunda Thati	9.95	9.95	2.78	2.7990
Bhilangana(Swasti)	26.60	26.60	7.04	2.6479
Vanala	6.30	6.30	1.73	2.7500
Uttam Sugar Mills	4.81	4.81	1.68	
Sub-Total	**365.91**	**351.48**	**82.20**	**2.3388**
Return Banking	315.68	295.47	3.44	0.1164
UI Overdrawal	762.27	713.48	321.33	4.5037
PTCUL	-	-	75.81	#DIV/0!
Open Market Purchases	138.91	130.02	100.36	7.7187
Total	**8,861.86**	**8,453.53**	**2,141.86**	**2.5337**

Note: 1-Above Fig. are as per REA and subject to change.
2- Above Fig are as per Power Purchase Bills.
3- Avg. Rate is calculated on Net Energy.
4- Net Energy is calculated consedering 4% PGCIL losses and 2.5% PTCUL losses.

JE AE

Chief General Manager

THE WORLD BANK
INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

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May 22, 2012

Mr. Bharat Jhunjhunwala
Lakshmoli, PO Maletha
Kirti Nagar, Uttarakhand 249161
India

Dear Mr. Jhunjhunwala:

World Bank Response to Representation on the Vishnugad Pipalkoti Hydro Electric Project

Thank you for the representation of March 2012, addressed to Ms. Isabel Guerrero, Vice President, South Asia Region, World Bank, from you and other individuals, in which concern was expressed about the Vishnugad Pipalkoti Hydro Electric Project (VPHEP) and aspects of hydropower development in general. My colleagues and I have benefited from several discussions with you, conducted through correspondence over the last year as well as in several personal meetings, including most recently on March 29, 2012, in Delhi, and on April 30, 2012, in Washington, DC. We appreciate and share your concern about improving hydropower practice in India.

The Annex to this letter provides our responses to the specific comments in the representation. I would like to address here two closely related aspects that are at the center of the intellectual debate on hydropower that is taking place in India and has been played out in other countries that have sought to develop their hydropower potential. These questions have figured prominently in your comments and in our recent discussions.

The first question is the relative value to society of development today versus development deferred to the future. The argument in favor of development today is obvious in the sense that hundreds of millions of Indians aspire to live better today and economic development is needed now in order to support these aspirations. The potential risk or cost of this could, of course, be inefficiency or unintended consequences arising from development decisions made on the basis of imperfect knowledge. Development deferred to the future, in contrast, has the advantage of improved knowledge of how to design and manage this development better. But it comes at the cost of depriving people of the benefits of development today. There is no right or wrong answer to this general question as the actual answer in any given case may be a function of public policy; professional judgment based on the state of knowledge in a particular field; and, ultimately, societal preferences.

Specifically in the case of hydropower, the position of the World Bank is that hydropower is a sufficiently mature technology and there exists a good understanding of its potential impacts and of how to mitigate them to justify supporting hydropower development, provided individual projects meet World Bank project preparation and implementation requirements. Whether or not development of hydropower potential is appropriate in a given situation requires a specific analysis of not only alternative uses of the river, but also of

alternative options for the generation of electricity, which for many countries, including India, is a developmental priority. In this respect, the Government of India (GOI) has two long-standing policy objectives of providing reliable access to electricity to all Indians and generally improving electricity supply for economic development. A technical objective that supports these policy objectives is to increase the share of hydropower in the country's electricity generation mix, primarily in order to provide peaking power.

The second question that has featured prominently in your comments and in our discussions is economic analysis and the treatment of externalities. We share the view that there are usually externalities (positive and negative) associated with development projects and that development in the context of a hydropower cascade can induce a number of negative impacts at the project and basin levels. A particular challenge in cascade development is that the river basin as a level of analysis is not captured in the typical project-level approach to impact assessment. Where possible, in carrying out economic analyses of projects that we consider for World Bank funding, we try to "internalize the externalities" through inclusion in the analysis of values for the posited externalities, or, in the absence of directly relevant data, through the use of proxy data. However, the World Bank's standard for valuating externalities is probably more conservative than the approach you put forward at the meeting with the World Bank on April 30. Generally, we would include in an economic analysis proxy values for externalities (positive or negative) only if we have a high degree of confidence in the robustness of the data. Otherwise, we consider the risk of subjectivity to be unacceptably high, such as in the case with the alternative calculations and data that you have suggested.

