CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Hydroelectric Project in Kinnaur District in Himachal Pradesh
Version 04
28/03/2012

A.2. Description of the project activity:

>>
Description of the project

The Government of India and the Government of Himachal Pradesh (GOHP) have identified the Sutlej River as an important source of hydropower and have initiated hydroelectric projects along Sutlej and its tributaries. The Sutlej River rises in the Tibetan Plateau, passes via steep valleys and gorges through the Himalayan Mountains and foothills and meets the Arabian Sea across the plains of Northern India and Pakistan. The Karcham-Wangtoo Hydroelectric Project (KWHEP) forms a part of an overall plan of development of the Sutlej river basin hydropower potential proposed by the GOHP. The project is being executed by Jaypee Karcham Hydro Corporation Limited (JKHCL), a special purpose vehicle formed by the promoter group Jaiprakash Associates Limited (JAL). Prior to the start of the project activity the existing demand in the Northern Region Grid was met through its existing fossil fuel based (coal, gas and diesel), nuclear, hydro and renewable energy based power plants.

The project activity has been devised to alleviate acute shortage of electricity generation capacity in the Northern Region of India especially at the time of system peak load by developing a 4 X 250 MW renewable and versatile run of the river hydro power project at Karcham & Wangtoo on the river Satluj in Himachal Pradesh. The project activity envisages a 98 m high concrete gravity diversion dam at Karcham; power intakes and 4 underground desilting chambers to exclude all particles above 0.2 mm size; 10.48 m diameter and 17 km long head race tunnel; an underground power house complex at Wangtoo to generate 4 X 250 MW power and 1.3 km long tail race tunnel to discharge the water back into river Satluj. The project activity will provide 4463.88 GWh (90% dependable energy) per annum of renewable energy and provide 1000 MW peaking power through out the year. In doing so, it will delay the necessity of construction of either a coal or gas or oil fired thermal power plant of similar capacity to supply to the primarily fossil fuel based regional grid, leading to reduction of Carbon Dioxide (CO_2) emissions in the atmosphere. The installed capacity of the Northern region (as on 31.03.2007) is 36359.43 MW. Almost 59% of the total installed capacity is constituted by thermal installations including coal, gas and diesel based generating stations. For the financial year 2006-07, there has been 8.51[1]% increase in energy demand from the previous year and a capacity shortage of about 15.46 % has been recorded. The annual energy shortage in the grid has been about 60.54 MU/day i.e. 10.91%[2] and a peaking shortage of 15.5 % during the year 2006-07. Thus electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources to meet the power shortages.

[1] http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.3.pdf

[2] NRPC Annual Report 2006-07 - .Page 3 of http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.1.pdf

This is a new hydroelectric project, with a small reservoir of area 588400 m^2 having a power density of **1699.52 W/m^2**. Construction work at project site has started from 18th November 2005 and the project activity is expected to start generation of power from August 2011.

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated following indicators for sustainable development in the interim approval guidelines for CDM projects:

Social well being

The project activity would raise the medium term employment opportunities for the local people during construction phase. Further on continuous basis, employment opportunities would be available for local inhabitants during life time of the project for operation and maintenance of the project.
The project activity will support the northern regional grid for sustained and quality supply of power for the local community. It will involve interalia construction of a 10+2 grade school, an industrial training institute, a 40 bedded hospital besides up-gradation of existing roads and bridges in the hilly terrain which would uplift the social life of the surrounding villages.

Economic well-being

The northern grid is facing acute shortage of electrical power and thereby, stunting the economic growth of the region. The project activity will be a move towards bridging the gap in supply and demand. During construction and operation phases of the project, employment would be generated for the local population. Further, the business opportunities are enhanced by the project activity for local stakeholders such as consultants, suppliers, manufacturers, contractors etc during the implementation phase. The project activity would contribute to the economic well being in the region over its entire life time.

Environmental well being

The project activity utilizes hydro resource for generating electricity which otherwise would have been generated through alternate fossil fuel based power plants, thereby contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions.
Furthermore, as hydro power projects produce no end products in the form of solid waste (ash etc.) during operation, they address the problem of solid waste disposal encountered by most other sources of power. A comprehensive catchment area treatment plan has been formulated comprising of plantation, construction of check walls, pasture improvement etc.

Technological well being

The project activity envisages installation of high efficiency turbines and generators and the power will be transmitted at high voltage to ensure low losses. Moreover, the technology being used is well established, most updated and environmentally safe.

A.3. Project participants:

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Name of Party involved	Private and/or public entity (ies)	Kindly indicate if the party

(*) ((host) indicates a host party)	Project participants (*) (as applicable)	involved wishes to be considered as project participant (Yes/No)
India (Host Country)	Jaypee Karcham Hydro Corporation Limited (Private Entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
India

A.4.1.2. Region/State/Province etc.:

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Himachal Pradesh

A.4.1.3. City/Town/Community etc.:

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District: Kinnaur
Village: Karcham & Wangtoo

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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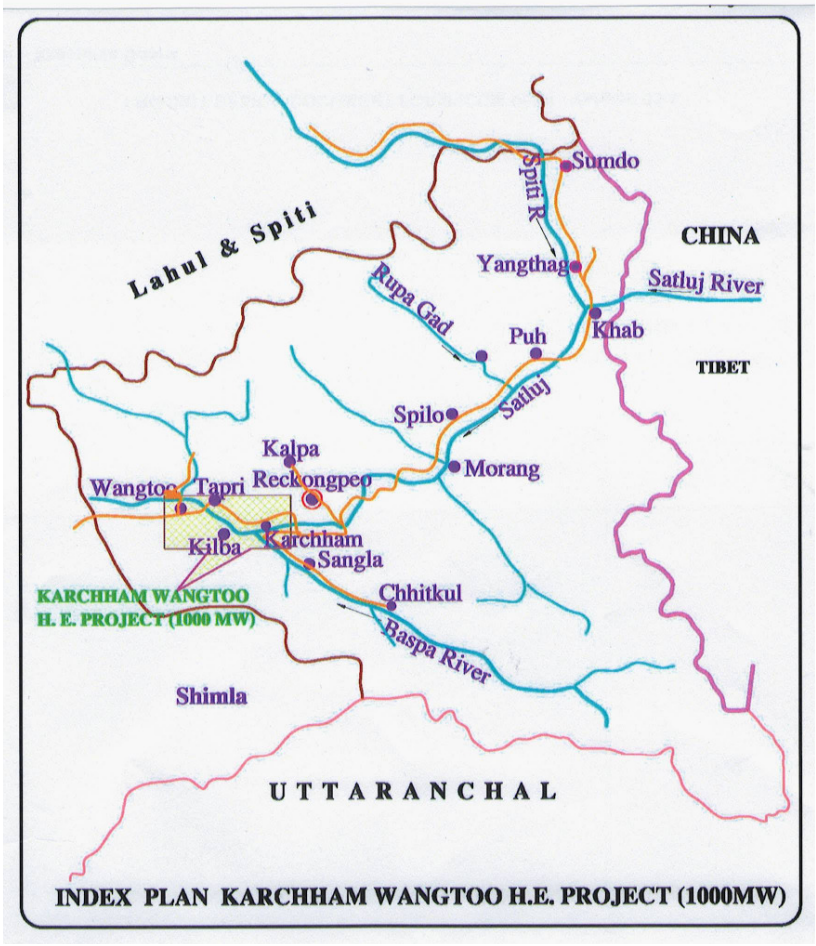
The project activity is located on the stretch of Satluj River between Karcham and Wangtoo in the District of Kinnaur of Himachal Pradesh. The geographic coordinates of the project area are the following:

Latitude - 31°30'50'' - 31°32'10'' N

Longitude - 78°11'15'' - 78°01'05'' E

Nearest broad gauge railway station is Kalka under Northern Railway which is 290 kms from the project site. The nearest airport to the project site is Shimla, which is 210 km from Karcham Wangtoo site. The airport is connected to the project site by a paved road. The location is further depicted in the following map:


Chamba
Keylong
Lahul & Spiti
Dharmasala
Kangra
Kulu
Hamirpur
Una
Mandi
Kinnaur
Kalpa
Bilaspur
Shimla
Solan
Kasumpti
Sirmaur
Nahan



A.4.2. Category(ies) of project activity:

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The project activity is a hydro power project considered under "Consolidated methodology for grid-connected electricity generation from renewable sources - Version 12.1.0, having a capacity of more than 15 MW. Therefore as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies', the project activity may principally be categorized in:

Scope Number - 1

Sectoral Scope – Energy Industries (renewable/non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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The Project activity is a run-of-river hydropower project that will utilize the natural flow of Satluj to generate electricity (thus will not involve the construction of a reservoir) with a total installed capacity of 1000 MW (4*250MW) and an operational time of 35 years. The electricity so generated will be exported to the Northern Regional Grid which in the absence of the proposed project activity would have been generated by the operation of grid-connected power plants and by the addition of new generation sources i.e. the baseline scenario.

The project will utilise the head available between tail waters of Baspa Hydroelectric Project Stage-II 300 MW and head waters of Nathpa–Jhakri Hydroelectric Project 1000 MW, and shall have an underground power station at Wangtoo, where the water will be discharged back to the Sutlej River. The project activity will utilize a gross head of 298.73 m for power generation and the major components are as following:

1. River diversion works
2. Diversion dam
3. Intake and sedimentation chambers
4. Head race tunnel
5. Surge shaft
6. Pressure shafts and penstocks
7. Power house complex for housing 4 x 250 MW generating units
8. Tail race works

The design features of the project components are presented in the following table:

River Diversion Works	
Diversion Tunnel	
Diameter	10.5m
Length	456 m
Coffer Dams	
Type	Rock fill with impervious core
Upstream	20.5 m high
Downstream	8.5m high
Diversion Dam	
Type	Concrete Gravity
Height from deepest foundation level	98 m
Total length at top	177.8 m
Live storage capacity	5449700 m^2
Main Spillway (Sluices)	
No. of bays	6
Size of each sluice	9 m (W) x 9 m (H)
Size of each gate	9 m (W) x 9.25 m (H)
Type of gates	Radial Gates (top sealing type)
Intake	
No. of bays	4
Size of each bay at trash racks	18 m (W) X 7.5 m (H)
Size of each gate	4 no, 6 m (W) x 5.25 m (H)
Sedimentation Chambers	
No. of Sedimentation chambers	4
Size of each chamber	505 m (L) x 16 m (W) x 28 m (H)
Particle size to be excluded	0.2 mm and above

Link & Connecting Tunnels	
Size	Four individual link tunnels of 6.0 m dia
Length of link tunnel	Link tunnels – 91 m each
Length of each tunnel	Outer link tunnels – 125.5 m Inner Link tunnels – 65.5 m
Gates at start of link tunnels	4 nos.
Size	6.0m (W) x 6.0m (H)
Flushing Conduits	
Number	4
Size	2.75 m dia circular
Lengths	300 m, 330 m, 370 m and 405 m
Headrace Tunnel	
Size & Type	10.48m dia circular, concrete lined
Length	17.2 km
Slope	1:150
Design discharge	417 Cumecs
Surge Shaft	
Type	Restricted Orifice
Diameter	16 m upto EL 1755.00 m; and 27 m from EL 1755.00 m to 1852.00 m
Top elevation	EL 1852.00 m
Pressure Shafts	
No. and type	4 nos. steel lined
Diameter	4.75 m
Length of each penstock	290.50 m
Valve Chamber	
Location	Downstream of Surge shaft
Size of chamber	95 m x 10 m x 22 m (LxBxH)
Type of valves	Butterfly valves
Diameter of each valve	4.75 m
Power House / Transformer Cavity	
Type	Underground
Installed capacity	1000 MW (4x250 MW)
Size of machine hall	143 m (L) x 21 m (W) x 49 m (H)
Size of transformer hall	143 m (L) x 15.5 m (W) x 25 m (H)
Average gross head	298.73 m
Net head at 417 cumecs discharge	275.93 m
D/S Surge chamber size	220 m (L) x 16 m (W) x 42.5 m (H)
Tail Race Tunnel	
Size & Type	10.48m dia Circular shape
Length	909 m
Generating Units	
Turbines	4 Francis Turbines, 255 MW/347000MHP
Make	Andritz VA Tech Hydro

Generators	4 semi- umbrella vertical synchronous generators, 277.70 MVA
Speed	214.30 rpm

The project activity utilizes conventional environmentally safe and sound hydropower technology and hence there is no technology transfer involved.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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Years	Annual estimation of emission reductions in tonnes of CO_2 e
2011-12 (August 2011 to March 2012)	1,066,123
2012-13	3,541,917
2013-14	3,541,917
2014-15	3,541,917
2015-16	3,541,917
2016-17	3,541,917
2017-18	3,541,917
2018-19	3,541,917
2019-201	3,541,917
2020-21	3,541,917
2021-22 (April 2022 to July 2022)	2,475,793
Total estimated reductions (tonnes of CO_2e)	**35,419,166**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**3,541,917**

A.4.5. Public funding of the project activity:

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There is no recourse to any public funding by JKHCL in the proposed project activity. The project proponent hereby confirms that there is no divergence of Official Development Assistance (ODA) to the proposed project activity. The required funds have been raised through various financial institutions and in-house funding.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title of the baseline methodology: "Consolidated Baseline Methodology for grid connected electricity generation from renewable sources"

Reference: ACM0002, Version 12.1.0 (EB 58), Sectoral scope: 1
It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

The approved methodology also draws upon:
Version 05.2 of the "Tool for demonstration and assessment of additionality";
Version 02 of the "Tool to calculate the emission factor for an electricity system";
Version 03 (EB 51, Annex 58) of the "Guidance on the Assessment of Investment Analysis"; and
Version 2.2 of the "Combined tool to identify the baseline scenario and demonstrate additionality"

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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Justification of the choice of methodology

The project activity is Grid connected renewable power generation and meets the applicability conditions of the chosen methodology as follows:

Conditions in the methodology	Applicability
The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The proposed project activity is the installation of a new run of river grid connected hydroelectric project. Thus, it fulfils the first applicability condition.
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use option 2: on page 10 to calculate the parameter $EG_{PJ,y}$) the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the	As mentioned above, the project activity is a new run of the river project and does not entail capacity additions, retrofits or replacements.

implementation of the project activity.	
In case of hydro power plants: - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir. - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section is greater than 4 W/m^2. - The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The proposed project activity involves a small new reservoir of 588400[3] m^2 surface area at full reservoir level. It however has a power density of 1699.52 W/m^2 and is thus satisfying this applicability criterion in the methodology.
The methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	The implementation of proposed project activity does not involve switching from fossil fuels to renewable energy at the project site. Hence, this applicability condition is also satisfied.
The methodology is not applicable to Biomass fired power plants	This condition is also satisfied as the proposed project is a run of river hydro electric project.
The methodology is not applicable to Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.	The proposed project activity envisages a power density of 1699.52 W/m^2 and is thus found to satisfy this condition.

This baseline methodology has been used in conjunction with the approved monitoring methodology ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 12.1.0).

B.3. Description of the sources and gases included in the project boundary:

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ACM0002 specifies that the project boundary will be:

The **spatial extent** of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The proposed project would be feeding the electricity in the Northern regional grid, managed by Northern Region Electricity Board (NREB) and Northern Region Load Dispatch Centre (NRLDC) which constitutes eight states (viz. Jammu & Kashmir, Himachal Pradesh, Delhi, Haryana, Punjab, Uttar Pradesh, Uttaranchal and Rajasthan) and one Union territory (Chandigarh). The proposed project would have marginal impact on all the generation facilities in the Northern grid. Thus all the power generation

[3] The surface area of the reservoir has been calculated from the Area Capacity Curve. The same has been provided to DOE during validation.

facilities connected to this grid form the project boundary for the purpose of baseline estimation. The Northern grid is also connected with other regional grids, however, the net exchange of energy within the regional grids is very small, and thus the other regional grids are not included in the boundary (however, for conservative and accurate estimation, the imports of electricity from other regional grids has been included in the baseline calculation).

The project activity has a distinctive physical demarcated boundary.
The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table below:

Overview on emission sources included in or excluded from the project boundary				
	Source	**Gas**	**Included ?**	**Justification / Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam.	CO_2	No	The project activity is a run of the river hydroelectric project and not a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	The project activity is a run of the river hydroelectric project and not a solar thermal or a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH_4	No	
		N_2O	No	

	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	The power density of the project activity is 1699.52 W/m^2. Since the power density of the project is greater than 10 W/m^2 the project activity emissions are not required to be estimated and are taken as zero.
		CH_4	No	
		N_2O	No	

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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As the project activity is the installation of a new grid-connected hydro power plant/unit, as per ACM0002, Version 12.1.0, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (Version 02) described step wise under section B.6.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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As per the decision 17/cp.7, paragraph 43, a CDM project activity is additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in absence of registered CDM project activity. The methodology requires the project proponent to determine the additionality based on 'Tool for the demonstration and assessment of additionality', Version 05.2. The step-wise approach to establish additionality of the project activity as per the additionality tool is provided below.

Prior Consideration of CDM:

"Guidance on the demonstration and assessment of prior consideration of the CDM" (EB49, Annex 22), states that for project activities with a start date before 2nd August 2008, for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, the serious consideration of CDM in the decision to proceed with the implementation of the project activity is to be demonstrated. The following elements demonstrate project proponent's serious consideration of CDM:

a) During the project evaluation in June 2003, the JKHCL Board considered the necessity of CDM funds to mitigate various risks associated with the project activity. The minutes of the meeting of the Board of Directors of JKHCL held on 2nd June 2003 clearly state that the CDM revenues were essential to mitigate various risks inherent to the project activity. Subsequent to the in principal decision to take up the project for further evaluation and mandatory clearances, JKHCL entered into

a contract with their group company Jaiprakash Associates Limited (JAL) for the in-house engineering, procurement and construction of the proposed project activity on 9th July 2003 with a condition that the contract would come into force only after the company issues a notice to proceed, while JKHCL continued efforts to obtain clearances for the project activity. Notwithstanding award of the contract, no progress on implementation i.e. construction or real action of the project activity could commence before accordance of the Environmental and Forest Clearances. However, the project proponent had already appointed a consultant to begin work on CDM baseline and methodology preparation for the project and the progress towards the same is provided in the table below.

