CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Title : **"Allain Duhangan Hydroelectric Project (ADHP)**
Version: 1.4~~3~~
Date : 12~~3~~ April~~September~~ 2007~~6~~

A.2. Description of the project activity:

Project Profile:
Allain Duhangan Hydroelectric Project (ADHP) proposed by AD Hydro Power Ltd. (ADPL) 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 proposed project consists of high head underground power plant that would utilise flows from a combination of glacial snow melt and monsoon rains in these two rivulets for the purpose of harnessing hydro power.

ADPL intends to function as a merchant power plant with short term Power Purchase Agreements (PPA) of 1-3 years duration. The power generated at the project would be fed into Northern Regional Grid (NR Grid) of India. A 220 kV power transmission line (of approximately 185km length) is proposed to be constructed to evacuate power from the project, to an existing substation at Nalagarh, from where it will be fed to the NR Grid.

Construction work at project site has been started and the project activity is expected to start generation of power from June 2008. The project energy benefits have been assessed at (Central Electricity Authority-CEA approved) 678.18 GWh year in 90% dependable years. The project activity has a power density factor of 6508 W/M2.

Project Purpose:
The purpose of the project activity is to generate electricity using renewable hydro energy and supply it to various consumers through NR grid. In the NR grid more than 70% of the power supplied is generated using fossil fuels (coal, Diesel, Gas etc). And as the project activity is a renewable energy based power project, it will reduce anthropogenic Green House Gases (GHG) emissions that would have been generated to supply power to NR grid using fossil fuel. The project activity shall also contribute to sustainable development[1] in following manner:

- Sustainable development through utilization of renewable hydro resources available in the project region.
- Catering to power demand in Northern India by augmenting power supply in the NR Grid.
- Conservation of natural resources (like coal, gas, petroleum fuels etc.) through use of renewable source of energy.
- Adhering & contributing to India's national policy of promoting clean power.
- Providing Employment opportunities[2] to local community during plant construction and operations

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[1] Sustainable development aspects are discussed in annex-5

[2] 2000 people during plant construction and 100 people during plant operations

- Development of infrastructure in the region
- Implementation of the project activity would catalyse implementation of other similar hydro power projects in India by private players.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (yes/no)
Government of India (Host Party)	AD Hydro Power Ltd. (ADPL)	Yes
Government of Italy	International Bank for Reconstruction and Development (IBRD) as the Trustee of the Italian Carbon Fund (ICF)	Yes

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

Himachal Pradesh

A.4.1.3. City/Town/Community etc:

Village: Pirni
Tehsil: Manali
District: Kullu

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

The project is located in Pirni village near Manali Town in the District of Kullu of Himachal Pradesh. The project site is located about 60 Kms from Bhuntar airport and 50 Kms. from the town of Kullu. Both these towns are located along the National Highway-21. Bhuntar is 500 Kms from national capital Delhi by road. Other locational details are provided in annex-6.

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

The project is a run of the river hydro power project and categorized in Scope Number 1; Sectoral Scope-Energy industries (renewable/non-renewable sources).

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

The project involves the construction of a barrage, forebay reservoir, head works, a de-silting basin, head race tunnel for both Allain and Duhangan streams terminating at storage reservoir, steel lined pressure shafts (partly inclined and partly horizontal), and an underground power house for 2 generating units, each of 96 MW capacity, tail race tunnel and an outdoor switchyard. The combined flows of the two rivers via a 1.69 km long pressure shaft will feed a single powerhouse with 2 units each of 96 MW capacity to be located in a rock cavern. The water from the powerhouse will be led back to Allain stream through a tailrace tunnel followed by an open channel.

The project involves use of conventional technology for generation of power. Turbine and generator are the key components of the plant. The type of turbine has been selected after a detailed study of the hydrology and other technical details. The project envisages using Jet Pelton turbine with 96 MW, 11kV, 0.9 PF, 3 phase, 50 Hz, 500 rpm vertical shaft hydro-generator with air coolers, static Excitation & braking equipment.