While there is an extensive body of professional literature on the methodology of economy analysis and methods of valuation of externalities, some are controversial and replete with methodological pitfalls. An example is determination of "willingness to pay" where the methodological deficiencies include: sampling bias; lack of sufficient information or technical knowledge on the part of those being interviewed (e.g. on the cost implications of different electricity-generating technologies) which reduces the relevance of responses; influence of the question formulation on the responses; and possible normative influence of the enumerator on the respondent. Resource and time constraints (and sometimes also formal and legal constraints, as well as considerations of national sovereignty) often do not allow us to collect data where such data do not exist.

However, this does not mean that we disregarded the negative environmental externalities in the case of the economic analysis of VPHEP. As we discussed on April 30, the environmental flow requirement that is mandated by GOI can be viewed, theoretically, as a composite measure of the value that Indian society accords to preserving the river in its natural state as opposed to exploiting the river for other purposes (irrigation, power generation, flood control, etc.) and this value functionally captures the anticipated negative impacts in the analysis. We note in this context the observation of the National Green Tribunal that "the environmental flow requirement critically depends upon the development stage of the region and what the society expects from the river" (Judgment of the National Green Tribunal (Principal Bench), appeal No. 5 of 2011, December 14, 2011, p. 28) (NGT Judgment).

As you know, in May 2011, following recommendations based on the interim cumulative impact assessment carried out by the Indian Institute of Technology and the Wildlife Institute of India (WII), GOI revised the environmental flow requirement of VPHEP

to 15.65 cumecs – one of the highest ever mandated for a hydropower project in India – subject to the condition that this would be reviewed upon submission of the final report. The WII final report was released on April 17, 2012, and the GOI is considering its recommendations at the highest level, as is civil society. This evolving debate in India is not unlike the experience of other countries which have developed their hydropower potential.

As concerns the project in general, VPHEP has been subjected to various reviews by the GOI through its regulatory and judicial authorities and has been found to be a well-prepared project within the ambit of existing scientific and technical knowledge. Its preparation has incorporated broadly accepted good practices in hydropower and has, in addition, demonstrated a number of innovations. The NGT Judgment upheld the forest clearance and expressed its view that the project preparation was robust, reflecting the incorporation of a number of innovative studies that address important issues in hydropower. Moreover, the World Bank's own sustained consultations with a wide range of stakeholders over the years have shown that the project enjoys a broad base of local and regional support, a fact that is also highlighted in recent media accounts (Hindustan, April 23; Amar Ujala, April 24; The Hindu, April 30; The Hindu, May 4).

Moving beyond specific project-level issues, we agree that there is scope for improvement in planning and management of the development of India's river basins for multiple uses. We also believe that the GOI has made important progress in its efforts to understand basin-level impacts through commissioning the cumulative impact assessment of hydropower development on the Bhagirathi and Alaknanda Rivers. As is evident from the statements of Prime Minister Dr. Manmohan Singh at the National Ganga River Basin Authority meeting of April 17, 2012, the GOI is cognizant of these serious issues and will examine the various options for the use of the river, keeping in mind the multiple uses of the river and the inevitability of trade-offs between conservation and development. We believe that this creates an opportunity for concerned members of civil society like yourself to participate in the deliberations and we hope that you will apply your passion and expertise to contributing to this process. Similarly, we note the opportunity for civil society contribution to the revision of the guidelines for cost-benefit analysis of hydropower projects that was mandated by the NGT. As you know, this exercise will be led by the Indian Institute of Forest Management in Bhopal on behalf of the Ministry of Environment and Forests. I thank you for having directly contributed to bringing about this important development and look forward to your continued contributions.