Further, it needs to be emphasized that there was practically no progress in the implementation of the project for the next 2 years which is clearly brought out in various minutes of the meetings of the Board of Directors of JKHCL between June 2003 and October 2005.

b) During this period the persistent risk to the proposed project activity due to floods became highlighted due to damage and losses from a flood in June 2005 suffered by the downstream Nathpa Jhakri project. This was the second of Landslide Lake Outburst Flood (LLOF) resulting in extensive damage experienced in the region and was attributed to Pareechu Lake. These two floods occurred in close succession to one another with the first occurring in July 2000, closely followed by a second LLOF occurring in June 2005[4].

The average daily discharge during June 2005 increased continuously from 112 m^3/s to 270 m^3/s up to mid-June. From mid-June onward the discharge increased exponentially causing a flash flood in the entire Satluj valley on 26th June. This flash flood was caused by failure of the landslide dam that was formed due to the blockade of the Pareechu stream, a tributary of Spiti River by a landslide that occurred during July 2003. This landslide blocked the river and created a natural dam. The breaching of the landslide dam responsible for the formation of the lake resulted in a massive amount of water being released, threatening inhabitants and damaging buildings downstream, such as the Nathpa Jhakri hydro electric project. There were three hydroelectric projects operating in the valley at the time, namely Nathpa Jakhri Hydel Project (1,500 MW), Sanjay Jal Vidyut Hydel Project (300 MW), and Baspa Stage II Hydel Project (330 MW). During and immediately after the flood, these projects were closed for 45 days as the silt content in the water exceeded the 5,000 ppm permissible limit thus resulting in a revenue loss of about US$ 144 m[5]. The proposed project activity could also face similar risk of damage and loss of generation which was an area of serious concern for the project proponent. Thus, the project proponent realized that the risk associated with Pareechu is a prolonged one and will remain for a long period during the operational lifetime of the project.

c) In the meeting of the Board of Directors of JKHCL held on 26th October 2005, it was resolved to issue the notice to proceed with the implementation of the project activity (decision to proceed) aided by the potential revenues from CDM upon receipt of Environment & Forest clearances. It was considered that with the reduction in assured returns on equity by CERC in tariff fixation and on account of various risks inherent to the project activity (experienced by the downstream Nathpa Jhakri project), the CDM revenues were essential for the viability of the proposed project activity.

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[4] "*Impact of Trans-Himalayan Landslide Lake Outburst Flood (LLOF) in the Satluj catchment, Himachal Pradesh, India*"- Vikram Gupta and M.P. Sah; www.springerlink.com/index/g194104x15202547.pdf

[5] [5] "*Impact of Trans-Himalayan Landslide Lake Outburst Flood (LLOF) in the Satluj catchment, Himachal Pradesh, India*"- Vikram Gupta and M.P. Sah; www.springerlink.com/index/g194104x15202547.pdf

Thus, the minutes of this meeting clearly demonstrate that the decision to proceed with the implementation of the project activity was accorded only after serious consideration of CDM benefits.

d) The continuing and real actions that were taken to secure CDM status for the project in parallel with its implementation is detailed below:

Activity	Date	Reference
"Site clearance" approval from MOE&F[6]	14/09/2001	Letter from MOE&F dated 14/09/2001
"In-principle approval" for diversion of 167.4247 ha of forest land from MOE&F[7]	21/11/2002	Letter from MOE&F dated 21/11/2002
Minutes of the meeting of Board of Directors of JKHCL discussing risks associated with the project activity and availability of CDM revenues to mitigate such risks.	02/06/2003	Extract of the Board resolution dated 02/06/2003
JKHCL awarded the EPC contract to the group company JAL with the condition that the contract would come into force only after the company issues a notice to proceed	09/07/2003	EPC Contract dated 09/07/2003
Offer from Consultant for providing CDM related services specifically for Baseline Methodology and PDD preparation.	24/11/2003	Letter dated 24/11/2003 from Director of EQMS to JKHCL
Appointment of Consultant with the initial scope of Baseline and Monitoring Methodology preparation	05/01/2004	Appointment letter dated 05/01/2004 from JKHCL to EQMS
Notification of the Central Electricity Regulatory Commission (CERC) (Terms and Conditions of Tariff) Regulations, 2004	26/03/2004	CERC website
Communications between Consultant and JKHCL illustrating the progress in work on scope of assignment and preparation of methodology	06/04/2004 – 10/09/2004	Letters dated 06/04/2004, 21/04/2004, 04/06/2004 and 10/09/2004
Approval of Approved Consolidated Baseline and Monitoring methodology for grid connected renewable energy generation projects (ACM0002)	03/09/2004	Minutes of the meeting of the CDM Executive Board held from 1st to 3rd September 2004
Presentation by Consultant to JKHCL on the applicability of ACM0002 to JKHCL project	25/10/2004	Letters dated 15/09/2004 and 27/09/2004

[6] Site clearance approval is not Environmental clearance. It only permits to survey the site and collect necessary data for preparing EIA and EMP reports.

[7] In principle clearance is not final approval and final approval was received only in November 2005

Completion of Stage I of the contract and request for notice to proceed with the preparation of PDD as Stage II	15/12/2004	Letter from EQMS to JKHCL dated 15/12/2004
JKHCL informed EQMS of pending Environmental Clearance and consequent inability to issue notice to proceed	21/01/2005	Letter from JKHCL to EQMS dated 21/01/2005
Proposal from Consultants Emergent Ventures India Pvt. Ltd. (EVI) for PDD preparation to JKHCL	18/02/2005	EVI Proposal dated 18/02/2006
Landslide Lake Outburst Flood (LLOF) due to Pareechu Lake breach resulting in damage and loss of generation at Nathpa Jhakri project downstream of proposed project activity	26/06/2005	Nathpa Jhakri management presentation http://sjvn.nic.in/pdf/cmd-presentation.pdf
Consent to Establish the Project granted by Himachal Pradesh Government (HPSEP & PCB)	08/08/2005	HPSEP&PCB/J.P. Karcham Wangtoo HEP -Kinnaur/2005-9217-34
Minutes of the meeting of Board of Directors of JKHCL in which the decision to proceed with the implementation of the project activity considering benefits from CDM was taken. **(Implementation decision)**	26/10/2005	Extract of the minutes of meeting of the Board dated 26/10/2005
Environment Clearance granted by Government of India Ministry of Environment & Forests (MoEF)	09/11/2005	MoEF approval dated 09/11/2005
Diversion of Forest land Clearance granted by Government of India, Ministry of Environment & Forests (MoEF) for diversion of forest land	17/11/2005	MoEF letter dated 17/11/2005
Issue of Owner's notice to proceed by JKHCL to the EPC contractor M/s JAL for starting the project activity post receipt of Environment Clearance	17/11/2005	JKHCL/EPC-JAL/05
Start of construction/civil works at site (**Project Activity Start Date**)	18/11/2005	1. JKHCL/EPC-JAL/05 2. Second supplementary implementation agreement for Karcham between the Governor of Himachal Pradesh and JKHCL
Letter from EQMS to JKHCL for starting the work on Stage II i.e. preparation of PDD, since the environmental clearances were in place.	05/12/2005	Letter dated 05/12/2005 from EQMS
Response from JKHCL to EQMS with respect to review of CDM internally and cancellation of further work related to CDM from EQMS	25/01/2006	Letter dated 25/01/2006 from EQMS
Signing of Power Purchase Agreement between PTC India Limited and JKHCL	23/03/2006	PPA dated 23/03/2006

Financial Closure for the project (with ICICI as the Lead Bank)	30/03/2006	ICICI Letter dated 30/03/2006
Meeting with reputed CDM consultants who had already registered projects with UNFCCC	June-September 2006	Meetings
Draft engagement letter from another reputed CDM consultant to JKHCL for finalisation of commercial terms and conditions to prepare PDD	09/11/2006	Email communication dated 09/11/2006
Singing of engagement letter - Appointment of reputed CDM consultant	03/05/2007	Engagement letter dated 03/05/2007
Appointment of Sharnam Seva Samiti for Social Audit (Stakeholder Consultation) for the CDM project	22/09/2007	Offer Letter dated 22/09/2007
Agreement for supply of Hydraulic turbines, governing system and spherical valves between JAL and VA Tech Escher WYSS GmBH	29/11/2007	JAL/KW/01-A/2007
Invitation of bids for validation from DOE	25/02/2008	Email Communication dated 25/02/2008
Presentation before DNA for HCA	17/03/2008	MoEF Invitation Letter
Letter of Host Country Approval for the project activity from NCDNA-MoEF	09/04/2008	Letter of approval dated 09/04/2008
Appointment of TUV NORD as validator	13/05/2008	
Sanction of land for the construction of project activity	26/08/2008	Letter from Deputy Commissioner, Kinnaur District, HP dated 26/08/2008
Public availability of the project for Global Stakeholder Process	21/10/2008	http://cdm.unfccc.int/Projects/Validation/DB/AXQUEOEK24GAUPJEOTASUR6N07X1M5/view.html
Expected commissioning of all 4 units x 250 MW	17/11/2011	

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Since the approved methodology applied for the proposed CDM project activity (ACM 0002) prescribes the baseline scenario, no further analysis of the alternatives is required. Thus, the project proponent is left with only two alternatives viz.:

Alternative 1: Proposed project activity undertaken without CDM
Construction of a new renewable run of the river hydroelectric project connected to the regional grid, implemented without considering CDM revenues. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline. However, in absence of CDM revenue it would have been difficult for the project proponents to implement the project activity on account of the lower returns as demonstrated in the investment analysis (please refer Step 2) and number of operational and technological barriers faced by the project activity (please refer to *Step 3: Barrier Analysis* in the same section of this document for details on the barriers faced). Hence it cannot be a part of the baseline scenario.

Alternative 2: No project activity
No project activity and equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity addition to the grid i.e. the baseline scenario.

As a result of the impressive growth attained by the Indian Power Sector, the installed capacity has gone up from mere 1,713 MW in 1950 to 132,329 MW as on 31.03.2007[8], consisting of 86,015 MW Thermal, 34,654 MW Hydro and 3,900 MW Nuclear.

Table 1: All India Installed Generation Capacity[9]

Region	**Hydro**	**Thermal**				**Nuclear**	**Renewable**	**Total**
		Coal	**Gas**	**Diesel**	**Total**			
Northern	13000.38	18027.50	3323.19	14.99	21365.68	1180.00	813.37	36359.43
Western	6918.83	22441.50	5820.72	17.48	28279.70	1840.00	1874.76	38913.29
Southern	11071.71	16172.50	3586.30	939.32	20698.12	880.00	4971.55	37561.38
Eastern	2496.53	14149.88	190.00	17.20	14357.08	0.00	46.76	16900.37
N.Eastern	1221.07	330.00	771.50	142.74	1244.24	0.00	48.91	2514.22
Islands	5.25	0.00	0.00	70.02	70.02	0.00	5.25	80.52
All India	34653.77	71121.38	13691.71	1201.75	86014.84	3900.00	7760.60	132329.21

It is evident that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India.

[8] CEA Annual Report 2006-07 Annexure – 10B All India Installed Capacity Page 187

[9] CEA Annual Report 2006-07 Annexure – 10B All India Installed Capacity Page 187

As is evident from the above table, the installed capacity of the Northern region grid (as on 31.03.2007) is 36359.43 MW[10]. Almost 59%[11] of the total installed capacity in Northern grid is constituted by thermal installations including coal, gas and diesel based generating stations. For the financial year 2006-07, there has been 8.51%[12] increase in maximum energy demand over the previous year. The annual energy shortage in the northern grid has been about 60.54[13] MU/day i.e. 10.91%[14] and a peaking shortage of 18.28 %[15] during the year 2006-07.

Currently, India faces severe power shortages (9.60% in 2006-07, and 13.8% during peak hours[16]), which translate into a substantial loss to the economy. India will require an additional 100,000 MW of generating capacity by 2012, even with a significant pace of loss reduction and enhanced efficiency gains, to continue with its current growth trajectory and to provide universal access to electricity. A continuation of the baseline scenario will ensure that the resulting increased demand-supply gap for electricity will be filled up by development of additional coal fired power stations (the fuel of choice given India's abundant coal reserves) during off-peak time and small diesel or coal fired plants during peak time[17].

Outcome of Step 1a:
The baseline scenario therefore is Alternative 2 or *status quo*, i.e., generation of power by grid-connected power plants through expansion of existing projects or setting up new power plants.

Sub-step 1b. Enforcement of applicable laws and regulations:

Both the above alternatives are in compliance with all applicable legal and regulatory requirements.

The implementation of project activity is a voluntary initiative and it is not mandatory or a legal requirement. For power generation, the Electricity Act 2003 does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of hydro energy and there is no legal requirement on the choice of a particular technology.

Outcome of Step 1b:

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[10] CEA Annual Report 2006-07 Annexure – 10B All India Installed Capacity Page 187

[11] CEA Annual Report 2006-07- Calculated from Annexure – 10B All India Installed Capacity Page 187

[12] NRPC Annual Report 2006-07- Calculated (i.e. (31516-29044)/29044) from Page 3- http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.2.pdf

[13] NRPC Annual Report 2006-07- Page 3- http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.1.pdf

[14] NRPC Annual Report 2006-07- Page 3 -http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.1.pdf.

[15] NRPC Annual Report 2006-07- Calculated ((31516-26644)/26644) from Page 3- http://nrpc.gov.in/Reports/ar06-07/Chapter2/Annex2.2.pdf

[16] CEA Annual Report 2006-07, Note "From the Chairperson"

[17] Article 6.7, Executive Summary of Environmental Assessment for Rampur Hydropower Project in Himachal Pradesh, India - http://sjvnindia.com/projects/rampurpdf/final-executive-summary.pdf

Thus, considering that the baseline scenario is in line with the applicable legal and regulatory requirements, the continuation of current practise where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions is the chosen baseline scenario which would have happened in the absence of the proposed project activity.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

As the electricity generated from the project activity will generate financial benefits in terms of revenues from the sale of electricity units. Therefore simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

Between the other two options – investment comparison analysis (option II) and benchmark analysis (option III), benchmark analysis has been adopted in accordance with the Guidelines on the Assessment on Investment Analysis (Annex 58, EB 51) wherein the Project Internal Rate of Return (IRR) of the project activity has been used as a financial indicator to assess the financial attractiveness of the project activity. The objective of the analysis under Option III is to assess whether the project's returns are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the crediting period of the project.

Sub-step 2b (Option III) - Apply benchmark analysis
The financial indicator chosen for the project activity is the Project Internal Rate of Return. Project IRR has been calculated based on project cash outflows and cash inflows only, irrespective of the source of financing. Considering the fact that the project is funded by a debt equity mix, project IRR has been considered as most appropriate financial indicator as it reckons the return on both the sources. Financial and economic theory holds that a firm must expect an after-tax project IRR on the funds it invests that is at least sufficient to induce investors to purchase and hold the firm's debt and equity. In assessing the viability of a project, a firm should theoretically only invest in the project if the project IRR is greater than the weighted cost of debt and equity. The "Guidance on the Assessment of Investment analysis", (EB 51, Annex 58) Paragraph 12 states that "*Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*".

The guidance also states that *"In the cases of projects which could be developed by an entity other than the project participant the* ***benchmark*** *should be based on publicly available data sources which can be clearly validated by the DOE. Such data sources may include local lending and borrowing rates, equity indices, or benchmarks determined by relevant national authorities."*

Weighted Average Cost of Capital (WACC) has been chosen as the benchmark for assessment against the project IRR. The WACC methodology, as described below is a widely accepted method for calculating the cost of capital which is understood by both the finance community and the industry. WACC has been calculated by taking the respective proportion of debt and equity in the financing pattern as weights. The benchmark for the project has been derived based on the cost of equity financing representing the required return on capital by equity investors and the cost of debt financing representing required rate of return on capital by the creditors as illustrated below:

WACC = [D/ (D+E)]*[Cost of Debt] + [E/ (D+E)]*[Cost of Equity]

Of the examples suggested by the additionality tool, the project proponent has identified the *Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type* [paragraph 6(a) of sub-step 2b)] as the cost of equity. The appropriate cost of debt has been taken as the *Prime lending rate* prevailing at the time of investment decision in accordance with "Guidance on the Assessment of Investment analysis", (EB 51, Annex 58). The same has been adjusted to tax rate in order to serve as a benchmark comparable to post tax IRR computations.

Cost of Debt:
Cost of debt is defined as the rate at which lenders agree to lend money to a project. The additionality tool and the guidance to investment analysis clarify that the benchmark for projects with more than one potential developer should not be based on project specific parameters but should represent the standard in the market. Accordingly, the Reserve Bank of India prime lending rate prevailing at the time of project start date has been considered as the cost of debt. The prime lending rate at the time of investment was in the range of 10.25% - 10.75% [Source Reserve Bank Web-link][18], the average PLR of 10.50% has thus been considered as appropriate cost of debt.

The post tax cost of debt therefore works out to: 10.50% * (1-8.415%) = **9.616%**

Calculation of Required rate of return on Equity:
Government bond rates, increased by a suitable risk premium to reflect private investment and/or project type, which is nothing but CAPM has been used to compute the cost of equity. This is in conformity with the recommendation of EB vide paragraph 6(a) of step 2(b) of Additionality Tool. Return on equity has been computed using the formula:

$Ke = Rf + \beta \times (Rm - Rf)$

Where:

Ke	= Rate of return on equity capital;
Rf	= Risk-free rate of return;
β (Beta)	= The stock's risk relative to that of the whole market;
Rm – Rf	= Market risk premium;

Risk free rate:
The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks. Therefore, the weighted average yield of Government of India Securities at the time of decision making are considered as risk free rate. This data is published by Reserve Bank of India. (Source: RBI).