"Pelton wheel turbine is an impulse turbine/Jet turbine, where jets of water hit the runner buckets to rotate the runner shaft, which in turn rotate the hydro generator, which produce the electricity. The whole pressure energy (head) gets converted in the kinetic energy to rotate pelton wheel."

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project activity is a run-of-river with no project emissions associated with its operations. In the absence of the project activity, same amount of power would have been generated using fossil fuels as in the case of current grid generation mix, which is dominated by rather inefficient coal-fired power plants[3]. The project activity thus avoids power generation using fossil fuels and reduces associated GHG emissions.

The project activity faced various barriers for implementation. Without CDM benefits it would have not been possible to implement the project.

The estimated total reduction in tonnes of CO2 equivalent over the crediting period of 10 years = 4946684~~5,036,160~~ tCO2e

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Years	**Annual estimation of emission reductions in tonnes of CO2 e**
June, 08 – May, 09	494668~~503616~~
June,09 – May, 10	494668~~503616~~
June, 10 – May, 11	494668~~503616~~
June, 11 – May, 12	494668~~503616~~
June, 12 – May, 13	494668~~503616~~
June, 13 – May, 14	494668~~503616~~
June, 14 – May, 15	494668~~503616~~
June, 15 – May, 16	494668~~503616~~
June, 16 – May, 17	494668~~503616~~
June, 17 – May, 18	494668~~503616~~
Total estimated reductions (tonnes of CO2 e)	4946684~~5036160~~
Total number of crediting years	10 Years Fixed Crediting Period
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	494668~~503616~~

A.4.5. Public funding of the project activity:

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[3] Current generation mix provided in annex-3

International Finance Corporation (IFC) Washington has taken an equity share in the project and has invested in debt capital as well. However this financing is not part of an International Official Development Assistance (ODA) effort. Details of investments are available to the DOE for validation.

SECTION B. Application of a baseline methodology

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

Methodology: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated baseline methodology ACM0002/Version 05, Sectoral Scope: 01, Dt 03 March 2006

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The position of the CDM project activity vis-à-vis applicability conditions in the ACM0002/Verson05 is described in the following table.

Applicability Conditions in the ACM0002/Version05	Position of the project activity vis-à-vis applicability conditions
Applies to electricity capacity additions from: Run-of-river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased.	The project activity is a grid connected run-of-the-river hydro power project
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	It is a renewable energy project with no fuel-switch involved.
The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and	The project activity supplies power to NR Grid which in turn caters to electricity demand in various states in North India. The NR Grid encompasses all power plants supplying power through the grid to the states of Delhi, Haryana, HP, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, and Union Territory of Chandigarh. Adequate data is available to estimate grid emission factor.

B.2. Description of how the methodology is applied in the context of the project activity:

The project activity uses the approach described in the ACM002/Version05**- "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"**

The project activity is passed through the following methodological steps as described in ACM0002 for determining the baseline.