Sincerely,

Hubert Nove-Josserand
Acting Country Director, India

Annex: World Bank Responses to Specific Comments Raised in Representation (March 2012) from Mr Bharat Jhunjhunwala and Others

cc: Mr. Nilaya Mitash, Director, DEA, MoF, GoI

Annex
Vishnugad Pipalkoti Hydro Electric Project

World Bank Responses to Specific Comments Raised in Representation (March 2012) from
Mr Bharat Jhunjhunwala and Others

Comment 1: Environmental Assessment. ***The environmental category should have been "A" in view of the impact on the cheer pheasant, otter and mahseer fish. The World Bank team made an error in not classifying the VPHEP project area as a "critical natural habitat", as indicated by the Wildlife Institute of India report (Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity in Alaknanda and Bhagirathi Basins, Uttarakhand;*** **interim progress report, May 2011)** ***that recognizes that the project will lead to the extinction of the cheer pheasant. World Bank staff have violated the principle of the precautionary approach that requires that the site may not be disturbed as it is the habitat to the endangered Cheer Pheasant and Otter.***

The project will have a negative impact on biodiversity, especially aquatic biodiversity. In assessing the impact of the project on biodiversity, the World Bank team relied on the assessment of the Wildlife Institute of India, which calculated biodiversity values for different hydropower projects and concluded that VPHEP has a low negative impact on biodiversity. However, since we are challenging the WII's assessment of the biodiversity in the Supreme Court, it is inappropriate for the World Bank to rely on the WII study. Similarly, it is inappropriate for the Bank team to accept recommendations of the cumulative impact assessment of the Alaknanda and Bhagirathi river basins that the Ministry of Environment and Forests commissioned from the Indian Institute of Technology, Roorkee, and the Wildlife Institute of India

The World Bank team violated the Bank's Operational Policies 4.00, Piloting the Use of Borrower Systems to Address Environmental and Social Safeguard Issues in Bank-Supported Projects, Table A1, "Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles", because the environmental damage has been ignored instead of undertaking surveys; 4.02 Environmental Action Plans because the World Bank staff ignored the aesthetic value of the river and failed to collect relevant data on use and non-use values; 4.04 Natural Habitats because the Bank staff ignored the existence value of the river. The project also violates the Bank's draft Operational Policy 9.00 Program-for-Results Financing because the Bank did not adequately ensure that the affected people and environment are protected, relying instead on the the cumulative impact assessment of the Alaknanda and Bhagirathi river basins that the Ministry of Environment and Forests commissioned from the Indian Institute of Technology, Roorkee, and the Wildlife Institute of India.

Response: The environmental category of the project has always been "A". The initial screening carried out by the World Bank in 2006 after being invited by GOI to consider the project for financing concluded that the project was "likely to have significant

adverse environmental impacts that are sensitive, diverse, or unprecedented" which is the criterion applied at the World Bank to category "A" projects (Operational Policy 4.01, Environmental Assessment). The specific impacts considered include those on rare, endangered and threatened animals, such as the cheer pheasant, otter and mahseer, but are not limited to these impacts.

Surveys were carried out as part of the environmental assessment. Before the engagement of the World Bank in the project, the project developer conducted baseline surveys covering the period from October 2005 to April 2006. Subsequently, following the engagement of the World Bank in the project in 2006, THDC undertook additional environmental studies (in the areas of bio-diversity, managed river flow and archeology) over the period April 2008-May 2009. The original environmental assessment and the additional environmental studies have been integrated into a consolidated Environmental Assessment and Environmental Management Plan (EA/EMP). These final documents are available on the developer's website at www.thdc.gov.in.

Concerning the assessment of the impact on biodiversity, the World Bank did not rely solely upon the WII report in the context of the appraisal of VPHEP. Detailed investigations related to biotic life and biotic resources, their current status and possible impacts on them from the project were conducted during the environmental assessment. Each of the environmental issues was examined at four levels: (i) the basin/sub-basin or catchment area level as appropriate, (ii) for the project influence area, determined to be an area 7 km all around the project sites; (iii) for the project's immediate influence area, determined to be 500 m all around the project affected areas; and (iv) the project-affected areas or the project's actual footprint equal to all the public and private areas acquired and used for the project. As described above, a study of the project impact on biodiversity was carried out in the context of the environmental impact assessment. The EMP includes a Biodiversity Management Plan which mandates measures for the mitigation of the anticipated impacts on flora and fauna in the project area.