The applicable risk free rate is 7.524%[19].

[18] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/66854.pdf

[19] http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/66774.pdf

Risk Premium:
The market risk premium, , is the premium above the risk-free rate of return that investors expect to earn on a well-diversified portfolio of securities. The most common approach for estimating the risk premium is to base it on historical data. In the CAPM, the difference between average return on stocks and return on government securities over an extended period of time as premium. It is preferable to use long term premiums, since considering shorter time periods can lead to large standard errors because of volatility in stock returns[20]. It is also preferable to calculate the risk premium based on geometric mean of the returns since arithmetic mean overstates the risk premium..

Therefore the risk premium has been calculated as the difference in compounded annual return between the broad well diversified market portfolio represented by BSE-500 index and the Government bond rates since the year of inception of BSE-500, i.e. February 1999. The detailed calculations are presented in the attached excel sheet.
Source: BSE Stock Exchange (www.bseindia.com)

The applicable risk premium is 10.29%.

Beta:
Beta (β) indicates the sensitivity of the company to market risk factors. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is hydro power generation; the approach therefore should be to base the beta for the project on the beta values of listed hydro power generation companies in India. However, in the absence of adequate data on companies which are exclusively functioning in the exact same type of business (i.e. hydro power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses. Therefore, we have considered beta values of all electricity generating companies in India.

The applicable Beta value has been determined on the basis of the Beta values of all power generating companies in India which were listed on the stock exchange at the time of this investment. However, at the time that JKHCL took the decision to invest in the project there were comparatively few companies listed which would be representative of the power sector. The following companies have thus been excluded due to lack of sufficient historical data as they were listed close to or after 26th October, 2005 (date of investment decision):

Sl. No.	Company	Date of Listing	Remarks
1.	Jaiprakash Hydro	18th April, 2005	Insufficient trading data available
2.	GVK Power	27th February, 2006	Listed post investment decision
3.	LITL	27th November, 2006	Listed post investment decision
4.	Torrent Power	28th November, 2006	Listed post investment

[20] page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran

			decision

Accordingly, the equity betas for the power sector companies considered provide an estimated beta for the power sector. Beta values of individual companies have been sourced from Bloomberg.

The table below summarizes the equity beta values:

Name	2 year Equity Beta as on 25/10/2005
Tata Power Co Ltd	1.326
Neyveli Lignite Corporation	1.480
CESC Limited	1.000
Gujarat Inds Power Co Ltd	1.447
Reliance Energy	1.170
NTPC Limited	0.979
BF Utilities Ltd	0.794

Source: Bloomberg[21]

The measured equity beta for a particular firm relates to the unique capital structure of that firm and that a change in the capital structure will change the degree of financial risk borne by the equity holders. Since financial leverage is a determinant of beta, it is necessary to un-lever beta to conform to the requirement of Guidance 15 of Annex 58, EB 51 read with paragraph 110(b) of the VVM. The beta has been unlevered with the following formula:

$\beta_{asset} = \beta_{equity} / (1+(1-t)*(D/E))$

Where β_{asset} corresponds to the un-levered β and the β_{equity} to the levered β.

The following table illustrates the asset beta values of the companies estimated using the above formula:

Company Name	Asset Beta (Unlevered)	Market Cap (Rs. Cr.)
Tata Power Co Ltd	0.91	7890.71
Neyveli Lignite Corporation	1.33	11743.97
CESC Limited	0.44	1675.62
Gujarat Inds Power Co Ltd	0.62	771.79
Reliance Energy	0.75	10563.48
NTPC Limited	0.73	79527.49
BF Utilities Ltd	0.54	1616.18
Total		116390.7
Weighted Average Beta	0.80	

[21] The beta value used, are the regression betas calculated by Bloomberg based on periodic stock returns.

The asset betas have then been weighted against the market capitalization of companies as on 25th October 2005 to get a weighted average of 0.80.

Thus using the above values of risk free rate, market returns and weighted average beta, the expected rate of return on equity using CAPM works out to is **15.74**%.

Applicable tax rate:
The loan tenure of the project is 15 years, it may be noted that for the first 10 years, all power projects in India are required to pay Minimum Alternate Tax (as per section 80 IA of Income Tax Act) only. Accordingly the marginal tax rate has been considered as 8.415% (MAT rate for the year 2005-06).

The WACC is calculated as per the following formula:
WACC = [D/ (D+E)]*[Cost of Debt] + [E/ (D+E)]*[Cost of Equity]

The WACC thus estimated is equal to **11.45 %. (**Detailed calculations of WACC are explained in the Benchmark estimation excel sheet).

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):
The internal rate of return for the proposed project activity without CDM revenues was computed for 35 years of operational life and 6 years of construction period based on the following assumptions:

Description	Value	Reference
Capacity of the project	1000 MW	As per DPR and Techno Economic Clearance (TEC) by CEA
Total Capital Cost (Rs in million)	56000	Estimated Cost as evidenced by ICICI Bank letter
Debt – Equity Ratio	70:30	CERC
Debt (Rs in million)	39200	Estimated Cost as evidenced by ICICI Bank letter
Interest on Long Term Debt	10.5%	As per prevailing Prime Lending Rate (PLR) at the time of decision making
Interest on Working Capital	11%	SBI PLR as per CERC regulations
Equity (Rs in million)	16800	Estimated Cost as evidenced by ICICI Bank letter
Plant availability	95%	As per CEA Guidelines

Gross Generation (GWh/year)	4463.88[22]	The figure has been arrived at after considering mandatory environmental releases of 6.8 cumecs from the TEC (CEA) figure, as stipulated in the environmental clearance for the project.
Hydrology (% Dependability)	90 %	As per TEC by CEA
O & M Cost including Insurance	1. 5 % of project cost	As per CERC terms and conditions of tariff, 2009.
Income tax rate	33.66 %	As per Finance Act 2005. This rate was prevalent at the time of investment decision.
MAT	8.415 %	As per Finance Act, 2005. This rate was prevalent at the time of investment decision
Auxiliary Consumption	0.7 %	As per CERC Guidelines 2009
Transformation Losses	0.5 %	As per CERC Guidelines, 2009
Return on Equity	14 %	CERC – Terms and conditions of tariff, 2009.
Free Power to State Government For first 12 years Beyond 12 years	 12% 18%	As per Implementation Agreement with the HP Government, 1999
Primary Energy Rate	0.7379	Northern Region Electricity Board letter dated 29/07/2005
Escalation in Primary Energy Rate per annum	6.07%	Calculated as average yearly increase from previous years (based on Wholesale Price Indices of "Electricity" published by Office of Economic Advisor,India)

At the time of investment decision, the project activity was envisaged to export the entire electricity generated to the regional electricity grid under a PPA, in accordance with the CERC guidelines. However, at a later date, the alternative of selling a part of the electricity in the open market was

[22] The generation has been determined by the project participants based on hydrological studies and historical data. The same figure was submitted to the government (Central Electricity Authority) while applying the project activity for implementation approval (techno economic clearance). Thus this figure is in compliance with EB48, Annex 11

explored. JKHCL entered into a long term PPA with PTC to purchase 70.4% of the installed capacity (704 MW) at the CERC regulated tariff. It retained the option of sale of 20% of the Saleable Energy during the first 12 years of operation and approximately 14% thereafter in the open market.

The tariff from merchant power sale applicable at the time of investment decision is calculated as follows:
Percentage volume (in FY 04-05) of electricity traded by trading licencees and its sale price is[23]:

Sale Rate (taken average) in Rs/Unit[24]	%age Volume (FY 04-05)
0.50	0.00%
1.50	10.21%
2.50	87.61%
3.50	2.18%
4.50	0.00%
5.50	0.00%
6.50	0.00%

Weighted Average Rate – INR 2.42 per unit

Annual Energy escalation is calculated by taking average yearly increase from previous years based on Wholesale Price Indices of "Electricity" published by Office of Economic Advisor, India[25]:

Financial Year	**2005-2006**	**2004-2005**	**2003-2004**	**2002-2003**	**2001-2002**	**2000-2001**	**1999-2000**	**1998-1999**	**1997-1998**	**1996-1997**	**1995-1996**
Index	263.4	253	248.8	238	224.8	200	168.9	157.2	151.8	133.5	127.8
Yearly %age increase		4.11 %	1.69 %	4.54 %	5.87 %	12.40 %	18.41 %	7.44 %	3.56 %	13.71 %	4.46 %

Percentage average increase – 6.07%

Using above average escalation rate, the rate applicable in the year 2011-12 will be INR 3.66 per unit.

The transmission cost has been taken as INR 0.33[26] per unit and the trading margin has been estimated to be INR 0.06 per unit using the data referred from CERC Annual Report 2005-06[27].

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[23] http://cercind.gov.in/Electric-Trading/priceanalysis.pdf

[24] The referred source provides price information with a class interval. Mid point has been taken here as per accepted convention in order to arrive at the weighted average price

[25] http://eaindustry.nic.in/indx_download_9394/yearlyf.xls

[26] Levelized tariff for 35 years, payable as transmission charge to the transmission utility by JKHCL. Backup sheet for the same has been submitted to DOE. This has been provided by power utility in line with Chapter 4 (Interstate

Thus the ex bus tariff applicable for sale in the open market after commissioning of the project activity at the time of investment decision after deducting the transmission cost and trading margin has been estimated to be INR 3.27 per unit. The same has been used in the IRR calculations. Considering the electricity forecast made by CEA in its 17th Electric Power Survey Report[28] that by 2011-12, the electricity requirements will be met in full, it is reasonable to assume that the merchant power will have a stabilised rate thereafter.

At the time of conceptualization of the project, the concept of open market sale in the country was in a nascent stage. The project proponent also did not have any experience in operation of merchant power plants. With no assured buyer, there is no guarantee for off taking of the output. Also, with the project activity being a hydel power project, 73% of the generation would happen between the months of May to September. If there is no spot demand for such power during these months, such power would need to be supplied to the grid for no additional revenues.

Thus although the provision for sale in open market was not contemplated at the time of investment decision, the same has been incorporated to be conservative while demonstrating project returns.

The IRR of the project activity without considering CDM benefits has been estimated to be **9.80** % which is lower in comparison to benchmark WACC of 11.45%.

Sub-step 2d. Sensitivity analysis

In accordance with the guidance on the assessment of investment analysis, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. The results of the sensitivity analysis are given hereunder:

Table: Results of Sensitivity Analysis

Parameters	**10%**	**Base Case**	**-10%**	**Comments**
Project Cost	9.56%	9.80%	10.14%	The IRR remains lesser than the benchmark even after an unanticipated

Transmission) of the CERC (Terms and Conditions of Tariff) Regulations, 2004 (Please refer Page 53 to Page 61 for tariff determination method) which were applicable at the time of investment decision. The power will be transmitted from project site in Himachal Pradesh to Abdullapur in Haryana where it will be fed into grid.Hence inter state tariff regulation is used for determination of transmission charges.

[27]Para-7.2, Page 64 http://cercind.gov.in/13042007/Ann_Rep-2005-06.pdf

[28] Page 45, Report on Seventeenth Electric Power Survey of India, CEA, March 2007

				reduction in capital costs by 10%.
Merchant Power Tariff	10.10%	9.80%	9.54%	An increase in the merchant power tariff of 10% yields an IRR lesser than the benchmark.
O&M Costs	9.63%	9.80%	9.98%	A decrease in O&M costs is not anticipated. However, even with a 10% decrease in these costs, the IRR remains lesser than the benchmark.
Return on Equity (for 15.5%)		10.11%		Even though 15.5% return on equity is not applicable to the proposed project activity for the determination of tariff as per the conditions of the PPA, nevertheless the IRR in this case still remains lesser than the benchmark.
Generation	10.81%	9.80%	8.80%	Even though the sensitivity analysis considers a 10% increase in generation, this scenario is not likely to occur. **An increase in generation is not likely to exceed 5% in the project context, which would result in an IRR of 10.29%, which remains lesser than the benchmark**.

The results of the sensitivity analysis as presented in the table above, confirms that the project IRR remains below the benchmark (i.e. 11.45%) even after reasonable variations in the critical assumptions.i.e. the returns from the project activity without CDM revenues remains lower than returns that would make the project economically attractive for the investors.

The project activity has been found sensitive to the following critical parameters:

1. Project Cost - The capital cost of the project activity mainly comprises of the cost of plant and machinery and the civil works. Further, as on July 2011 the actual expenditure incurred has already exceeded the projected capital cost of Rs. 56000 million used for financial analysis by over 10%.. The increase in capital cost will imply an increase in the equity percentage of the project cost which will not be accounted for in the tariff estimation in the merchant sale and will have to be borne by the project proponent.

2. Generation - The amount of electricity generated from a hydroelectric power project is dependent, interalia, on various hydrological factors. Since the project activity is a run-of-the-river hydroelectric project, the energy generation is mostly dependent on the river flows. The design energy generation has been assessed based on 90% dependable year flows with 95% machine availability in accordance with the CERC guidelines. The same principle was considered by the Central Electricity Authority, Govt. of India for estimation of design energy in the Techno-Economic Clearance (TEC) for implementation of the project activity.

It has been experienced from the operation of the run-of-the-river hydro power stations on the same river in the vicinity of the project activity, that the average of annual energy generation does not exceed even 5% above the design energy although in some years with high flows, the actual energy generation for that year may exceed design energy by 10% or so. An analysis has been conducted in respect of 1500 MW Nathpa Jhakri HEP (in public sector owned by Satluj Jal Vidyut Nigam Ltd., a Joint Govt. of India and Govt. of H.P. undertaking) which is an immediate downstream development on the same river as the project activity. The study for the actual average annual energy generation in the six years of operation from commissioning in 2003-04 to 2008-09 indicates that only 85.44% of the design annual energy generation was achieved. The actual and design energy data for the same is provided in the table below:

Nathpa Jhakri Project				
Year	**Energy Generation (MU)**			**Reference to Publication (for actual generation)**
	Design Energy	**Actual**	**%age w.r.t Design Energy**	
2003-04	1231 (adjusted for part year)	1121	91.1	Review of Performance of Hydro Power Stations 2003-04 (CEA, MoP, Govt. of India)
2004-05	6612	5109	77.3	Review of Performance of Hydro Power Stations 2004-05 (CEA, MoP, Govt. of India)
2005-06	6612	4054	61.3	Review of Performance of Hydro Power Stations 2005-06 (CEA, MoP, Govt. of India)
2006-07	6612	6001	90.8	Review of Performance of Hydro Power Stations 2006-07 (CEA, MoP, Govt. of India)
2007-08	6612	6404.58	96.9	Review of Performance of Hydro Power Stations 2007-08 (CEA, MoP, Govt. of India)
2008-09	6612	6608.76	99.95	Review of Performance of Hydro Power Stations 2008-09 (CEA, MoP, Govt. of India)
Average from Year 2003-04 to 2008-09	**5715.17**	**4883.06**	**85.44**	

Note: *Design Energy approved as 6612 MU by CEA during June, 2009 in place of 6951 MU approved earlier during design review carried out in October, 2002. Reference: Letter from Central Electricity Authority (CEA) dated 7/07/2009 to SJVNL*

Further, an analysis of actual average annual energy generation in respect of immediately upstream 300 MW Baspa – II HEP (in Private Sector owned by M/s. Jaiprakash Power Ventures Ltd.) on river Baspa which joins the river Satluj in Karcham dam reservoir has been carried out. The study conducted since operation for the last 6 years from 2003-04 to 2008-09 indicates that the average actual annual generation achieved is 101.4% of the design annual energy generation. The data for the actual and design energy generation is presented in the table below:

Baspa – II Project				
Year	**Energy Generation (MU)**			**Reference to Publication (for actual generation)**
	Design Energy	**Actual**	**%age w.r.t Design Energy**	
2003-04	1193 (adjusted for part year)	1112	93.21	Review of Performance of Hydro Power Stations 2003-04 (CEA, MoP, Govt. of India)
2004-05	1213	1193	98.35	Review of Performance of Hydro Power Stations 2004-05 (CEA, MoP, Govt. of India)
2005-06	1213	1167	96.20	Review of Performance of Hydro Power Stations 2005-06 (CEA, MoP, Govt. of India)
2006-07	1213	1315	108.44	Review of Performance of Hydro Power Stations 2006-07 (CEA, MoP, Govt. of India)
2007-08	1213	1280.84	105.6	Review of Performance of Hydro Power Stations 2007-08 (CEA, MoP, Govt. of India)
2008-09	1213	1291.9	106.50	Review of Performance of Hydro Power Stations 2008-09 (CEA, MoP, Govt. of India)
Average from Year 2003-04 to 2008-09	**1209.7**	**1226.6**	**101.4**	

Note: *Design Energy is the generation in MU in a 90% dependable year with 95% machine availability as per TEC by the CEA, GoI.*

Reference: www.hperc.org

This study clearly shows that the increase in average actual annual energy generation over and above design annual energy generation is most likely to remain below 5% and such an increase by 10% is not likely to occur in the context of the project activity. The sensitivity analysis for determining IRR, therefore, has been conducted considering range in generation variation by +5% and -10% which is the scenario with most likelihood of occurrence. However, as per the 'Guidance on the Assessment of Investment Analysis', the sensitivity analysis has also been conducted covering the recommended +10% and -10% range of variation in generation as well.

Further, the change in IRR corresponding to the variation in generation is primarily due to the sale of some portion (29.6%) of power through merchant route. Since the tariff for merchant power is fixed and does not get adjusted for variation in generation like CERC tariff, hence there is a change in project returns and corresponding change in IRR with variation of generation.