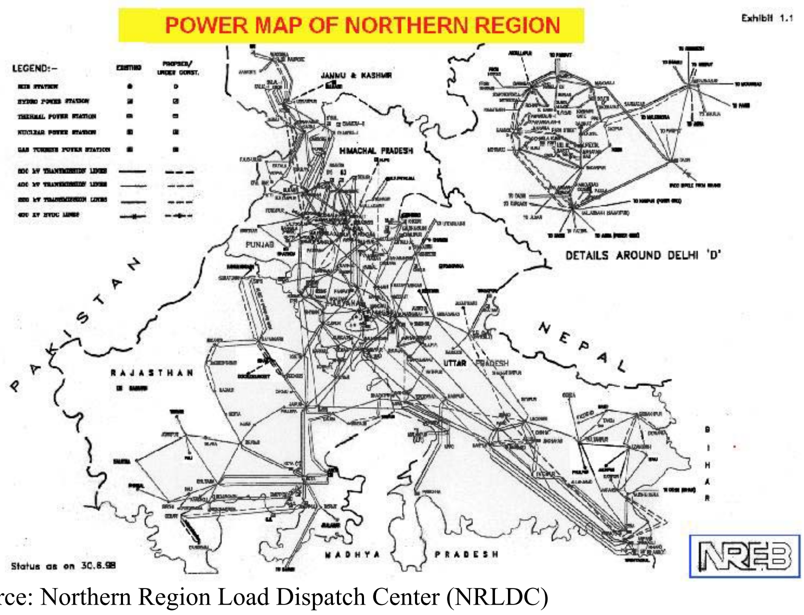
STEP 1: Grid Selection

Project Electricity System-

Baseline scenario for the project activity is the "Electricity delivered to the grid by the project that 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) baseline calculation.

India's power & electricity operations are organized into five "power regions", i.e. North, South, East, West and North East. Power generation projects have traditionally been planned and implemented on the basis of the projected demand in the region and also the availability of fuel. However over a period of time demand –supply gaps have emerged across regions on account of long gestation periods, demand patterns and consumer mixes. It is a fairly common occurrence that, while there may be surplus energy in one region at any point of time, there is a deficit in other region. However due to inadequately developed intra-regional transmission system, regional exchanges of power is still limited.

ADHP is in the state of Himachal Pradesh which is connected to NR Grid. The power produced in the plants shall be dispatched to the NR grid through Nalagarh sub-station. ADHP is contributing to the NR grid as a whole and so the region selected for estimation of grid emission factor is taken as NR Grid.



Source: Northern Region Load Dispatch Center (NRLDC)

A list of power generating units contributing towards the NR grid is given in annex-2

Connected Electricity System-

There are power exchanges among various electricity grids and NR grid is also fed from other regional grids e.g. western & eastern region grids

Table 1.1: Inter-Regional Exchange – Imports (GWh)		
Year	**From Western Region**	**From Eastern Region**
2004-05	1495.78	1520.02
2003-04	282.02	2616.78
2002-03	140.78	1520.02

Source: www.nrldc.org/nrldc/grid-reports.asp; 2002-03, 20023-04, 2004-05

For the purpose of determining the Operating Margin, CO2 emission factor for electricity imports $COEF_{i,j,imports}$ from other connected electricity systems has been considered as '0' tCO2/ MWh to be more conservative as described in ACM0002/version054

STEP 2: Calculation of the Operating Margin emission factor (EF_{OM})

There are four methods suggested by the methodology ACM0002 –
1. Simple OM
2. Simple adjusted OM
3. Dispatch Data Analysis OM
4. Average OM

Among these four options the method of **Simple OM** is adopted for the project activity as –

1. Adequate data for Dispatch Data Analysis is not available, and
2. Low cost/ must run power sources contribute less than 50% of the total grid generation in the five most recent years. The grid is thermal power dominated; more than 70% power is supplied using thermal energy sources. Less than 30% is provided by hydro and other sources.

Generation Mix of Power Generation in Northern Region for 5 Years					
	2000-01	2001-02	2002-03	2003-04	2004-05
Thermal (Coal+Gas)	108430.5	113715.8	108298.1	111833.4	115550.8
Low cost/Must run	35740.8	37116.9	37472.5	44169.2	45357.4
Total	**144171.3**	**150832.6**	**145770.6**	**156002.7**	**160908.2**
% of Low cost/must run	**25%**	**25%**	**26%**	**28%**	**28%**
Unit	GWh				
Source	www.nreb.co.in www.nrldc.org				

Simple OM: The Simple OM emission factor ($EF_{OM,simple}$) is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants.