We note that the report of the WII cited in the representation does not state that the project will lead to the extinction of the cheer pheasant or any other species. Specifically, the report states that the VPHEP "*project area has predominantly secondary scrub and steep grassy slopes on either bank that are habitats for the endangered cheer pheasant....These vegetation categories have long been subjected to intensive cutting and annual cool season burning. Presently, the distribution and population status of cheer pheasant in this area is very poor, largely due to habitat degradation and loss as a result of increasing anthropogenic pressures and developmental activities in the area.*" (p. 64). With respect to the otter, the report states that "*the only aquatic mammal reported in the basin was otter but its distribution is doubtful nowadays*" (p. 72), and the report does not mention otters in the review of the wildlife in the VPHEP zone of influence.

Concerning Bank Operational Policies (OP 4.00, OP 4.02 and OP 9.00, these policies were not triggered by the project. OP 4.04 was triggered for the project influence area resulting in the carrying out of the analyses and the formulation of measures included in the Environmental Management Plan (EMP). As indicated in the cumulative impact assessment that was commissioned by the Ministry of Environment and Forests, the

project does not result in any significant conversion or degradation of critical natural habitats.

Comment 2: Economic analysis and consideration of externalities. ***The project economic evaluation does not take into account externalities such as the aesthetic, cultural and existence value of a free-flowing river and other "non-use" values. If these externalities were taken into account, the project economic evaluation would be negative.***

The project violates the Bank's Operational Policy 4.00 Piloting the Use of Borrower Systems to Address Environmental and Social Safeguard Issues in Bank-Supported Projects, Table A1, "Environmental and Social Safeguard Policies—Policy Objectives and Operational Principles" because a survey of non-use value has not been undertaken; and Operational Policy 10.04 Economic Evaluation of Investment Operations because the Bank staff failed to determine whether the project creates more net benefits to the economy than other mutually exclusive options for the use of the resources in question.

Response: Mr. Nove-Josserand's letter lays out some of the broad principles behind the World Bank's standards with respect to economic analysis. The methodology of the economic analysis that was conducted for the project followed widely accepted professional standards for economic analysis. The economic analysis took into account costs and benefits for which robust estimates were available or could be derived from proxy data. In addition to the quantifiable costs and benefits of any project, the economic analysis referred to other costs and benefits the existence of which can be postulated but which cannot be appropriately quantified and are therefore not considered sufficiently robust for inclusion in the cost-benefit analysis. It is important to use only robust data as the results of any analysis can be influenced in either a positive or negative direction by the inclusion of variables for which no robust data are available. The results of this conservative analysis, including sensitivity analysis, indicate that VPHEP is an economically viable project.

Specifically as concerns the observation on the aesthetic value of the river, this is an example of a value that can be posited but which is difficult to measure with existing data or contingent valuations methods in general. This value is above (exogenous to) the project level and, therefore, more appropriately reviewed in a higher level decision-making process that examines the relative costs and benefits of river basin development versus non-development. We believe that Government of India has carried out this process in its various deliberations with respect to the Bhagirathi and Alaknanda basins (as reflected in the corpus of studies and consultations carried out and negotiations with the Government of Uttarakhand), parts of which are being developed for hydropower generation. With respect to the stretch of the Alaknanda River in which VPHEP will be built, there is no significant human or animal activity dependent on the river as, for most of this stretch, the river gorge is very deep, its steep terrain making access to the river impossible or very difficult. In the few places where access to the river is possible, the river water is used by local communities for bathing on religious occasions and for performing last rites, and our understanding is that the environmental flow requirement

mandated by the Ministry of Environment and Forests keeps in mind these occasional uses of the river in the lean season.

Please note that VPHEP does not rely upon the provisions of OP 4.00, Piloting the Use of Country Systems, because it was prepared under World Bank policies and procedures. Field-based surveys were conducted for both the social impact assessment and environmental impact assessment. A survey of the "non-use values" of the river would have to have been based on a national sample of public perceptions of the trade-offs between development and preserving the natural landscape which would not have been practical.