3. Merchant Power Tariff – As stated above, the project proponent entered into a long term PPA with PTC to purchase 80% of the saleable energy (704 MW) at the CERC regulated tariff based on CERC (terms and conditions of tariff) guidelines 2004. This portion of the tariff gets adjusted on variation in energy, capital costs, operation and maintenance costs etc to give a 14% fixed return on equity. However, since the project proponent has the option of sale of 20% of the Saleable Energy during the first 12 years of operation and approximately 14% thereafter in the open market, a sensitivity analysis is being done on this portion of the tariff. It is worthwhile to mention that the level of this tariff is highly uncertain and depends on the availability of power, its demand and its shortages. There is no guarantee that the project proponent will be able to find any off-taker for the portion of electricity proposed to be sold in the open market. In such a scenario, the project proponent may have to supply the power to the grid for free and face monetary losses. Taking into account a large number of power plant capacity additions planned in the next five year plan (which constitutes mega and ultra mega power plants of huge capacity), the price for electricity is going to be competitive, which may even result in reduction in merchant power tariffs. Thus a +10% and -10% variation in the tariff applicable for merchant sale is reasonable in the project context and has been considered in the sensitivity analysis.

4. O&M Costs – The O&M costs constitute about 1.5% of the total project cost. However, since the project activity has a significant lifetime, these costs will increase over time due to wear and tear of equipments and civil structures. The IRR study incorporates the escalation in these costs every year based on the CERC regulations. A 10% variation over and above this provision is thus considered a reasonable assumption.

5. Return on Equity (for 15.5%) – The decision to implement the proposed project activity was taken on 26/10/2005 and the PPA with PTC for major portion of annual generation was signed on 21/03/2006. The applicable guidelines for the determination of tariff were CERC (terms and conditions of tariff) guidelines 2004 which stipulate a return on equity of 14%. However, this rate has been revised to 15.5% in the subsequent guidelines which although are not applicable to the proposed project as per the conditions of the PPA, nevertheless, its impact on the project returns has been estimated and incorporated in the sensitivity analysis.

Outcome of Step 2:
It can be justifiably concluded that the CDM revenues which the project activity would generate through sale of the emission reductions is very crucial to sustain the operations of the project activity. The returns from the project after considering CDM revenues give a project IRR of 11.54%. Thus, with CDM benefits the project becomes financially attractive in as much as the project IRR crosses the benchmark.

Hence the project is additional.

Step 3: Barrier Analysis:

Sub-step 3a: Identify barriers that would prevent the implementation of the type of the proposed project activity

The project proponent has not opted for Barrier Analysis to demonstrate additionality for the project activity.

Step 4: Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:

The re-assessment studies of hydro-electric potential of the country, completed by CEA in 1987[29], have assessed the economically exploitable hydro power potential as 84,044[30] MW at 60% load factor. As on 31.03.2007, the hydro-electric schemes in operation account for only 20.32% and those under execution for 5.18% of the total potential at 60% Load Factor. Thus, the bulk of the potential (74.50%) remains yet to be developed.

The All-India aggregate installed capacity of electric power generating stations under various utilities as on 31.3.2007 was 132329.21 MW comprising 34653.77 MW of hydro, 86014.84 MW of thermal, 3900 MW of nuclear and 7760.60 MW of Renewable Energy Sources (RES). The percentage share of hydro, thermal, nuclear and RES of the total installed capacity stood at 26.19[31]%, 65%, 2.95% and 5.86% respectively.

India has for many years faced severe power shortages. Currently, at the time of peak demand, power shortages are estimated to be about 12%, while annual energy shortages are nearly 7% of demand[32]. These shortages are likely to continue and increase in the foreseeable future, even with the planned additions in generation capacity. Analysis shows that the gap in supply (after considering the impact of price elasticity on demand) can be only marginally reduced by loss reduction and efficiency gains. The

[29] Paragraph 3.2, Preliminary Ranking Study of Hydro Electric Schemes published by CEA

[30] Paragraph 3.2, , Preliminary Ranking Study of Hydro Electric Schemes published by CEA

[31] Annexure 10(b), Page 187, CEA Annual Report 2006-07

[32] Ministry of Power Annual Report 2004-05 http://www.powermin.nic.in/reports/pdf/ar04_05.pdf

Government estimates that India[33] will require an additional 100,000 MW by 2012, if the country is to reach its year-on-year growth target of 8% and provide power to all households.

Besides these problems in overall generating capacity, the share of hydropower in the overall generation mix has been declining in recent years (refer table below); with the result that now hydropower constitutes only 25% of India's total generating capacity. Given the availability of abundant indigenous coal resources, relatively cheap coal-fired power stations are likely to continue to be the preferred generation alternative for years to come and thus implementing hydro power plants is clearly not the prevailing practice.

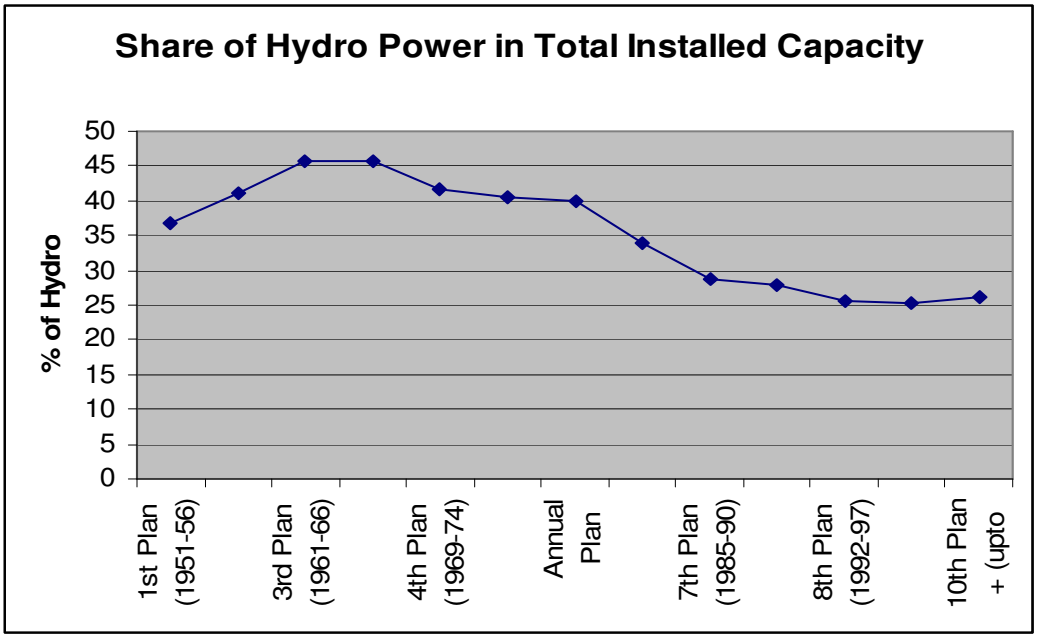
The following table shows the percentage share of hydro power during 1st to 10th plan (upto November 1, 2006[34]):

Table 10: Installed capacity and percentage of hydro power share in total installed capacity

Plan Period	**Capacity Addition during the Plan**	**Installed Capacity at the end of Plan (MW)**		
		Hydro	**Total installed Capacity**	**Hydro as % of Total Installed Capacity**
1st Plan (1951-56)	380.19	1061.44	2886.14	36.78
2nd Plan (1956-61)	977.18	1916.66	4653.05	41.19
3rd Plan (1961-66)	2207.08	4123.74	9027.02	45.68
3 annual plans (1966-69)	1783.17	5906.91	12957.27	45.58
4th Plan (1969-74)	1058.39	6965.3	16663.56	41.80
5th Plan (1974-79)	3867.77	10833.07	26680.06	40.60
Annual Plan (1979-80)	550.90	11383.97	28447.83	40.01
6th Plan (1980-85)	3076.05	14460.02	42584.72	33.96
7th Plan (1985-90)	3828.41	18307.63	63636.34	28.77
2 Annual Plans (1990-92)	881.50	19194.62	69065.39	27.79
8th Plan (1992-97)	2427.65	21644.8	85019.31	25.46
9th Plan (1997-02)	4538.25	26261.23	103410.04	25.40
10th Plan (2002-07)	**7886**	**34653.77**	**132329.21**	**26.18**

[33] http://www.powermin.nic.in/transmission/transmission_overview.htm

[34] Page 6, Hydro Development Plan for 12th Five Year Plan (2012 -2017) published by CEA



As mentioned previously, the table above clearly illustrates the declining share of hydro power in India. This is despite the fact that significant potential for hydro power has long been established in India. The first hydro electric power project was established in 1897[35] in Darjiling (now Darjeeling) in eastern India. Despite this early start of hydro power in India and the high potential for generation, there has progressively been a fall in the share.

Analysis of other activities similar to the proposed project activity:

According to Additionality Tool (Version 05.2), similar project activities are those that rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing etc. The project activity under consideration is a large scale run of the river hydroelectric project activity with installed capacity of 1000 MW (250 x 4). Similar project activity is being considered as a large scale project activity within a range of +/- 50%[36] of the capacity of the proposed project activity (this range is being considered appropriate in reference to the guidance provided by the CDM EB in the request for review of a run of the river hydro power project in India) set up by a private investor in the host country (India) and was under operation at the time when the decision to proceed with the project activity was undertaken.

Application of the definition given in the additionality tool for similar projects to the candidate project activity would warrant the exclusion of following types of projects:

1. *Projects which have received additional funding*: Those projects which have received additional funding such as from CDM, VCS etc.

[35] http://www.indiastudychannel.com/resources/18871-HYDRO-ELECTRIC-POWER-PLANT.aspx

[36] http://cdm.unfccc.int/Projects/DB/DNV-CUK1218186379.41/ReviewInitialComments/N0ARGQ9PKPD7PQCX0ZO7XCHG0RP1XP

2. *Storage based hydro power projects*: Reservoir based projects eliminate variation in generation and have provisions for peaking power which provides additional revenues.
3. *Projects implemented by public sector utilities/government organizations*: Investment climate as well as access to finance for public sector projects is different from the project activity which is being developed by a private investor. The list of public sector projects which have been excluded is provided in Appendix I.
4. *Project under construction/implementation at the time of investment decision*: These projects are to be excluded from common practice analysis as per the guidance for common practice analysis. Only those projects can be compared to the proposed project activity which was under operation prior to the decision to proceed with the project activity by JKHCL.
5. *Projects with installed capacity lower than 125 MW and higher than 1500 MW*: These projects which are <125 MW and >1500 MW are being excluded since similar scale projects are assumed to be between the range of ±50% of the capacity of each unit as well as total size of the proposed project activity.

The hydroelectric projects of total installed capacity above 125 MW which had been implemented/under construction at the time of investment decision (i.e. 26th October 2005) were analysed from the list of hydro projects implemented in India. Adopting an even more comprehensive approach, all projects till 31st May 2010[37] were considered and private sector projects with capacities from 125 MW till 1500 MW from the list were identified (Please refer Appendix I). The list of commissioned and under execution private sector projects considered in the common practice analysis is provided below with the reasons for their exclusion stated alongside:

Investor name	Location	Size (MW)	Distinction/Reason for exclusion	Project Activity
M/s Tata Power Company	Bhira (Maharashtra)	300 (6*25 MW + 1*150 MW)	Project Description: Tata Power company had implemented Bhira 150 MW project in the year 1952. Further, an additional 150 MW pumped storage scheme was added in the year 1997. Reasons for exclusion: 1. It is not a run of the river project, (http://envfor.nic.in/divisions/iass/Executive%20Summary%20EIA.pdf) 2. The project activity was implemented in phases with first phase consisting of 6 x 25 MW was implemented in the year 1952 representing a completely different regulatory regime. The same can be checked from the link above.	The project activity is a run of river project. The project activity is regulated by CERC Tariff Order 2004 and EA 2003

[37]List of H.E. Stations in Country With Station Capacity Above 25 MW.pdf as Published by CEA

M/s Jaiprakash Hydro Power Ltd.	Baspa (Himachal Pradesh)	300	Project Description: The Baspa-II project is a run-of-the-river hydro-electric power plant with an installed capacity of 300 MW. Reasons for exclusion: 1. The project is selling power to Himachal Pradesh state and is thus determined under the state tariff regulations. Hence, the project has a completely different regulatory regime. 2. The project activity is seeking additional funding under the Voluntary Carbon Standard Scheme. Thus the project activity is also facing barriers and would not have been operating without the additional revenue stream being sought for under the voluntary scheme. The VCS Verification report verified by DNV is being submitted as proof.	The project activity is supplying power to multiple states and is regulated by CERC (Central) Tariff regulation The project activity is not getting any additional revenue.
M/s Jaiprakash Power Ventures Ltd.	Vishnu prayag (Uttaranchal)	400	Project Description: The 400 MW Vishnu Prayag Hydro-electric Project was commissioned in October, 2006 is a run-of-the river project located across river Alaknanda in district Chamoli of Uttarakhand. Reasons for exclusion: 1. The project is selling power to Uttar Pradesh state and is thus determined under the state tariff regulations. Hence, the project has a completely different regulatory regime. 2. The project activity is seeking additional funding under the Voluntary	The project activity is supplying power to multiple states and is regulated by CERC (Central) Tariff regulation The project activity is

			mechanisms. Thus the project activity is also facing barriers and would not have been operating without the additional revenue stream being sought for under the voluntary scheme. The VCS Verification report verified by DNV is being submitted as proof.	not getting any additional revenue.
M/s Alaknanda Hydro Power Company Limited (GVK)	Srinagar (Uttaranchal)	330	The 330 MW run of the river Shrinagar Hydroelectric project is located on Alakananda River, a major tributary of Ganga river in the state of Uttarakhand. The project activity is expected to get commissioned in the year 2011. Reasons for exclusion: 1. The project activity is seeking CDM revenues. The respective documentation can be accessed at: http://cdm.unfccc.int/UserManagement/FileStorage/B4CY1IQ5HNFGU2T3WAO7M8XERZLPSJ	Not to be considered
M/s Rajasthan Spinning & Weaving Mills (RSWM) Limited	Allain Duhangan (Himachal Pradesh)	192	Project Description: Allain Duhangan Hydroelectric Project (ADHP) is a run-of the-river 192 MW hydro power project at the confluence of Allain & Duhangan rivulets at Pirni village in Manali town of Kullu district in Himachal Pradesh state of India. The project activity was expected to start generation from June 2008. Reasons for exclusion: 1. The project activity is registered under the CDM and the respective documents can be accessed at: http://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view	Not to be considered
M/s Shree Maheshwar Hydel Power Corp. Limited	Maheshwar (Madhya Pradesh)	400	Project Description: The Maheshwar hydro project is a 400 MW run-off-the-river project on the River Narmada, located at Mandleshwar, District	

			Khargone, 108 Km. south-west of Indore. The project is expected to be commissioned in 2011-12. Reasons for exclusion: 1. The project was initially envisaged as a public sector project and later transferred in 1994 to the private sector[38] under a completely different regulatory regime. 2. The project was allotted in 1989 to the Madhya Pradesh Electricity Board[39] which is a public sector agency. 3. The project is still not operational[40] as on 30 June 2011 and hence is not to be considered in the common practise analysis	The project activity is regulated by CERC Tariff Order 2004 and EA 2003. The PP is a private developer
M/s Teesta Urja Ltd.	Teesta – III (Sikkim)	1200	Project Description: The Teesta Stage – III, RoR, HEP is a Run-of-the-river Power development scheme on the Teesta River, to utilize drop of about 800 m, between the Chungtang and Sankalan village in Sikkim. The project is expected to be commissioned in 2011-12. Reasons for exclusion: 1. The project activity is seeking CDM revenues. The respective documentation can be accessed at: http://cdm.unfccc.int/Projects/Validation/DB/4NUB299IQ53P6M05UQYZDMM57L6JA4/view.html	Not to be considered
M/s LANCO	Teesta – VI (Sikkim)	500	Project Description: The Teesta Hydro Electric Project (500 MW) is a new grid connected hydro-electric project. The project activity intends to generate 500 MW electric power utilising naturally available hydro	

[38] http://www.edf.org/documents/2409_NarmadaTimeline.pdf

[39] http://www.edf.org/documents/2409_NarmadaTimeline.pdf

[40] http://www.projectsmonitor.com/ELECTRICITY/moef-lifts-stopwork-order-on-maheshwar-hep

			potential energy in the Teesta River and export the energy to grid in Sikkim state of India. The project is expected to be commissioned after March 2012 in 12th Plan. Reasons for exclusion: 1. The project activity is seeking CDM revenues. The respective documentation can be accessed at: http://cdm.unfccc.int/Projects/Validation/DB/2C8SFUHZ2BKSJTU84DXRWE3JXFT4C2/view.html	Not to be considered

The above analysis indicates that there **is no similar project activity** in the host country **implemented by a private investor** with installed capacity over 125 MW which was under operation at the time of the investment decision of the proposed project activity.

Sub-step 4b: Discuss any similar options that are occurring:

At present, there are no similar hydroelectric projects of the same magnitude under operation by a private entity in the host country.

Hence as per additionality tool further analysis of step 4 (b) is not required and since no similar project activities can be observed, the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Emission Reductions

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y) and project emissions (PE_y)), as follows:

$$\mathbf{ER_y = BE_y - PE_y}$$

where the baseline emissions (BE_y) include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$\mathbf{BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the version 02 of the "Tool to calculate the emission factor for an electricity system"

Calculation of $EG_{PJ,y}$

(a) Greenfield plants

Since the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore:

$EG_{PJ,y} = EG_{facility,y}$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Calculation of $EF_{grid,CM,y}$

In accordance with the "Tool to calculate the emission factor for an electricity system" Version 02, combined margin CO_2 emission factor for grid connected power generation is calculated stepwise as below:

The data used for the calculation of the baseline emission factor was obtained from the baseline calculations published by the CEA, *Baseline Carbon Dioxide Emissions from Power Sector – Version 4.0*, which uses ACM0002. The relevant parts of the calculations are referenced in the methodology outline below, with detailed data provided in Annex 3. A complete explanation of the assumptions employed by the CEA can be obtained from the *CO_2 Baseline Database for the Indian Power Sector User Guide - Version 4.0*.

Step 1. Identify the relevant electric power system

For the purpose of determining electricity emission factors, a **project electricity system** is defined by the spatial extent of power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

The Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power

Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid.

Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan). Recently, the Indian regional grids have started to work in synchronous mode, i.e. at same frequency.