The vintage of data for estimating Simple OM taken is 3-year average based on the most recent statistics available. (OM for the year 2002-03, 2003-04 & 2004-05 has been considered)

Table 1.2: Data used for the estimation of Simple OM emission factor

SN	Parameter	Source
1	Detail of power plants connected to the NR grid electricity system	NREB/NRLDC annual reports for the years 2002-03, 2003-04 & 2004-05
2	Gross power generation data for all the generating units	NREB/NRLDC annual reports for the years 2002-03, 2003-04 & 2004-05
3	Auxiliary power consumption for power generation	Performance Review of Thermal Power Stations for 2004-05; CEA report
4	Net power generation for all the generating units	Estimated based on gross power generation and auxiliary power consumption
5	Fuel emission factor	IPCC default values[4]
6	Design Heat Rate of generating units	Performance Review of thermal power Stations for 2002-03, 2003-04, 2004-05
7	Regional Heat Rate	Performance Review of thermal power Stations for 2002-03, 2003-04, 2004-05

Table 1.3: Data used for Simple OM emission factor

Parameters	2002-2003			2003-2004			2004-2005			Source
	Coal	Gas	Diesel	Coal	Gas	Diesel	Coal	Gas	Diesel	
NCV_i (kcal/kg)	4171	10750	9760	4171	10186	9760	4171	10750	10186	Coal: General Review 2000-01, 2002-03, 2003-04, 2004-05 (CEA) Gas: IPCC-Good Practice Guidance Diesel: General Review 2002-03 (CEA)
$EF_{CO2,i}$ (tonne CO_2/TJ)	96.1	56.1	74.1	96.1	56.1	74.1	96.1	56.1	74.1	IPCC 1996 Revised Guidelines and the IPCC Good Practice Guidance
$OXID_i$	0.980	0.995	0.990	0.980	0.995	0.990	0.980	0.995	0.990	Revised 1996 IPCC Guidelines
$COEF_{i,j\,y}$(tonne of CO_2/ton of fuel)	**1.645**	**2.512**	**2.998**	**1.645**	**2.512**	**3.129**	**1.645**	**2.512**	**3.129**	**Calculated as per ACM0002/ version05**

[4] IPCC default values for emission factor for fuels have been considered as authentic plant/ country specific values for fuel emission factors in India are not available. As per ACM0002, in case on unavailability of this data, IPCC default values could be used. Unavailability of authentic plant/ country specific values for fuel emission factors is also evident from the fact that Central Electricity Authority (CEA) in India has also used IPCC default values for recently conducted estimation of grid emission factor for regional grids in India (http://www.cea.nic.in/planning/c%20and%20e/user%20guide%20ver1.1.pdf).

Operating Margin Estimation for Northern Grid (T CO2/MWh)	
OM, 2002-03	0.972
OM, 2003-04	0.972
OM, 2004-05	0.970
Average OM	**0.971**

Operating Margin Estimation for Northern Grid (T CO2/MWh)	
OM, 2002-03	0.955
OM, 2003-04	0.947
OM, 2004-05	0.931
Average OM	**0.945**

STEP 3: Calculation of the Build Margin emission factor (EF_{BM})

Calculation of the Build Margin emission factor $EF_{BM,y\ ex\text{-}ante}$ 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 plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently).

Build Margin Estimation for Northern Grid 2004-05 (T CO2/MWh)	
Build Margin	**0.529**

STEP 4: Calculate the Grid Emission Factor (*EF)*

Grid Emission factor is the weighted average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}):

$EF = wOM \text{ X } EF_{OM} + wBM \text{ X } EF_{BM}$

Where the weights *wOM* and *wBM*, by default, are 50% (i.e., $wOM = wBM = 0.5$), and EF_{OM} and EF_{BM} are calculated as described in Steps 2 and 3 above and are expressed in tCO2/MWh. The weighted averages applied by the project participants are fixed for the entire crediting period.

Combined Margin for Northern Grid 2004-05	
OM, 2002-03	0.972
OM, 2003-04	0.972
OM, 2004-05	0.970
Average OM	**0.971**
BM	**0.529**
Combined Margin, CM	**0.750**

Combined Margin for Northern Grid 2004-05	
OM, 2002-03	0.955
OM, 2003-04	0.947
OM, 2004-05	0.931
Average OM	**0.945**
BM	**0.529**
Combined Margin, CM	**0.737**

STEP 5: Leakage

As per 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 – see applicability conditions above). As per the ACM0002 methodology, these potential emission sources are not accounted as leakage.