Comment 3: Water quality and sediment. ***The negative impacts of the project on water quality have been ignored. Water of the Ganga River is known to possess special bactericidal qualities, beneficent radioactivity, high levels of elements that have a positive psychological impact on bathers. The data on water quality from the Vishnuprayag HEP [upstream of VPHEP] show a negative impact on a number of indicators, and these data may be taken as indicative of what will happen in the VPHEP project site as VPHEP is of similar size and structure. Moreover, the World Bank has not taken into account the impact of the project on the creation of sediments (sediments are created when fast-flowing river water rubs against the stones. Diverting most water through tunnels will remove this weathering and reduce creation of the sediments).***

Response. Please note that part of the concern expressed here is addressed above in our response to Comment 2, "Economic analysis and consideration of externalities".

In the course of project preparation, the anticipated impact of the project on water quality was studied. When in 2006 the GOI asked the World Bank to consider the project for financing, the World Bank reviewed the Environmental Impact Assessment report that had been prepared by that point in time, and identified additional studies and analysis that needed to be carried out to meet the World Bank's requirements for project preparation. One such study was the managed river flow study, the scope of which was (i) measurement of current river flow, (ii) water use, quality and water-borne diseases, (iii) aquatic ecology, (iv) downstream hazards and (v) pollution load assessment. A scenario-based model was prepared and run to assess impacts of the project on water quality and pollution load. This modeling exercise indicated that there are no significant negative impacts on the water quality of the river due to the project. Based on the results of the modeling, recommendations were provided in the Environmental Management Plan of the project. The study and recommendations are available on the website of THDCIL (www.thdc.gov.in).

Around 95% of the annual sediment load flows during the monsoon period of four months. During this period of the year, a large portion of the river flow will remain in the river and the natural sediment load of the river will flow through the spillways of the diversion dam. The water that is diverted into the tunnel will pass through desilting chambers; any sediment retained in the desilting chambers will also be released into the river immediately downstream of the dam at regular intervals in the operation phase. Therefore, the quantity and characteristics of sediments in the river water should not be

impaired. In the non-monsoon season, the concentration of sediment in the river is considerably lower. Any sediment in the water that reaches the power house will be discharged back into the river through the tailrace tunnel. Thus, during this period, the sediment concentration in the river downstream of the project will not be significantly modified from the current situation.

Comment 4: Analysis of Alternatives. ***Generally, other ways of meeting India's increasing demand for electricity such as solar, biomass and wind generation should have be explored more thoroughly. The Bank team violated Operational Policy 4.04 Natural Habitats (Annex A, definitions), Operational Policy 4.07 Water Resources Management and Operational Policy 10.04 - Economic Evaluation of Investment Operations because it failed to consider (i) the "no project" alternative, and (ii) the alternative of a partial obstruction of the river instead of a barrage which would allow upstream migration of fish and downstream flow of debris and sediments. An example of such a partial obstruction is the Bhimgoda Barrage at Haridwar.***

Response: The World Bank agrees that in order to address India's growing demand for electricity from existing consumers and the Government's objective of providing access to electricity to the estimated 350 million Indians who are without reliable access to electricity, it is essential to consider all forms of electricity generation as well as energy efficiency and demand-side management. We are fully cognizant that there are no easy solutions to energy problems; all options for solutions impose costs and have certain benefits relative to other options. In India, the World Bank supports investment operations as well as analytical work devoted to advancing renewable energy and energy efficiency (see two ESMAP-funded, World Bank-executed studies: (i) *Unleashing the Potential of Renewable Energy in India,* available at: http://siteresources.worldbank.org/INDIAEXTN/Resources/Reports-Publications/Unleashing_potential_of_Renewable_Energy_in_India.pdf, and (ii) *Energy Intensive Sectors of the Indian Economy: Path to Low Carbon Development,* available at: http://www.esmap.org/esmap/sites/esmap.org/files/India_LowCarbon_FullReport.pdf). In addition, we are providing support to the Ministry of New and Renewable Energy in connection with the National Solar Mission.

Many of the alternative sources of electricity generation still cannot be developed affordably relative to other costs of supply, nor could they be developed on a scale that would, under present conditions, allow them to make an appreciable contribution to addressing India's demand for electricity. For example, solar power has yet to be deployed on a large scale anywhere in the world, and it still costs consumers more than four times conventional coal-fired generation, which dominates the Indian power system. The significant increase in the cost to consumers would be harmful to India's poorest people in terms of their ability to benefit from electricity both at home and in their efforts to secure employment. From a broad planning perspective, hydropower needs to be part of India's generation mix because it provides not only kilowatt-hours, but also unique system-management features needed to address the India's chronic shortage of peaking capacity which leads to load-shedding during the periods of peak demand.