Table 11: States connected to different regional grids

Regional grid	**Northern**	**Western**	**Southern**	**Eastern**	**North Eastern**
States	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Delhi	Gujarat, Madhya Pradesh, Maharashtra, Goa, Chattisgarh	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu,	Bihar, Orissa, West Bengal, Jharkhand	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

The Northern Region grid managed by Northern Region Electricity Board (NREB) constitutes eight states (viz Himachal Pradesh, Jammu and Kashmir, Haryana, Punjab, Uttaranchal, Delhi, Uttar Pradesh and Rajasthan) and one union territory (Chandigarh). These states under the regional grid have their own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power generated by central generating stations is shared by more than one state depending on their allocated share. NRLDC facilitates the share of power generated by the central generating stations. Presently the share from central generating stations is a small portion of their own generation. The Northern, Eastern, Western and North – Eastern grids have been synchronized to form one NEWNE grid.

For the purpose of determining the emission reductions achieved by the Project the "Tool to calculate the emission factor for an electricity systems" (Version 02) states that the "project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints". On this basis the CEA, *Baseline Carbon Dioxide Emissions from Power Sector - Version 4.0* defines the project electricity systems within India as two regional grids. This is justified "as electricity continues to be produced and consumed largely within the same region, as is evidenced by the relatively small volume of net transfers between the regions, and consequently it is appropriate to assume that the impacts of CDM project will be confined to the regional grid in which it is located". The project is located in Himachal Pradesh and is therefore as per the CEA's grid definitions it is within the northern regional grid. Also, it is preferable to take the regional grid as project boundary than the state boundary as it minimizes effect of inter state power transactions, which are dynamic and vary widely. Considering free flow of electricity among member states and the union territories through the Northern Region Load

Dispatch Centre (NRLDC), entire Northern grid is considered as a single entity for estimation of baseline.

Step 2: Choose whether to include off-grid power plants in the project electricity

The PP has chosen not to include off grid power plants and hence only grid connected power plants are considered i.e. Option I. This is because there is a lack of publically available data on off grid power plants in India.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

As per the tool, any of the four methods can be used. For the proposed project activity, simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid,\ OM,\ y}$). However, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Table 12: Share of Low Cost / Must-Run (% of Net Generation)

	2005-06	**2006-07**	**2007-08**
NEWNE	18.0%	18.5%	19.0%
South	27.0%	28.3%	27.1%
India	**20.0%**	**20.9%**	**21.0%**

Ref: CO_2 Baseline Database for the Indian Power Sector – CEA, Version 04.

Percentage of total grid generation by low cost/must run plants (on the basis of average of three most recent years) = 20.66 %

The calculation above shows that the generation from low-cost/must-run resources constitutes less than 50% of total grid generation, hence usage of the **Simple OM method** in the project case is justified.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) *y*:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

or

- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

The project proponents choose the *Ex ante* option for estimating the simple OM emission factor wherein as described above a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period will be undertaken.

Step 4. Calculate the operating margin emission factor according to the selected method

The simple OM method has been selected as justified above. The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units using the following formula:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,,y}$	=	Simple operating margin CO_2 emission factor of in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power unit m in year y (MWh)
m	=	All power units serving the grid in year y except low-cost / must-run power units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data has also been endorsed by the DNA and is the most authentic information available in

the public domain. The details of same can be found on CEA website at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm.

Step 5. Identify the group of power units to be included in the build margin

The sample group of power units *m* used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project proponents should use the set of power units that comprises the larger annual generation.

Since in India, the installed capacity and corresponding annual generation from power plants is quite high, the sample group containing set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently comprise the sample group with the larger annual generation. Thus the sample group *m* consisting of option (b) is used for the estimation of build margin.

In terms of vintage of data, project proponents can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project proponent wishes to choose option 1.

Step 6. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid, BM, y}$ = Build margin CO_2 emission factor in year y (tCO_2 / MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh)
$EF_{EL, m, y}$ = CO_2 emission factor of power unit *m* in year y (tCO_2 / MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

Calculations for the Build Margin emission factor $EF_{grid, BM, y}$ is based on the most recent information available on the plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently.

Step 7. Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

As mentioned before, the CEA has calculated the baseline emission factors for various regional grids in India according to the formulas specified above. As this is the most authentic information available in the public domain. The baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness[41].

Project activity emissions

[41] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

According to the chosen baseline methodology ACM0002, for hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for project emissions, estimated as follows:

a) If the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = \frac{EF_{RES} \otimes EG_y}{1000}$$

Where,

PE_y = Emission from reservoir expressed as tCO_2e/year

ES_{Res} = Default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO_2e /MWh.

EG_y = Electricity produced by the hydro electric power project in year y, in MWh

b) If the power density of the project is greater than 10 W/m^2: $PE_y = 0$.

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity, in W/m^2.

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

Leakage

According to ACM0002, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using ACM0002 shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus the leakage emissions are nil.

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	tCO_2/GWh

Description:	Operating Margin emission factor for NEWNE regional grid
Source of data used:	Referred from CO_2 Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 4.0.
Value applied:	1.0086
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is calculated in accordance with the Tool to calculate the emission factor for an electricity system with 3years vintage data (2005-06, 2006-07 and 2007-08) on Net Generation provided by CEA with an option of ex ante calculation based on Simple Operating Margin Method. Computed once during PDD finalization.
Any comment:	The data will be archived for two years beyond the crediting period.

Data / Parameter:	$\mathbf{EF_{BM,y}}$
Data unit:	tCO_2/GWh
Description:	Build Margin emission factor for NEWNE regional grid
Source of data used:	Referred from CO_2 Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 4.0.
Value applied:	597.7
Justification of the choice of data or description of measurement methods and procedures actually applied :	CEA has Calculated it as per ACM0002 for the year 2007-08. The build margin is calculated in this database as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation and option of ex ante calculation. Computed once during PDD finalization.
Any comment:	The data will be archived for two years beyond the crediting period.

Data / Parameter:	$\mathbf{EF_{grid,CM,y}}$
Data unit:	tCO_2/GWh
Description:	Combined Margin CO_2 emission factor for NEWNE regional grid
Source of data used:	Estimated figure based on 50% of OM and 50% of BM values
Value applied:	803.1 tCO_2/GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is calculated it as per Tool to calculate the emission factor for an electricity system (Version 02) with 3years vintage data and option of ex ante calculation based on 50% of OM and 50% of BM values approach. Computed once during PDD finalization.
Any comment:	The data will be archived for two years beyond the crediting period.

Data / Parameter:	$\mathbf{A_{BL}}$
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.
Source of data used:	Project Site.
Value applied:	0

Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	

Data / Parameter:	**Cap_{BL}**
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data used:	Project Site.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determine the installed capacity based on recognized standards.
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

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Calculation of Baseline Emission Factor:

In accordance with the CEA CO_2 Baseline Database for the Indian Power Sector – Version 04, the emission factor is calculated as follows:

	2004-05	**2005-06**	**2006-07**	**Source**
Simple Operating Margin Emission Factor (tCO_2/MWh)	1.0195	1.0083	0.9992	CEA Database, Version 4.0
Net Generation in OM (GWh)	359,271	379,471	401,642	CEA Database, Version 4.0
Net electricity import from ER, WR, SR and NER (GWh)	4,853	5,126	8,193	CEA Database, Version 4.0
Net generation incl imports (GWh)	364,124	384,597	409,834	Calculated
Weighted Generation Operating Margin Emission Factor (tCO_2/MWh)	**1.0086**			Calculated
Build Margin Emission Factor (tCO_2/MWh)	**0.5977**			CEA Database, Version 4.0
wOM	0.5			Tool to calculate Emission

		Factor for an Electricity System
wBM	0.5	Tool to calculate Emission Factor for an Electricity System
Combined Margin Emission Factor (tCO_2/MWh)	**0.8031**	Calculated

Annual Generation EG_y is calculated as follows:
Parameters

Energy generation in 2011-12 (16/08/2011 to 31/03/2012)	1343.64	GWh
Electricity Generation from 2012-13 onwards (01/04/2012 to 31/03/2013)	4463.88	GWh
Auxiliary consumption	0.7	%
Transformation Losses	0.5	%
Net generation in 2011-12 (16/08/2011 to 31/03/2012)	1327.51	GWh
Net Generation from 2012-13 onwards (01/04/2012 to 31/03/2013)	4410.31	GWh
Baseline Emission factor (Northern Grid)	803.1	tCO_2/GWh

The Baseline Emission Factor for the Northern Grid has been calculated using data from :
The CO_2 Baseline Database for the Indian Power Sector, Central Electricity Authority (CEA), Version 4.0.

Baseline Emissions
$BE_y = EF_y \times EG_y$

Baseline emissions in 2011-12 (16/08/2011 to 31/03/2012)	1066123	tCO_2
Baseline Emissions from 2012-13 onwards (01/04/2012 to 31/03/2013)	3541917	tCO_2

Project activity emissions
Elevation at Full Reservoir Level = 1810.00 m
Surface area at full reservoir level = 588400 m^2
Power Density **= 1699.52 W/m^2**

The power density of the project activity is 1699.52 W/m^2. Since the power density of the project is greater than 10 W/m^2: $PE_y = 0$.

Leakage
According to ACM0002, Leakage (L_y) is 0.

Emission Reductions
$ER_y = BE_y – PE_y - L_y$
$ER_y = BE_y$

Emission Reductions in 2011-12 (16/08/2011 to 31/03/2012)	**1066123**	**tCO_2**
Emission Reductions from 2012-13 onwards (01/04/2012 to 31/03/2013)	**3541917**	**tCO_2**

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of Project activity emissions (tonnes of CO_2e)	Estimation of Baseline emissions (tonnes of CO_2e)	Estimation of Leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2011-12 (October 2011 to May 2012)	0	1,066,123	0	1,066,123
2012-13	0	3,541,917	0	3,541,917
2013-14	0	3,541,917	0	3,541,917
2014-15	0	3,541,917	0	3,541,917
2015-16	0	3,541,917	0	3,541,917
2016-17	0	3,541,917	0	3,541,917
2017-18	0	3,541,917	0	3,541,917
2018-19	0	3,541,917	0	3,541,917
2019-20	0	3,541,917	0	3,541,917
2020-21	0	3,541,917	0	3,541,917
2021-22 (April 2022 to July 2022)	0	2,475,793	0	2,475,793
Total (tonnes of CO2 e)	0	**35,419,166**	0	**35,419,166**

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/year
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data to be used:	Measured at Project activity site. (Pothead Yard)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4410.31 GWh/yr
Description of measurement methods	Meters installed at the switchyard would accurately monitor electricity supplied to the grid. Hourly measurement and monthly recording will be done.

and procedures to be applied:	
QA/QC procedures to be applied:	The metering system will include a main meter and a back-up check meter of accuracy class 0.2%. All meter data will be stored in electronic and paper formats as specified in the monitoring plan. Meters will be calibrated prior to synchronization of the project and then recalibrated as required. The main and the check meters will be calibrated once in two tariff years. The calibration certificates of the meters will be stored. Invoices for the quantity of electricity exported and sold will also be stored and will allow cross checking of the net metered generated electricity. The gross metered electricity generation data (minus estimates for auxiliary loads and losses) can also be used as a further cross check of the net metered generated electricity.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**TEG_y**
Data unit:	MWh/year
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y.
Source of data to be used:	Measured at the Project activity site. (Pothead Yard)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4463.88
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording by energy meter.
QA/QC procedures to be applied:	Electricity meters would be properly maintained with regular testing and calibration schedules to ensure accuracy. The meter will be calibrated once in two tariff years. The metering system will include a main meter and a back-up check meter of accuracy class 0.2%. All meter data will be stored in electronic and paper formats as specified in the monitoring plan.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**Cap_{PJ}**
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be	Monitored at Project site by JKHCL

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$1000 * 10^6$
Description of measurement methods and procedures to be applied:	The Cap_{PJ} would be verified through the technical specification sheet of the turbines installed in project activity.
QA/QC procedures to be applied:	-
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**A_{PJ}**
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Measured at Project site by JKHCL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	588400
Description of measurement methods and procedures to be applied:	As the reservoir provides only the diurnal storage, the area considered is for the condition when the reservoir is full. There are no seasonal fluctuations in the reservoir.
QA/QC procedures to be applied:	-
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

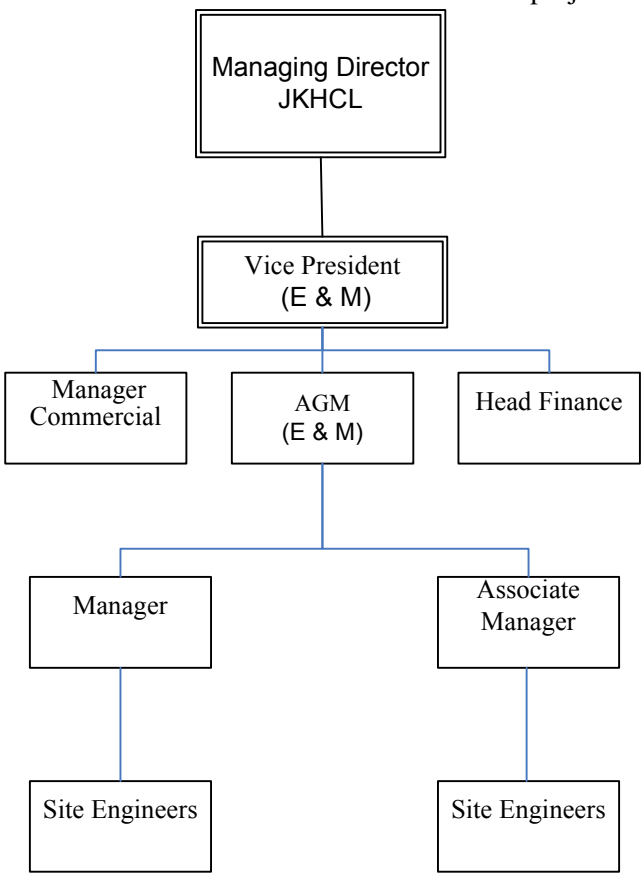
B.7.2. Description of the monitoring plan:

>>

The monitoring plan is being devised as per approved consolidated methodology ACM0002 - **"Consolidated baseline methodology for grid-connected electricity generation from renewable sources".**

A CDM project team would be constituted with participation from relevant departments. People will be trained on CDM concept and monitoring plan. This team will be responsible for data collection and archiving. This team will meet periodically to review CDM project activity check data collected,

emissions reduced etc. On a weekly basis, the monitoring reports will be checked and discussed by the senior CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions. On monthly basis, these reports are forwarded at the management level. The O&M structure for the CDM project activity is as follows:



Further, the monitoring arrangements proposed for the project activity have been extensively described in Annex 4 below.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

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Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:
30/09/2008

Name of person/entity determining the baseline:
Jaypee Karcham Hydro Corporation Limited has determined the baseline for the project activity. The entity is a project participant listed in Annex-I where the contact information has also been provided.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
18/11/2005
In accordance with the 'CDM glossary of terms' the start date of a project activity is defined as the "the earliest date at which either the implementation or construction or real action of a project activity begins".

The start date has thus accordingly been chosen in accordance with the owner's notice to proceed with the construction of the project activity which was provided to the EPC contractor M/s Jaiprakash Associates Limited on 17th November 2005 with the starting date as 18th November 2005. The project implementation or construction or real action began on 18th November 2005 immediately after the mandatory environment clearance and forest clearance was accorded by the MoEF, Government of India on 9th November 2005 and 17th November 2005 respectively.

Further the financial closure of the project took place in March 2006 only and the purchase agreement for generating plant equipment was executed later on 29th November 2007. Thus the above date is chosen as the earliest date when the real action starts in the project activity.

C.1.2. Expected operational lifetime of the project activity:

>>
35 years[42], 0 months

Considering useful life of electro mechanical equipment (Plant & Machinery).

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>>
Not chosen

C.2.1.2. Length of the first crediting period:

>>
Not chosen

[42] http://www.cercind.gov.in/131205/appendix_2.pdf

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
15/10/2011 (Expected commissioning date of first unit of 250 MW)
JKHCL hereby confirms that the crediting period will not commence prior to the date of registration.

C.2.2.2. Length:

>>
10 years and 0 months.

SECTION D. Environmental impacts

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D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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The Environment Impact Assessment (EIA) for the project has been done comprehensively by one of the most reputed environment research institute - National Environmental Engineering Research Institute (NEERI), Nagpur, India, to analyse the environmental impacts associated with various activities envisaged by the project proponent against the backdrop of existing environmental quality at the project area and the statutory requirements. This is in compliance with the Environment Impact Notification, 1994[43] which is the applicable regulation in India.

The report, completed in 2005, reviews the legal and administrative framework for the EIA and then describes the project in all these aspects. The report also describes the quality of air, water, noise, land, socio-economic aspects and environment around the project. Predictive analysis has been done to estimate impacts of the project on the environment. Some of these impacts may affect the environment temporarily but can be countered by safety and environmental stabilization measures.

Description of the plausible environmental impacts predicted in the EIA for the proposed project activity are as follows:

Air and Noise Environment

- The plying of trucks and other transport vehicles and use of construction machinery, marginal increase in the levels of Suspended Particulate Matter (SPM), oxides of nitrogen and sulphur is likely to occur, which will be sporadic and limited to construction phase only.

- The traffic load on National Highway, NH-22 during construction of Karcham-Wangtoo Project would more or less remain the same as was during construction of Baspa Stage II (300 MW) and Nathpa-Jhakri(1500 MW) H.E. Projects.

- The vehicular traffic as well as operation of other equipment will get minimised on completion of the construction phase of the project. Therefore, rise in the existing background levels of air pollutants is not expected during operational phase.

- The noise levels in the nearby human settlements and at quarry and crusher operation sites, dam and power house construction sites will remain within the standards promulgated by the Occupational Safety and Health Administration (OSHA). The noise levels due to noise generating sources at the proposed dam site will be in the range of 80 – 95 dBA during construction activity and workers exposed to these noise levels will not get adversely affected. As the project area is covered with forests and hills, there will be substantial noise attenuation. The nearest habitation sites are more than 1 to 2 km away from the construction sites. Hence, the increase in noise levels during construction phase will not be significant in the habitation zone.