STEP 6: Emission Reductions

The project activity reduces carbon dioxide through displacement of grid electricity generation with fossil fuel based power plants by renewable-hydro energy based electricity. The emission reduction ER_y due to the project activity during a given year y is calculated as the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y)[5].

B.3. 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:

The ADHP is a run-of-the-river hydel project which will supply power through the NR Grid. The power generated by the project activity displaces the power that would have otherwise been generated using fossil-fuel as in the current supply mix of the grid. NR grid is operating with a mix of hydro, nuclear (Total 28%) and fossil fuel (Total 72%) power plants.

As per the decision 17/cp.7 Para 43, a project activity is considered additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in the absence of the registered project activity.

In the following steps, the additionality of the project activity is demonstrated following the approach described in ***"Tool for demonstration and assessment of additionality"***.

Step 0: Preliminary screening based on the starting date of the project activity

The crediting period of the project activity will start after the registration of the project activity, so step 0 does not apply to the project activity.

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

In sub steps 1a & 1b realistic and credible alternatives available to project developers are identified which provide output comparable to the project activity. Then it has been verified whether these alternatives are in compliance with all applicable legal & regulatory requirements or not.

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

The project activity is a Run-of-the-River hydel project to generate power by renewable sources of energy. Two alternatives can be identified to the project activity for this purpose. Either project

[5] Detailed formulas given in Section D

developers can implement the project without considering it as a CDM project or situation could continue as it is i.e. no implementation of ADHP.

Alternative 1: Implementation of ADHP not undertaken as a CDM project activity

Under this alternative, the project activity would use renewable sources of energy for generation of electric power and would operate as peaking power merchant. Thus project activity would displace certain amount of electricity that otherwise would have been generated in the grid. NR grid is connected with number of power plant using different sources for power generation like thermal-coal & gas, hydro and nuclear.

The implementation of project activity is not feasible without CDM benefits as it faces many barriers which could be resolve only on the basis of carbon credit backed benefits.

Alternative 2: Continuation of Current Situation

The continuation of the current situation i.e. ADHP is not implemented, would imply that the grid power would be generated by the operation of the power plants currently connected to the NR grid and by the addition of new plants – which are mostly fossil-fuel based (as most recently built plants). This alternative thus truly represents the scenario in the absence of project activity and has been considered as baseline.

Sub Step 1b- Enforcement of applicable laws and regulations

Both of the alternatives identified here are in compliance with applicable laws and regulations.

Step 2 is skipped because Step 3 is applied.

Step 3: Barrier analysis

The project activity uses step-3 (Barrier Analysis) of additionality tool to establish project activity additionality.

A: Investment barriers, other than the economic/financial barriers in Step 2 above:

The project activity is a large scale hydro power project and there were many barriers faced by project proponents for the project activity implementation. Financial closure is the major barrier faced by the project activity. This is evident by the fact that MoU was signed in 1993 and the Implementation Agreement was signed in 2001 with the Himachal Pradesh State Government and despite receiving all other necessary clearances in time; project has not achieved financial closure till now[6].

Project proponents started dialogues for financial assistance with various Indian financial institutions in early 2002 but project faced many problems arranging finance. Financial closure was achieved in 2005 only once the IFC showed its willingness to lend financial assistance because of the CDM potential of the project activity. After IFC's involvement in the project it became easier for the project proponents to convince other financial institutions of the financial credibility of the project. The following are the reasons for the difficulty in securing finance for large hydro projects in India.

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[6] This is the most common problem faced by other similar kinds of projects as well.

High Capital Cost:
The development of hydro projects entail high capital cost, long gestation period, difficult terrains, geological risks, hydrological risks and rehabilitation and resettlement related issues. This explains why out of India's hydro power potential of around 150,000 MW, only 17% has been exploited[7] and only 14% has been used for generation, despite low Operation & Maintenance (O&M) cost involved in the operation of the projects.