The "no project" alternative was considered in the Environmental Assessment and is described in the Project Appraisal Document. The World Bank is of the view that in the context of India's chronic power deficit and the development imperative as articulated by the GOI, the "no project" alternative would yield negative results. India's electricity deficiency has been identified in all investment climate assessments; a recent World Bank study, *More and Better Jobs in South Asia*, highlighted it as the single most significant barrier to investments and creation of jobs. The development of various energy resources, including hydropower, is thus central to India's development and goal of inclusive growth. (This report may be found at the following URL: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:23008605~menuPK:2246552~pagePK:2865106~piPK:2865128~theSitePK:223547,00.html.)

In the course of the project design and preparation, numerous technical and locational alternatives were considered. The alternative of a partial obstruction of the river (along the lines of the Bhimgoda Barrage near Haridwar) suggested in the representation is impractical for VPHEP for several reasons. The valley at the site of the VPHEP diversion dam is a V-shaped gorge. Once the alluvium is excavated to an acceptable foundation, the river bed will be only a few meters wide. By the time the dam is constructed to a height which would allow the river to be divided into obstructed and unobstructed zones and provide acceptable submergence of the intake, the flow velocity in the unobstructed section would be too high for unobstructed fish passage. Moreover, a partial obstruction of the river would mean a project with no storage, which would undermine the project's value to overall power system management. Electric power systems require both base load and peak load power generation.

Base load generation is provided by fossil fuel-fired plants, by nuclear and by hydropower plants with no storage at all (as for that fed by the Bhimgoda Barrage). Thermal base load plants cannot be used for peak-load generation because of their long start-up times which make it impossible for them to respond quickly to variations in the demand for electricity. Hydropower base load plants cannot be used because of their lack of storage. Peak load generation can be provided by low efficiency combustion turbines burning oil or oil products or natural gas, hydropower or pumped storage plants. For India, the non-hydro options to provide peak load generation are limited and also associated with negative environmental impacts; therefore, hydropower is an important strategic option for the development of the Indian power system. For hydropower plants to provide peaking power, they must have a minimum amount of storage. In off-peak periods water must be stored so that the full flow can be delivered in the short daily peak period. The maximum operating level is based on this requirement; the minimum operating level is based on the requirement to provide sufficient submergence of the intake to prevent vortices which cause turbulent air entrainment. Currently, the ratio of hydropower installed capacity to thermal installed capacity is about 25:75; Government of India has identified as optimal for system management a ratio of 40:60, indicating the need for a considerable expansion of the country's installed generation capacity based on hydropower.

Comment 5: Poverty Alleviation. ***The World Bank has not undertaken a study of whether the project will lead to poverty alleviation or poverty accentuation. This will depend on whether the environmental, cultural and social costs imposed on poor people are greater or less than the benefits accruing to them from provision of electricity.***

Response: The project preparation process included comprehensive social and environmental impact assessments that were carried out by the project developer and appraised by the World Bank and an economic analysis carried out by the World Bank according to the World Bank's methodology, as described above. They are available at www.thdc.gov.in. The conclusion of the appraisal process is that the project will make a net contribution to social welfare. National-level considerations of access to electricity and poverty alleviation are important topics but are not part of the individual project appraisal process. As detailed in earlier communications, the available data indicate that additional power is being provided to households in rural India although more needs to be done in view of the very large numbers of households who still do not have access to electricity.

VPHEP incorporates a number of provisions to share benefits with communities in the project area and will in addition provide royalty payments to the State of Uttarakhand. In addition to the developer's support to local small-scale infrastructure projects all project-affected families will receive 100 kWh/month (equivalent to 1,200 kWh per annum, which is higher the GOI target) for free for 10 years. It is clear from wide-ranging consultations over several years and most pointedly from recent protests in support of the project (extensively covered in Hindi and English news media) that the majority of people in the project area are of the view that the project will contribute to increasing their standard of living. As the access to electricity in the VPHEP project area is high, increased access to electricity did not emerge in the consultations process as a high priority of the project-affected people.