[43] http://www.cercind.gov.in/131205/appendix_2.pdf

Water Environment

- The flow contribution from tributaries for intervening stretch during lean period begins from 0.59 km of the dam site. The total flow contribution from tributaries in the river stretch from 0.59 km to 18.65 km downstream during lean season is 5.50 cumec. In addition to this, a minimum of 6.8 cumecs[44] water shall be released from dam at all times in river Satluj during lean season from environmental consideration.

- On an average, the per capita domestic water requirement is 70 lpd. Disinfection of water sources is recommended for safe potable water. Total water requirement for domestic use during the construction phase will be 0.42 mld, of which 0.34 mld will be generated as domestic wastewater from workers' camps of Karcham and Wangtoo.

- The average slope in the river stretch between Karcham and Wangtoo is about 1:100 with flow velocity of the order of 4 m/sec. The river shall be able to carry the sediments during monsoons and there will be no accumulation of silt in the downstream of dam. The dominant discharge in the Satluj river during monsoons is about 2000 cumecs. The intake will take only 521.25 cumec. Rest will be released through sluice spillway provided in the dam with crest at El.1778.

Land Environment

- The accessibility to the area will improve due to road widening. This may lead to increased tourism activities generating employment and earnings. The movement of local population will be improved.

- Dumping sites have been identified along the Satluj. These sites will be developed properly before dumping the spoils / debris. Retaining walls corresponding to year 2000 flood level as per design given by Himachal Pradesh Public Works Department (HPPWD) will be constructed to avoid muck spill into the Satluj.

- Soil erosion, erosion intensity and land slides in the project area are minimized through site specific engineering measures. Catchment area treatment may also improve land environment leading to combating erosion of the land. Promotion of insitu moisture conservation and increase in productivity of all types of land may be achieved through afforestation.

Biological Environment

- Direct impacts on wild vegetation *per se* are considered to be of moderate localised significance and is not likely to make adverse impact. At the major construction sites where works on the surface are to be executed, viz. dam, intake, adit portals for head race tunnel and underground power house and pothead yard, the landscape will get changed into a constructed one from the natural one.

[44] As per Environmental Clearance accorded to the project by MoEF

- During all activities of the project, about 1191 number of trees will be felled. The girth of most of these trees is within the range of 10 to 40 cm (classes III-IV). The trees, to be felled, are in the forest ranges Kilba, Kalpa and Nichar under six compartments, of which unprotected forest (UF) Karcham is most conspicuous comprising of 625 trees. No adverse impact due to dust emission during construction phase is anticipated because trees are tall with narrow leaf surface area and mostly dominated by coniferous tree species of Deodar and Pines.

- Fishing is not practised in the stretch of the river between Karcham and Wangtoo. Hence impact on fisheries is insignificant. Resultant formation of reservoir due to dam will enhance fish production.

- The floral biodiversity is moderate which is not expected to degrade since submergence area is very small and confined to narrow river stretch. Further Catchment Area Treatment (CAT) plan will improve the biodiversity of the project area.

Socio-economic Environment

- The compensation for private land, private buildings and families rendered homeless and landless would be paid to Project affected persons as per Relief and Rehabilitation (R&R) scheme of Himachal Pradesh Government.

- There will be some strain on the existing infrastructure facilities, viz. water supply, sanitation, housing, energy etc. due to migration of workers. As the project proponents are to provide these facilities to the workers, the adverse impact will be mitigated.

- Due to the project activities there will be increased employment both during construction and post construction / operation stages. The employment potential for the construction activity is estimated at about 6000. The breakup of employment is managerial / engineering (370); supervisory (500); skilled (2400); and unskilled (2730). This will have a positive impact on the economy of population, both local and regional.

- With improved infrastructure facilities, viz. housing, roads, transport facilities, communications, education, water supply, sanitation, health services etc. will improve the quality of life of the population in the area.

- The construction of power project will trigger an all-round increase in developmental activities such as housing, transport and education and these will have positive impact on the life style of the population.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

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JKHCL has devised an Environment Management Plan (EMP) which will combat all the adverse environmental impacts and will ensure environment friendly operation of Karcham-Wangtoo hydroelectric power project.

- Public consultation, public hearing and opinion survey in more than 40 surrounding villages have focused on requirements / expectations of the people. Accordingly the EMP has been framed to satisfy the local population in the Project area.

- To minimize the Suspended Particulate Matter (SPM), water sprinkling at construction sites, dumping sites, access roads and stone crushing plants will be regularly done. Trucks will be covered carrying construction material to minimize spills / accidents.

- Periodical and preventive maintenance of construction equipment and construction vehicles will be done to meet the emission standards. Vehicular traffic on highway (NH 22) will be controlled in consultation with police department and transport of construction material and machinery is done during lean traffic period.

- Noisy construction works shall be undertaken during day time only and sound barriers installed wherever possible. Personnel protection equipment including ear muffs, plugs will be provided to workers working near machines, blasting and drilling sites and crusher operations.

- Baseline survey of houses / buildings in the villages likely to be affected due to construction activities is to be carried out by the Committee constituted by Deputy Commissioner, Kinnaur. If any houses / buildings face damage due to dam, tunneling and power house construction activities undertaken by project proponents, suitable remedial measures shall be taken as mutually agreed.

- Controlled blasting shall be resorted to and seismographs shall be installed at all strategic points for monitoring the intensity of the blast on a regular basis.

- Minimum environmental flow of 6.80 cumec of river water shall be maintained immediately downstream of the dam during lean season.

- The proponents shall undertake augmentation/restoration of all the water supply schemes to bring the overall water supply to a level equal to or more than the current per capita availability. The names of the schemes, details of works to be undertaken and order of starting the work in each of these schemes shall be conveyed to the Proponents by the District Administration.

- Although no rare or endangered plant or animal species are affected by submergence due to dam construction, existing forest cover is increased over a period of time in order to ensure conservation of biodiversity. Special efforts will be made to manage bio-conservatory in consultation with forest department. Changes in species composition and diversity both for flora and fauna will be conducted through ecological surveys

- The fisheries management plan targets overall improvement in aquatic environmental conditions. The plan could incorporate choice of fish species, public participation in the activity and development of fish trade.

- The proponents will establish additional trout seed production center in consultation with State Fisheries Department. They will also ensure adequate production and supply of seeds and

improve fish processing technology. Harvesting of fishes prior to initiation of de-silting of dam to prevent fish mortality.

- Work plan will be formulated for re-vegetation of the spoil dumping sites comprising evaluation of physical and chemical properties to ensure supportive and nutritive capacity.

- R&R plan has been prepared by the HP State Government as per the State Government guidelines and accepted by the Project proponents.

- Catchment Area Treatment (CAT) plan is initiated to mitigate adverse impacts due to soil erosion and sediment transport. Restoration of construction sites, filling borrow pits will be done through landscaping.

- Proponents shall set up a 40 bed hospital to cater to medical needs of the population of about 25000 including local and migrant population.

- The proponents shall open a good quality training center near the Project location with relevant trades to provide necessary skills to local inhabitants to increase their employability.

- Information mechanism shall be established to report quickly to the villagers about the sudden release of water from the dam.

- The disinfected drinking water of Bureau of Indian Standards (BIS) standards is provided to the workers with adequate public health facilities. Regular water quality monitoring may be taken up for the safe potable water supply.

- Wastewater from the permanent workers camps is treated before discharging into the water body.

- Post construction monitoring activities will include status of muck disposal areas, borrow pits and landfill sites. Change in land use pattern and effectiveness of CAT plan will be monitored using satellite imageries.

- Post monitoring of environmental indicators like river water quality, sediment transport analysis, land use, soil erosion, ecological changes, aquatic life is conducted periodically as per guidelines issued by the project monitoring committee. Frequency of such monitoring with respect to parameters will be decided by the Project Monitoring Committee.

- Environmental monitoring will be ensured through a District level Inter Departmental Monitoring Committee under the Chairmanship of Deputy Commissioner, Kinnaur with representatives from all the concerned departments and the Proponents. This Committee will meet periodically for compliance of the recommendations as detailed in Table 9.1 of Vol. I. of EIA Report.

The Project Proponents have made sufficient provision in the Project Cost to carryout CAT Plan and EMP to mitigate adverse impacts and maximize beneficial impacts. Further, the detailed measures and costs related to the EMP have been provided in Appendix II.

SECTION E. Stakeholders' comments

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E.1. Brief description how comments by local stakeholders have been invited and compiled:

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The project activity being undertaken by JKHCL is the construction of a run of river hydro electric development on the river Satluj of 1000 MW generation capacity. The project is designed with minimal storage thus eliminating the huge storage area required by the reservoirs in such large dams. By virtue of being a run of river design the project proponent is minimizing displacement of people of the region and thus mitigating one major adverse impact of such large scale hydro-electric projects.

However, JKHCL being a socially and environmentally responsible organization has endeavoured to do a detailed stakeholder consultation process with special emphasis on the socio-environmental impact of the project on the region. Since it is a run-of-river project there is no substantial displacement of people. Nevertheless JKHCL has ensured proper measures for addressing every possible impact of the project on the local stakeholders. This is a voluntary initiative by the project proponent and has been conducted by an independent third party, Sharnam Sewa Samiti (SSS) which is a NGO specializing in such social assessments. The study was done in an independent manner with direct interaction with local stakeholders to provide an unbiased picture of the concerns and comments of these stakeholders. In order to understand issues associated with the project, baseline data related to the demography in the project area was considered vital. The study utilized baseline data from secondary sources such as Census, the District Statistical Hand Book and the Planning Department, Earthquake and Dam breach sensitivity research studies by Indian Institute of Technology, EIA study and the Environmental Management Plan conducted by National Environmental Engineering Research Institute (NEERI). Primary data has been collected mainly through the consultation with the community members and interviews of PRI representatives from project villages. Extensive desk review was done prior to the fieldwork to enable in depth orientation of the team.

The study conducted was structured in the following manner:

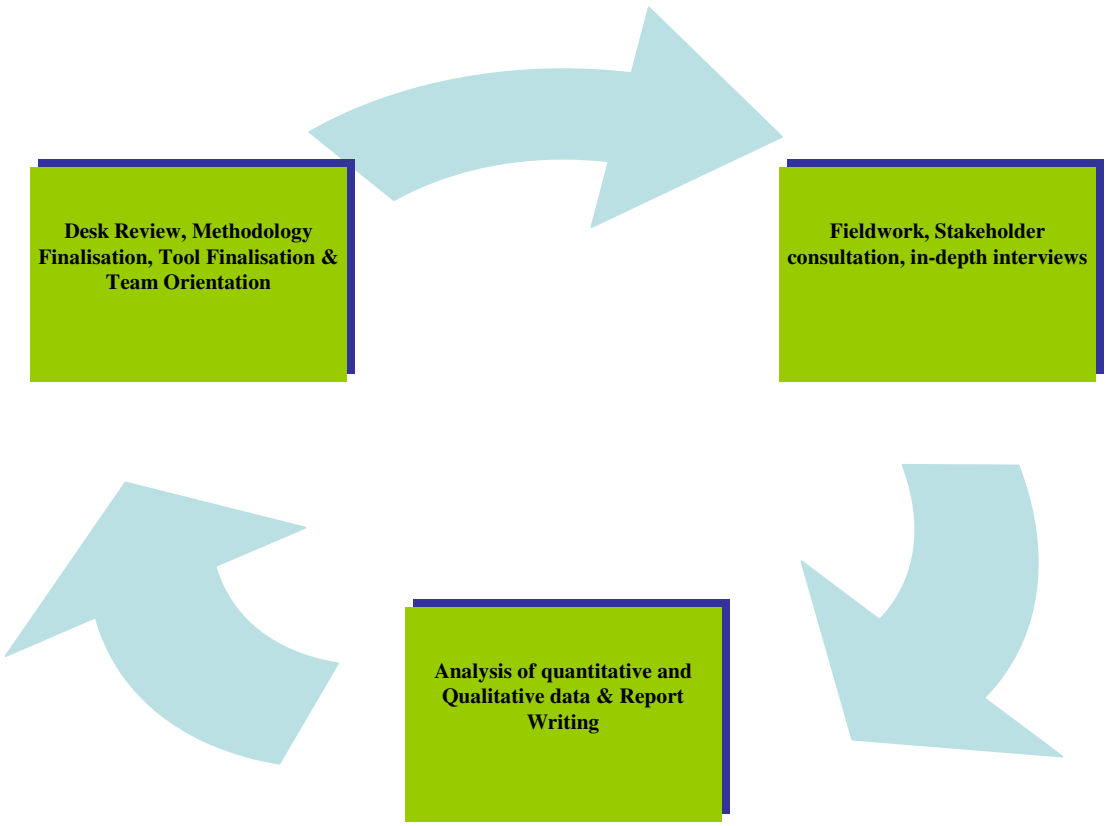
1. Identification of stakeholders with respect to the project activity.
2. Discussions/Interaction with stakeholders and sharing of information.

   The interactions and assessments were conducted using the following tools:

- Focus Group Discussions (FGD)
- Participatory Rural Appraisal (PRA)
- Social mapping
- Semi-structured Interview (SSI)
- Key Informant Interview

3. Inviting comments and concerns from stakeholders inter-alia through a 'Survey Questionnaire' and compilation of the same along with identification of actual impacts on the local community and region

The following diagram represents the knowledge loop that was followed:



The above structure of the study was designed to ensure accurate depiction of social impacts of the said project activity on the local inhabitants/stakeholders. It has been undertaken with a two-fold objective of complying with the procedural requirement of stakeholder consultation as stipulated by UNFCCC, along with ensuring positive contribution of the project towards socio-economic development of the region. Other than consultation of stakeholders for the CDM procedural requirements, major objectives for the study were primarily:

- Stakeholder analysis for documentation of community views and opinions since inception of the project
- Assessing Impacts of the project on the region as well as on the community since project inception
- Tracking compliance of the various Development plans made before project inception

The study was done with these aims and the methodology was designed in view of the World Commission on Dams guidelines. The Project area includes **45** villages and hamlets of **12** Gram Panchayats spread across two Tehsils namely ***Nichar*** and ***Kalpa*** of Kinnaur District in Himachal Pradesh. All the 12 Panchayats were visited to minimise under representation of villages in the study.

Villages visited during the study

S.No.	Tehsil	Gram Panchayat
1	Nichar	Punang
2	Nichar	Chagaon

3	Nichar	Yula
4	Nichar	Meeru
5	Nichar	Panwi
6	Nichar	Urni
7	Nichar	Katgaon
8	Kalpa	Kamru
9	Kalpa	Sapni
10	Kalpa	Kilba
11	Kalpa	Mewar rali
12	Kalpa	Roghi

The methodology for the above mentioned techniques, such as FGD and PRA. FGDs were conducted wherever a group could be organised and the discussion was based on a comprehensive FGD checklist. Interviews were conducted with individual informants like shopkeepers, Gram Pradhans etc. *Discussion and Debriefing* was the primary method of data collection while interacting with government officials and members of NGOs.

Within each Panchayat, the study team endeavoured to meet the community from all associated villages and hamlets. It was considered important to use participatory techniques in interaction with the community. Hence each group interaction started with a PRA and social mapping exercise, which always attracted a large number of people especially youth. After mapping, FGDs were initiated using the FGD checklist as reference. The team also made sure that men and women from both tribal and non-tribal households and all possible socio-economic groups were covered and their views documented. During interactions, the team found that in some villages, women were less vocal in front of men hence separate interactions with women were also organised at several sites. The process ensured that women and people from the tribal community freely shared their opinions and feedback regarding the project.

Besides above mentioned procedures, a more intensive data collection exercise was conducted with stakeholders being provided a brief on the project activity and a survey questionnaire to gauge their level of knowledge and understanding of the project activity. This exercise also involved understanding specific comments or issues the stakeholders may have with respect to the said project activity being undertaken by JKHCL, besides apprising them of the contribution of the project to GHG abatement and mitigation of climate change.

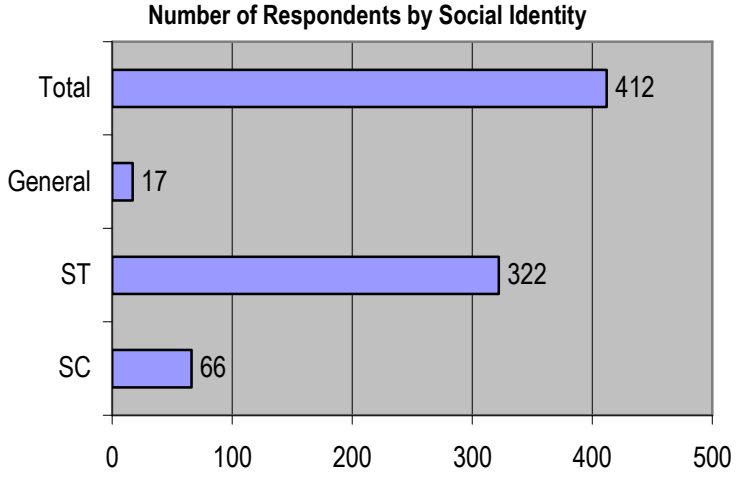
The study began with an identification of the local stakeholders in the region where the project activity is being undertaken. As mentioned before, by virtue of being a run of river project, there was minimal displacement of inhabitants and the stakeholders were identified as parties being directly or indirectly impacted by the said project activity. Accordingly, the stakeholders identified for the proposed project activity are as follows:

1. Local population
    - Various sections from the community
        - SC (Scheduled Caste)
        - ST (Scheduled Tribe)
        - OBC (Other Backward Classes)

- Government officials
- NGOs
- Village heads
- Vulnerable groups like women

2. Ministry of Environment & Forests, Government of India
3. Central Electricity Authority, Government of India
4. Civil and construction work contractors
5. H.P State Environment Protection & Pollution Control Board, Government of Himachal Pradesh

The local populace of the region where the said project activity is being undertaken are the primary stakeholder to be consulted. The stakeholders were divided into different categories so that different perception and views of all the stakeholders are taken into consideration. The categories of stakeholders identified during the process were Households in the Project influenced Area, Project Affected households, Tribal, Vulnerable Stakeholders like women and old, Elected Representatives, Government Functionaries, NGO Functionaries, Media and Project Team.