Typical capital costs for power projects in India:

Type of Power Project	Capital Cost (USD Mn/MW)
Gas based	0.88
Coal based	0.88
Wind	1.10
Co-generation	0.99
ADPL's 192 MW hydro	1.04

@ 1 USD =45.33 INR
(*Source : IDFC Research, Powerline)*

Low Return on the Investments:
The development of the project activity without considering it as CDM project activity is financially less attractive than other investment options and not feasible. The project activity entails high capital cost and the Internal Rate of Return (IRR) of the project without considering CDM benefits is only 10.69%[8], which is low in comparison to the company's weighted average capital cost (WACC) of 12.60%. This was one of the reasons why project took long time for financial closure.

Issues with Peaking merchant power plants:
ADPL intends to function as a merchant power plant with short term PPA of 1-3 years duration. The power generated at the project would be fed into NR Grid of India to be used by various users connected to the grid. As most of the State Electricity Boards (SEB) in India are facing financial problems, there is a risk of non-payment by SEBs hence the project is conceptualised as peaking merchant with short term PPA. However Indian FIs are wary of investing in peaking merchant plants due to lack of long term power off-take guarantee for the project.

Risk Perception of Lenders:
Indian Banks and Financial institutes view hydro power projects by private sector companies as risky ventures because of (i) their limited experience in financing hydro projects for private sector; (ii) the lack of full hydrological insurance cover, and (iii) volatility in electricity prices which make revenues unstable.

Lenders require higher equity participation from the investors to cover for the risk inherent in private sector-promoted hydro power projects (as high as 50% equity component as against 30% for equity component approved by Government). This makes financial closure difficult to achieve for hydro projects.

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[7] Most of this capacity is executed by Government owned agencies and not private players.

[8] IRR details provided in annex-7

Because of high capital cost and risk perception of lenders, it is difficult to arrange capital for hydro power projects in India. Involvement of the IFC - backed by CDM benefits - in the project activity has helped in lowering the risk perception of Indian Financial Institutions and banks in funding the hydro power project.

Problems faced for financial closure by private players in India is a well documented fact now. Same has been discussed by various forums like ministries, industry forums etc. These documents would be made available to DOE during validation.

B: Infrastructural Barrier –
The Plant is located in a hilly forest area in Himachal Pradesh. Lack of infrastructural facilities was a major barrier for project implementation.

Evacuation facility: The project activity is in hilly area and is surrounded by dense forest with no power evacuation facility in the nearby area. Project proponents will have to develop a power transmission network of 185 KM to evacuate power generated in the power plant. This will require commitment of additional financial & managerial resources from ADPL.

Geological Risk: Two water streams are linked underground for power plant construction. As the power project is located in a hilly area, it faces a huge geological risk of encountering hard rocky structure for excavation leading to cost and time over run. Also erosion of turbine components due to high head and sand/silt content (and also due to quartz crystals of high hardness) in the water may be excessive and reduce the annual energy production.

Step 4: Common Practice Analysis

ADPL's hydro project is one of the first hydro Independent Power Producers (IPPs) in India. An analysis of total power generated in northern region shows that there are not many large scale hydro power projects promoted by private players, hence it is one of its kind in the region

There is minimal private sector participation in hydro power generation in India. Nearly 98% of installed capacity is with Government owned utilities. There are only two IPP who have large hydro power projects in India: Tata Power (India's oldest private sector power generator having more than 448 MW of hydro power generation capacity installed way back in 1930) and Malana Power Company Ltd. (a LNJ Bhilwara group company and one of the equity investor in the ADPL)).

Lack of private sector participation in hydro power sector is due to difficulties in arranging finance for the projects. Further, most hydro projects in India have run up high capital costs, faced considerable implementation delays, run into geological related problems and faced significant rehabilitation & resettlement related problems, which have contributed to the high financial risk now associated with hydropower projects. In addition, private power generation in India has a chequered past, since state utilities are the usual off takers and the financial standing of most state owned utilities is in a parlous state. Given this background, most private investors are wary of venturing into hydro power development in India.