Stakeholders were identified as per the following table:

Stakeholder type	Reason	Issues Discussed	Tools used
Community: SC	They are a sizeable proportion of the local community and their views were necessary to minimise under representation	1. Overall impacts of the project 2. Direct and Indirect benefits due to the project 3. Status of rehabilitation and compensation 4. Improvement in local infrastructure 5. Impact on livelihoods and apple production 6. Perceptions Vs facts etc 7. Any caste based effect on	PRA, Social mapping, FGD, SSI

		the community related with the project	
Community: ST	They form the numerical majority of the local populace	1. Overall impacts of the project 2. Direct and Indirect benefits due to the projects 3. Status of rehabilitation and compensation 4. Improvement in local infrastructure 5. Impact on livelihoods and apple production 6. Perceptions Vs facts etc	PRA, Social mapping, FGD, SSI
Community: Gen	This is a small group in each village but their views were necessary to minimise under representation	1. Overall impacts of the project 2. Direct and Indirect benefits due to the projects 3. Status of rehabilitation and compensation 4. Improvement in local infrastructure 5. Impact on livelihoods and apple production 6. Perceptions Vs facts etc	PRA, Social mapping, FGD, SSI
Community: Women	Women are generally more vulnerable to changes especially socio-economic changes	1. In addition to the above, any special drudgeries introduced to the life of women	PRA, Social mapping, FGD, SSI
PRI representatives	They form the key link between the community and the government and take peoples views, demands and feedback to policy makers	1. Status of Local Area Development (LADA) activities 2. Role of PRIs in implementation of RRP, DMP and	SSI, SQ
Government Officials	They are part of the administration, monitor the progress of the project and are responsible for ensuring compliance of various plans	1. Progress of the project and related issues 2. Status of compliance of CAT, Disaster Management Plan (DMP) and Relief and Rehabilitation Plan (RRP)	Discussion and Debriefing

The Stakeholder Consultation Report primarily deals with socio-economic impact of the project activity and provided an opportunity for the local population to express their viewpoints and comments with respect to the project.

A total of eighteen community level consultation events were held during the study wherein approximately 412 people participated. In addition, 29 other stakeholders from PRIs, Government departments and local NGOs were covered. A summary of the various categories of stakeholders consulted during this process is provided in the table below. This table also provides data on the number of stakeholders consulted, issues discussed and tools used with respect to different stakeholders are mentioned in the following table:

Stakeholders				
Stakeholder Type	**Number**	**Purpose of Consultation**	**Issues Discussed**	**Tool Used**
Community	412	• Gathering of views on the project • Understanding impact on community • Assessing extent of benefits and damage	• Overall impacts of the project • Direct and Indirect benefits due to the projects • Status of rehabilitation and compensation • Improvement in local infrastructure • Impact on Livelihoods and apple production • Perceptions of stakeholders as against facts etc	1. PRA 2. Social Mapping 3. FGD 4. SSI
PRI representatives	13			
Member ZP	1	• Understanding issues related to the project • Assessing Role of PRIs in rehabilitation and LADA related work	• Compensations • Agreements between project proponents and Gram Panchayats • LADA plans and work	1. SSI

Pradhan/Members	12	• Assessing implementation of LADA Work • Assessing dynamics between the community, PRI representatives and project proponent	• Status of compensations • Agreements between project proponents and Gram Panchayats • LADA plans and work	1. SSI
Government Officials	16			
CMO	1	• Understanding health status of the region • Assessing changes in disease patterns in the region • Identifying impact of project workers and their presence on local health issues	• Status of communicable and non communicable diseases • Change in disease patterns of local population • Status of HIV prevalence	1. Discussion & debriefing
Medical officer	1	• Understanding Health status of the region • Assessing changes in disease patterns in the region • Identifying impact of project workers and their presence on local health issues	• Status of communicable and non communicable diseases • Change in disease patterns of local population • Status of HIV prevalence	1. Discussion & debriefing

PO DRDA	1	• Gathering views related to project implementation • Understanding implementation of RRP and LADA activities	• Dynamics between proponents, PRI representatives and community • Progress of LADA plans and problems • Issues and progress related with implementation of the RRP, CAT plan and DMP	1. Discussion & debriefing
SDM	1	• Gathering views related to project implementation • Understanding implementation of RRP and LADA activities	• Dynamics between proponents, PRI representatives and community • Progress of LADA plans and problems • Issues and progress related with implementation of the RRP, CAT plan and DMP	1. Discussion & debriefing
Tehsildar	2	• Gathering views related to project implementation • Understanding implementation of RRP and LADA activities • Understanding local dynamics	• Dynamics between proponents, PRI representatives and community • Progress of LADA plans and problems • Issues and progress related with implementation of the RRP, CAT plan and DMP	1. Discussion & debriefing
Exec Engineer IPH	1	• Understanding situation of water sources and possible impacts due to project work	• Number and quality of water sources • Change in sources due to project • Possible changes in the future in sources of water	1. Discussion & debriefing

Brigadier, Army	1	• Understanding issues related with Eco development of the area and possible role of the army	• Eco development work being done by the army	1. Discussion & debriefing
Lt. Col ETF	1	• Understanding issues related with Eco development of the area and possible role of the army	• Eco development work being done by the army	1. Discussion & debriefing
DC Kinnaur	1	• Gathering views related with project implementation • Assessing compliance on implementation of RRP and LADA activities	• Dynamics between proponents, PRI representatives and community • Progress of LADA plans and problems • Issues and progress related with implementation of the RRP, CAT plan and DMP	1. Discussion & debriefing
Sup. Engineer PWD	1	• Gathering technical views related with construction, boring and blasting • Assessing the validity of alleged cases of cracks in houses due to project work	• Safety and legal compliance of blasting activities with standards. • Progress of blasting/boring activity • Discussion on cracks in houses and its relation with blasting also understanding the process of verification of such cases	1. Discussion & debriefing

Sup. Engineer IPH	1	• Understanding situation of water sources and possible impacts due to project work	• Number and quality of water sources • Change in sources due to project • Possible changes in sources of water in the future	1. Discussion & debriefing
Forest Department	1	• Assessing status of compliance of CAT plan	• Progress of CAT plan finances • Progress of physical work in the CAT plan • Reasons for delay etc	1. Discussion & debriefing
Asst Engineer, HP Pollution Control Board	1	• Assessing pollution hazards due to the project	• Issues related with air and water pollution • Impact of Dust over local area • Muck disposal methods and related issues	1. Discussion & debriefing
Director, Horticulture	1	• Assessing project impact on horticulture in general and on apple farming in particular	• Horticulture productivity and markets in the region • Local crops and their volume • Status of apple production and possibilities of project impact on the same	1. Discussion & debriefing
Research Officer, Horticulture	1	• Assessing project impact on horticulture in general and on apple farming in particular	• Horticulture productivity and markets in the region • Local crops and their volume • Status of apple production and possibilities of project impact on the same	1. Discussion & debriefing

NGO Functionaries	2	• Understanding issues pertinent to the region, community • Understanding the status of differences between proponents and the community	• Issues pertaining to Baspa II and Nathpa Jhakri projects	1. Discussion & debriefing

The above stakeholders were consulted as part of the stakeholder consultation process, besides the Stakeholder Consultation Report conducted by Sharnam Sewa Samiti. The comments received by each of these stakeholders, along with the ways in which they were addressed are presented in the following section.

E.2. Summary of the comments received:

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The Stakeholders Consultation Report was conducted using a process providing the stakeholders with an opportunity to understand the project activity and give their comments. Provided below is a summary of the comments received from the local stakeholders.

a) ***Local population (Villagers/Representatives of local governing bodies)***

Comment from Local Villagers	Response of Project Proponent
The rock structure in the region is not solid enough to bear the impact of blasting as the mountains shake during blasting conducted underground, resulting in cracks in houses.	Damage to houses due to the underground works could not be proven but even then the proponents have agreed to pay compensation of the verified cases by the district administration. The project proponent entertains such claims and responds to the reports of the government monitors who check such cases and verify if the cracks have come due to the project. Additionally, an amount of Rs. 2.5 Million has been deposited with the D.C. towards Corpus fund for disbursement of relief in case of damage to houses. Further, the mountains in this area are comparatively young and fragile and hence prone to natural shifting and breakdown. As a result small landslides and occasional cracking of building in the area is a common phenomenon since centuries.
Water sources in the region would dry up and result in water scarcity.	There is no evidence to suggest that the project activity has any adverse impact on the water sources in the region. No water source has been

	reported to have dried so far due to the project. Occasionally water sources do dry up even due to natural causes. The Irrigation and Public health department is planning to conduct a survey of water sources in the area, which may throw some more light on the issue.
The apple production in the area has been adversely effected by the project and the project activity has resulted in the occurrence of 'Rust' disease in the apples.	The project proponent conducted an investigation to assess any impact the project may have had on the production apple production, and contacted the Horticulture department as part of the stakeholder assessment to verify these claims. Officials at the Horticulture department have stated that firstly there has been no decline in apple production in the last 2 years and secondly, apple production has not been affected due to the project. There is a general dip in production in particular years due to climatic factors and this happens across the apple belt. Officials also shared that there is no known linkage between dust and blasting with apple production.
The local villagers were concerned that the influx of labourers for the project would cause cultural invasion vitiation and introduce diseases carried by the labourers.	There is no evidence to suggest that the outside labour brought in for the project is having any adverse effects on the cultural environment of the region. Discussions with senior medical officers revealed that the area was fraught with TB cases in the past but it has been controlled and now only minor and occasional disease is found. There has been no data to suggest that any new trend or new disease, which can be attributed to the project, has been noticed.
The local villagers were concerned about the environmental impact on the region due to the project activity.	The project proponent has endeavoured to minimize adverse impacts due to the project activity and is ensuring sufficient resources are made available to the local authorities to remedy any possible damage the region's natural environment. In this context, JKHCL has deposited Rs. 149.29 Million to the forest department, which is responsible for implementing the CAT plan approved by the government. While Rs.145.24 Million have been paid in cash, Rs. 4.05 Million has been paid as fixed deposits and equipment. A balance of Rs. 170.15 Million is still payable by the company in the remaining period of the project implementation. Similarly for compensatory afforestation, the

	company has deposited an amount of Rs. 26.43 Million with the forest department. The work of compensatory afforestation is to be done by the Forest Department of Govt. of HP as per the project agreement. Though staff of the forest department did share that some afforestation work has been started but the community does not agree with this view rather it has the opinion that even nursery preparation has to be taken up. Regarding the Disaster management plan, an amount of Rs. 5.50 Million has been deposited with the DC, Kinnaur. In addition to this allocation, the company is setting up an early warning system based on VSAT stations. It is estimated that it will be established before completion of the Dam.

b) ***Ministry of Environment & Forests (MoEF), Government of India***

After having reviewed the project at the planning stage, the MoEF had provided a NOC for the project in the first instance.
The project proponents had also got conducted a comprehensive EIA study, which had been submitted to the MoEF. The MoEF duly carries out the appraisal of the EIA and adjudge the project activity to be permissible from an environmental perspective. After scrutinizing the EIA report, it has issued the environmental clearance besides according the diversion of forest land for the purpose of the project activity.
Further, the MoEF is the Designated National Authority (DNA) for the host country. Hence, before the project is validated, the Host Country Approval (HCA) is to be provided by the MoEF. This is done after another review of the project and any further observations that may remain pending shall be suitably addressed before the HCA is granted.

c) ***Central Electricity Authority (CEA), Government of India***

The CEA is the federal/central regulatory authority which governs the electricity generation and distribution in the host country. Hence, a clearance for a large scale project, such as the said project activity, is mandatory before the project can be implemented. This clearance is provided in the form of a techno economic clearance, which the project proponent has already received.
This was done during the inception stage of the project, where the consent to establish was granted and there were no adverse comments received by the project participant.

d) ***H.P State Environment Protection & Pollution Control Board (HP SEPPCB)***
The H.P SEPPCB is the state level environmental regulatory authority under whose jurisdiction the site for the said project activity is located. Accordingly, the project activity was thoroughly scrutinized at the onset, in accordance with the applicable regulations, such as the Water and Air Acts. Only after fully

satisfying the HP SEPPCB was the project proponent granted the consent to establish the said project activity.

E.3. Report on how due account was taken of any comments received:

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The project proponent has thus addressed the comments/reservations the local inhabitants had about the project activity. Further, the stakeholder consultation process was conducted by a third party in a transparent and extensive manner and the report of the same is providing a comprehensive representation of the real situation. The third party that conducted the process ensured that it was done in a fully inclusive manner, besides conducting separate meetings with women and tribals, to ensure an accurate representation of impact and perceptions about the project activity.

Over and above this, the project proponent is a socially responsible organization and endeavours to maximize benefits of the project activity to the local inhabitants. There have been number of measures undertaken to comply with mandatory regulatory obligations. However, the project proponent has also undertaken a number of initiatives voluntarily to ensure the local stakeholders also benefit from the project activity in the region. JKHCL has undertaken these voluntary initiatives, along with complying with mandatory requirements for the project and has sought to address all the concerns of the stakeholders. Thus, JKHCL has demonstrated its commitment to address the concerns of the stakeholders and minimizing the adverse impacts of the project activity on them, and shall continue to do so in the future as well.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Jaypee Karcham Hydro Corporation Limited
Street/P.O.Box:	Sector 128
Building:	
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State/Region:	Uttar Pradesh
Postcode/ZIP:	201304
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FAX:	+91-120-4609464
E-Mail:	dp.goyal@jalindia.co.in
URL:	
Represented by:	Mr. Dharam Paul Goyal
Title:	Managing Director
Salutation:	Mr.
Last name:	Goyal
Middle name:	Paul
First name:	Dharam
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Direct FAX:	
Direct tel:	+91-120-4609207
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the proposed project activity.

Annex 3

BASELINE INFORMATION

The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the Combined Margin emission factor for the Northern grid, the details of which are available on the following website.
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
The procedures and formulas used for estimation of the baseline factor and the assumptions made have also been detailed in there.

Energy Generation in 90% Dependable Year (1993-94)

Energy Generation in 90% Dependable Year (1993-94)							
(On 95% Machine Availability Basis)							
Month	**Period**	**10- Daily Discharge, cumec**	**Release for aquatic life, cumec**	**Available Discharge, cumec**	**Power limited to 950 MW**	**Energy, GWH**	**Design Energy on Monthly Basis, GWh**
JUN	I.	499	6.80	499.00	950.00	228.00	**684.00**
	II.	698	6.80	698.00	950.00	228.00	
	III.	617	6.80	617.00	950.00	228.00	
JUL	I.	716	6.80	716.00	950.00	228.00	**706.80**
	II.	1085	6.80	1085.00	950.00	228.00	
	III.	686	6.80	686.00	950.00	250.80	
AUG	I.	731	6.80	731.00	950.00	228.00	**706.80**
	II.	579	6.80	579.00	950.00	228.00	
	III.	554	6.80	554.00	950.00	250.80	
SEP	I.	513	6.80	513.00	950.00	228.00	**614.50**
	II.	469	6.80	469.00	950.00	228.00	
	III.	272	6.80	265.20	660.43	158.50	
OCT	I.	194	6.80	187.20	466.19	111.89	**280.02**
	II.	157	6.80	150.20	374.05	89.77	
	III.	126	6.80	119.20	296.85	78.37	
NOV	I.	119	6.80	112.20	279.41	67.06	**186.24**
	II.	111	6.80	104.20	259.49	62.28	
	III.	102	6.80	95.20	237.08	56.90	

DEC	I.	91	6.80	84.20	209.69	50.32	**142.08**
	II.	82	6.80	75.20	187.27	44.95	
	III.	78	6.80	71.20	177.31	46.81	
JAN	I.	71	6.80	64.20	159.88	38.37	**118.77**
	II.	74	6.80	67.20	167.35	40.16	
	III.	68	6.80	61.20	152.41	40.24	
FEB	I.	69	6.80	62.20	154.90	37.18	**110.31**
	II.	69	6.80	62.20	154.90	37.18	
	III.	82	6.80	75.20	187.27	35.96	
MAR	I.	78	6.80	71.20	177.31	42.55	**158.52**
	II.	95	6.80	88.20	219.65	52.72	
	III.	103	6.80	96.20	239.57	63.25	
APR	I.	124	6.80	117.20	291.87	70.05	**201.78**
	II.	107	6.80	100.20	249.53	59.89	
	III.	127	6.80	120.20	299.34	71.84	
MAY	I.	233	6.80	226.20	563.31	135.19	**554.06**
	II.	288	6.80	281.20	700.28	168.07	
	III.	621	6.80	621.00	950.00	250.80	
TOTAL ENERGY							**4463.88**

Annex 4

MONITORING INFORMATION

The monitoring plan has been already explained in section B.7.2. Furthermore a CDM manual has been prepared outlining all the responsibilities and procedures related to monitoring of emission reductions in the CDM project activity.

The metering and monitoring procedures are in accordance with the Power Purchase Agreement (Article 8), and an excerpt of the same is presented below:

Metering

Installation of Meters

All meters shall be installed by the Company at its own cost. Each meter shall be of static type, conforming to latest IEC-687/IEC-62053-22, and shall meet the requirements of IEGC. Each Meter shall be capable of displaying the following parameters by turn on demand and storing all such parameters for a period of ten (10) days:

i. Average frequency for each successive 15 minute block, as a two digit code (00 to 99 for frequency from 49.0 to 51.0 Hz),
ii. Net Wh transmittal during each successive 15 minute block, up to second decimal, with plus/minus sign,
iii. Cumulative Wh transmittal at each midnight, in six digits including one decimal,
iv. Cumulative VArh transmittal at voltages above 103% of the nominal voltage at Interconnection point , at each midnight, in six digits including one decimal,
v. Cumulative VArh transmittal at voltages below 97% of the nominal voltage at Interconnection point, at each midnight, in six digits including one decimal,
vi. Date and time blocks of failure of voltage transformer supply on any phase, as star (*) mark.

A set of Meters comprising (a) a set of Main Meters and (b) a set of Check Meters shall be installed by the Company on each circuit of the outgoing transmission lines so as to record frequency quantities of both Active energy and reactive energy for (a) energy exported by the Project to the Grid during each settlement period and (b) energy imported by the Project from the Grid during each settlement period.

One such set of meters shall be installed by the company at the Interconnection Point and one complete set of tested, calibrated and sealed Meters shall be kept as spare in safe custody of the Company. All such meters shall be sealed in the presence of CTU (Project State Utility) and the Company, which seal shall remain intact unless it is broken by the Testing Laboratory for testing and calibration.

Accuracy class, Testing and Calibration of Meters

The accuracy class of measuring instruments shall be equal or better than:

a) 0.2% for Wh measurement of Meters,

b) 2% for KVArh measurement of Meters; and
c) 0.5% for current transformers and voltage transformers;

All the Main Meters and Check Meters shall be tested and calibrated by a reputed Testing laboratory. The Meters (and associated circuits, if necessary) shall be tested and calibrated I accordance with the provisions set out in the Connection Agreement and the IEGC, at least once in two (2) Tariff years, or at any time when the difference between the readings of the Main Meter and the corresponding Check Meter is found to exceed zero point four percent (0.4%). The company shall bear the cost of testing and calibration of the Meters. A notice of seven (7) days shall be issued by the Party which arranges for such testing and calibration, to enable authorized representatives of the other parties to witness the testing and calibration.

Inaccuracy of Meters

If during any testing and calibration, a Main Meter is found to be within zero point two percent (0.2%) permissible limit of error and the corresponding Check Meter is found to be beyond such limit of error, the Monthly bill shall be as per the reading of the Main Meter. The corresponding Check Meter shall be repaired and calibrated by the Testing Laboratory or replaced by a new and tested meter.

If during any testing and calibration, a Main Meter is found to be beyond zero point two percent (0.2%) permissible limit of error but the corresponding Check Meter is found to be within limit of error, the monthly bill shall, for that Month and till the date and time of the repair and calibration or replacement of the defective Main Meter, be as per the reading of the Check Meter. The corresponding Main Meter shall be replaced forthwith with a spare tested and calibrated meter, and the defective Main Meter shall be repaired and calibrated by the Testing Laboratory or replaced by a new and tested Meter.

If during any testing and calibration, a Main Meter and corresponding Check meter are both found to be beyond zero point two percent (0.2%) permissible limit of error, both the Meters or at least the Main meter shall be replaced forthwith with a spare tested calibrated meter.

Appendix I

List of All hydro power projects above 125 MW as on 31/05/2010[45]
considered in the common practice analysis
(Note: Private sector projects are highlighted)

Project and Investor name	Location (State)	Unit Size (MW)	Total Capacity (MW)	Public/ Private	Comments
Commissioned Projects					
Bhakra – L (BBMB)	H.P.	5*108	540	Public	Excluded being Public Sector
Bhakra – R (BBMB)	H.P.	5*157	785	Public	Excluded being Public Sector
Dehar (BBMB)	H.P.	6*165	990	Public	Excluded being Public Sector
Pong (BBMB)	H.P.	6*66	396	Public	Excluded being Public Sector
Baira SIUL (NHPC)	H.P.	3*66	198	Public	Excluded being Public Sector
Salal – I (NHPC)	J & K	3*115	345	Public	Excluded being Public Sector
Salal – II – (NHPC)	J & K	3*115	345	Public	Excluded being Public Sector
Chamera- I (NHPC)	H.P.	3*180	540	Public	Excluded being Public Sector
Chamera- II (NHPC)	H.P.	3*100	300	Public	Excluded being Public Sector
Uri (NHPC)	J & K	4*120	480	Public	Excluded being Public Sector
Dhauliganga (NHPC)	Uttaranchal	4*70	280	Public	Excluded being Public

[45] List of H.E. Stations in Country With Station Capacity Above 25 MW.pdf as Published by CEA

					Sector
Dulhasti (NHPC)	J & K	3*130	390	Public	Excluded being Public Sector
Nathpa Jhakri (SJVNL)	H.P.	6*250	1500	Public	Excluded being Public Sector
Tehri (THDC)	Uttaranchal	4*250	1000	Public	Excluded being Public Sector
Largi (HPSEB)	H.P.	3*42	126	Public	Excluded being Public Sector
Baspa – II (JHPL)	*H.P.*	*3*100*	*300*	*Private*	*Considered for common practise analysis*
Baglihar (J&KSPDC)	J & K	3*150	450	Public	Excluded being Public Sector
Ranjit Sagar Dam (PSEB)	Punjab	4*150	600	Public	Excluded being Public Sector
R.P. Sagar (RRJUVNL)	Rajasthan	4*43	172	Public	Excluded being Public Sector
Rihand (UPJVNL)	Uttaranchal	6*50	300	Public	Excluded being Public Sector
Chibro (UJVNL)	Uttaranchal	4*60	240	Public	Excluded being Public Sector
Ramganga (UJVNL)	Uttaranchal	3*66	198	Public	Excluded being Public Sector
Chilla (UJVNL)	Uttaranchal	4*36	144	Public	Excluded being Public Sector
Manerbhalli Stage II (UJVNL)	Uttaranchal	4*76	304	Public	Excluded being Public Sector
Vishnuprayag (JPVL)	*Uttaranchal*	*4*100*	*400*	*Private*	*Considered for common practise*

					analysis
Ukai (GSECL)	Gujarat	4*75	300	Public	Excluded being Public Sector
Kadna (GSECL)	Gujarat	4*60	240	Public	Excluded being Public Sector
Sardar Sarovar-CHPH (SSNNL)	Gujarat	5*50	250	Public	Excluded being Public Sector
Sardar Sarovar-RBPH (SSNNL)	Gujarat	6*200	1200	Public	Excluded being Public Sector
Indira Sagar (NHDC)	M.P	8*125	1000	Public	Excluded being Public Sector
Omkareshwar (NHDC)	M.P	8*65	520	Public	Excluded being Public Sector
Pench (MPGPCL)	M.P	2*80	160	Public	Excluded being Public Sector
BanSagar Tons – I (MPGPCL)	M.P	3*105	315	Public	Excluded being Public Sector
KoynaI & II (MAHAGENCO)	Maharashtra	4*70 + 4*80	600	Public	Excluded being Public Sector
Koyna III (MAHAGENCO)	Maharashtra	4*80	320	Public	Excluded being Public Sector
Koyna IV (MAHAGENCO)	Maharashtra	4*250	1000	Public	Excluded being Public Sector
Ghatghar PSS (MAHAGENCO)	Maharashtra	2*125	250	Public	Excluded being Public Sector
Bhira (Tata Power)	*Maharashtra*	*6*25 + 1*150*	*300*	*Private*	*Considered for common practise analysis*
Lower Sileru (APGENCO)	Andhra Pradesh	4*115	460	Public	Excluded being Public Sector

N.J. Sagar (APGENCO)	Andhra Pradesh	1*110 + 7*100.8	815.60	Public	Excluded being Public Sector
Srisailam (APGENCO)	Andhra Pradesh	7*110	770	Public	Excluded being Public Sector
Srisailam LBPH (APGENCO)	Andhra Pradesh	6*150	900	Public	Excluded being Public Sector
Sharavathy (KPCL)	Karnataka	10*103.5	1035	Public	Excluded being Public Sector
Kalinadi (KPCL)	Karnataka	3*135 + 3*150	855	Public	Excluded being Public Sector
Varahi (KPCL)	Karnataka	4*115	460	Public	Excluded being Public Sector
Kadra (KPCL)	Karnataka	3*50	150	Public	Excluded being Public Sector
Sharavathy Tail Race (KPCL)	Karnataka	4*60	240	Public	Excluded being Public Sector
Almatti dam (KPCL)	Karnataka	1*15 + 5*55	290	Public	Excluded being Public Sector
Jog (KPCL)	Karnataka	4*13 + 4*21.6	139	Public	Excluded being Public Sector
Idukki (KSEB)	Kerala	6*130	780	Public	Excluded being Public Sector
Sabarigiri (KSEB)	Kerala	6*50	300	Public	Excluded being Public Sector
Kuttiyadi & K Extn. (KSEB)	Kerala	3*25 + 1*50	125	Public	Excluded being Public Sector
Lower Periyar (KSEB)	Kerala	3*60	180	Public	Excluded being Public Sector
Kundah – II (TNEB)	Tamil Nadu	5*35	175	Public	Excluded being Public Sector

Kundah – III (TNEB)	Tamil Nadu	3*60	180	Public	Excluded being Public Sector
Mettur Tunnel (TNEB)	Tamil Nadu	4*50	200	Public	Excluded being Public Sector
Periyar (TNEB)	Tamil Nadu	4*35	140	Public	Excluded being Public Sector
Kadamparai (TNEB)	Tamil Nadu	4*100	400	Public	Excluded being Public Sector
Pykara Ultimate (TNEB)	Tamil Nadu	3*50	150	Public	Excluded being Public Sector
Hirakud – I (OHPC)	Orissa	2*49 + 2*32 + 3*37.5	275.50	Public	Excluded being Public Sector
Balimela (OHPC)	Orissa	6*60 + 2*75	510	Public	Excluded being Public Sector
Rengali (OHPC)	Orissa	5*50	250	Public	Excluded being Public Sector
Upper Kolab (OHPC)	Orissa	4*80	320	Public	Excluded being Public Sector
Upper Indravati (OHPC)	Orissa	4*150	600	Public	Excluded being Public Sector
Purulia PSS (WBSEDCL)	West Bengal	4*225	900	Public	Excluded being Public Sector
Teesta (NHPC)	Sikkim	3*170	510	Public	Excluded being Public Sector
Kopili (NEEPCO)	Assam	4*50	200	Public	Excluded being Public Sector
Ranganadi (NEEPCO)	Arunachal Pradesh	3*135	405	Public	Excluded being Public Sector
Under execution					

Parbati St. II (NHPC)	H.P.	4*200	800	Public	Excluded being Public Sector
Chamera – III (NHPC)	H.P.	3*77	231	Public	Excluded being Public Sector
Parbati – III (NHPC)	H.P.	4*130	520	Public	Excluded being Public Sector
Kol Dam (NTPC)	H.P.	4*200	800	Public	Excluded being Public Sector
Rampur (SJVNL)	H.P.	6*68.67	412	Public	Excluded being Public Sector
Uri – II (NHPC)	J & K	4*60	240	Public	Excluded being Public Sector
Koteshwar (THDC)	Uttaranchal	4*100	400	Public	Excluded being Public Sector
Loharinagpala (NTPC)	Uttaranchal	4*150	600	Public	Excluded being Public Sector
Tapovan Vishnugad (NTPC)	Uttaranchal	4*130	520	Public	Excluded being Public Sector
Teesta Lower Dam –III (NHPC)	West Bengal	4*33	132	Public	Excluded being Public Sector
Teesta Lower Dam –IV (NHPC)	West Bengal	4*40	160	Public	Excluded being Public Sector
Subansiri Lower (NHPC)	Arunachal Pradesh	8*250	2000	Public	Excluded being Public Sector
Kameng (NHPC)	Arunachal Pradesh	4*150	600	Public	Excluded being Public Sector
Lower Jurala (APGENCO)	Andhra Pradesh	6*40	240	Public	Excluded being Public Sector
Allain Duhangan (ADHPL)	*H.P.*	*2*96*	*192*	*Private*	*Considered for common practise*

					analysis
Karcham Wangtoo (JKHCL)	*H.P.*	*4*250*	*1000*	*Private*	*Project Activity*
Shrinagar (GVK)	*Uttaranchal*	*4*82.5*	*330*	*Private*	*Considered for common practise analysis*
Maheshwar (SMHPCL)	*M.P.*	*10*40*	*400*	*Private*	*Considered for common practise analysis*
Teesta- III (Teesta Urja Ltd.)	*Sikkim*	*6*200*	*1200*	*Private*	*Considered for common practise analysis*
Kishanganga (NHPC)	J & K	3*110	330	Public	Excluded being Public Sector
Teesta- VI (LANCO)	*Sikkim*	*4*125*	*500*	*Private*	*Considered for common practise analysis*

Appendix II

Environment Management Plan

Cost for environmental management and monitoring as per Meeting of State Level EIA & Monitoring Committee held on 17.3.2005 and as contained in Environmental Clearance from MoEF dated 9.11.2005

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
Environmental Management			
1.	**Rehabilitation and Resettlement**		
	a) Compensation for land for permanent works		
	i) Govt. / forest land	95.6 ha	18.727

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
	ii) Private land	3.65 ha	4.86
	b) **Lease rent for land for temporary works (7 years)**	64.41 ha	37.059
	c) **Compensation under R&R Scheme**	-	0.485
	d) **Compensation for trees**	1191 Nos.	4.486
	e) **Compensation for buildings**		
	i) Government buildings (plinth area)	2343.12 m^2	25.361
	ii) Private buildings (plinth area)	3686.33 m^2	31.683
		Sub total (1)	**122.661**
2.	**Plantation of trees on roads, work sites and camp sites etc. development of parks and nurseries and protection for 6 years**	1.0 lakh Nos.	19.800
		Sub total (2)	**19.800**
3.	**Provision for maintaining environmental and ecological balance of the area**		
	a) Reclamation of quarry and borrow areas	Lumpsum	3.500
	b) Wildlife protection	Lumpsum	2.00
4.	Compensatory afforestation	320 ha	25.450
5.	Public health measures	Lumpsum	4.00
6.	Subsidy towards firewood, fuel etc.	Lumpsum	10.00
7.	Catchment area treatment for prevention of soil erosion, afforestation etc.	-	319.40
8.	CONSTRUCTION OF FISH TROUT SEED FARM		
	i) Expansion of rearing space at Sangla / Dhamwari for seed production		10.00
	ii) Purchase of Hatchery equipments for Sangla / Dhamwari Farms		4.00

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
	iii) Purchase of fish feed & transportation of seed for stocking		0.50
	iv) Construction of Angling at Sangla (fully furnished)		2.50
	v) Providing assistance to fish farms for the construction of race ways for fish farming		1.00
	Sub-total (8)		**18.00**
9.	**Compensation for loss of environmental value of forest land**	167.4247 ha	97.106
10.	**Provision of warning system in case of dam break**		
	a) Costs of Vsats	13.00	6.00
	b) Power equipment	13.00	3.920
	c) Installation charges of Vsats	13.00	1.20
	d) Construction of buildings	260 m^2	1.170
	e) Flood Monitoring Stations		1.00
11.	**Construction of retaining walls and other protection works at dumping sites as per the detailed structural drawings**	15 km @ Rs 77 lakh/km	115.50
12.	**Restoration of areas (including afforestation and engineering structures) used for dumping provision of sprinklers and transportation of muck to the dumping sites**	40.25ha @Rs 3 lakh/Ha	12.075
	Sub total (3 to 12)		**620.61**
13.	**Provisions for making good deficiency in water supply/irrigation schemes as a consequence of this Project**	Lumpsum	70.00 + 30.00

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
14.	**Provision for making good damages to houses as a consequence of this Project**	Lumpsum	10.00
15.	**Provisions for relocating the 22 kV switchyard/control station at Karcham due to its submergence after dam construction at Kil**	Lumpsum	2.50
16.	**Provision for making arrangements for dumping of muck and stacking of boulders associated with construction of transmission towers**	Lumpsum	1.00
	Sub-total (13 to 16)		**113.50**
17.	**Environmental Monitoring**		
	(i) Air, noise, water, soils quality monitoring during construction for 6 years	Lumpsum	3.50 =(3.0+0.5)
	(ii) Air, noise, water, soils quality monitoring during operation stage for 4years	Lumpsum	1.500
18.	**Environmental equipment support and laboratory facilities**	Lumpsum	1.50
19.	**Bio-monitoring studies of dam upstream and downstream**	Lumpsum	0.300
20.	**Provision for disaster relief**	Lumpsum	10.00
	Sub total (17 to 20)		**16.80**
21.	**Provision for setting up a self contained Health Care Institution**	Lumpsum	85.00
22.	**Provision for disaster management equipment**	Lumpsum	1.00
23.	**Provision for relief and rescue equipment**	Lumpsum	2.00
24.	**Provision for emergency Operation centre**	Lumpsum	2.50
	Sub total (21 to 24)		**90.50**

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
25.	**Roads and Bridges**		
i)	Construction of left bank road from Karcham to Wangtoo		200.00
ii)	Construction of double lane realigned NH22 from Karcham to Rali (total 3.5 km out of which 1.5km needs to be widen to double lane standard (including widening of bridge at Rali or provision of another bridge, if technically, feasible		70.00
iii)	Upgradation of NH-22 from Karcham to Jangi Sand Mines (Raita Khan) including strengthening of bridges		80.00
iv)	Construction of double lane bridges over Satluj (d/s of dam) and Baspa rivers		85.00
v)	Construction of wall near Tapri		5.00
vi)	Widening of NH-22		12.50
		Sub-total (25)	**452.50**
26.	**Implementation of village micro plans**		20.00
27.	**Setting up ITI for skill upgradation**		30.00
28.	**Community Assets**		50.00
29.	**Accommodation and allied expenses for Police (including recurring expenses for first year- actual recurring expenses will depend on the requirement of force)**		6.00 (3.0+3.0)
30.	**Provision of seismographs for auto-monitoring (including cost of monitoring)**		2.50

Sl. No.	Description	Quantity/ Unit	Amount (Rs. In Million)
		Sub-total (26 to 30)	108.50
		Grand total (1 to 30)	1544.622

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