Step 5: Impact of CDM Registration

As discussed in the step 2 & step 3 of the additionality analysis above, the project is financially not attractive without the CDM benefits and also faces significant barriers for implementation. ADPL had decided to invest in the project activity after taking into account possible CDM revenue.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project site:

The project activity boundary covers the point of water supply to the point of power generation and export to the grid, where ADHP has a full control. Thus, the project boundary includes the water level over the intake, penstock, flow control valves, turbine, generator, control systems, auxiliary consumption units, synchroniser and the power evacuation system (Switch yard, transmission line) at the project activity site.

Electricity Grid:

NR Grid has a pool of state & private owned power generating plants. The units are owned by central government, respective state governments, private enterprises and in some cases jointly owned. Data about all these plants have been considered while estimating the grid emission factor. It also includes the electricity imports from other regional grids. The states in the NR grid are Delhi, Chandigarh, Haryana, Uttaranchal, Himachal Pradesh, Punjab, Rajasthan, J&K and Uttar Pradesh.

Therefore northern regional grid of India would be part of the geographical and system boundary for the project.

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid Electricity Generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification- this is conservative
		N_2O	No	Excluded for simplification- this is conservative
Project Activity	Electricity Generation	CO_2, CH_4, N_2O	No	The project activity is a run-of-river hydro power and hence no emissions.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The baseline was completed on 20/10/2005 by Emergent Ventures India Pvt. Ltd. The person who identified the baseline is not the project participant and not listed in the Annex1.

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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:

The project activity is expected to start power generation on 1st June 2008 (Expected commissioning date of first unit of 96 MW, second unit of 96 MW- 16th June 2008).

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

40 Years

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

C.2.1. Renewable crediting period

Not applicable

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/06/2008

C.2.2.2. Length:

10 Years

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

Methodology: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated monitoring methodology ACM0002/Version 05, Sectoral Scope: 1, Date: 03 March 2006

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

The project activity meets the applicability criteria of the 'Approved baseline methodology ACM0002'. (Please refer to Section B.2. for details). The applicability criteria of the 'Approved monitoring methodology ACM0002' are identical to those of the 'Approved baseline methodology ACM0002'. Therefore the project activity has used the 'Approved monitoring methodology ACM0002' in conjugation with the 'Approved baseline methodology ACM0002' for the project activity.

The project activity would monitor following as per the guidance provided in the approved methodology (ACM0002):

- Electricity generation from the proposed project activity;
- Data needed to calculate the operating margin emission factor, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to recalculate the build margin emission factor, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

Project emission associated to the project activity is zero. Therefore this section is Not Applicable

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1	EGy : Electricity supplied to the grid by the project activity	ADHP records/ Invoice records	MWh	Directly Measured	Hourly measurement and monthly recording	100%	Electronic	Meters installed at the switchyard would accurately monitor electricity supplied to the grid. Invoice details of these sales to various customers could also be used for cross-checking the data.
2	EFy : CO2 emission factor of the grid	NREB/NRLDC/CEA	tCO2/ MWh	Calculated	Once at the time of submission of PDD	100%	Electronic	Calculated as weighted sum of OM and BM emission factors as per step 3 in ACM0002. Fixed ex-ante.
3	EFOM,,y :CO2 simple operating margin emission factor of the grid	NREB/NRLDC/CEA	t CO2/ MWh	Calculated	Once at the time of submission of PDD	100%	Electronic	Calculated as Step 1 of ACM0002. A 3-year average, based on the most recent statistics available at the time of PDD submission,
4	EFBM,y : CO2 build margin emission factor of the grid	NREB/NRLDC/CEA	t CO2/ MWh	Calculated	Once at the time of submission of PDD	100%	Electronic	Calculated as Step 2 of ACM0002. The Build Margin emission factor EFBM,y ex-ante is based on the most recent information available on plants already built at the time of PDD submission.

5	Fi,j,y :Amount of fossil fuel i, consumed by each power source/ plant in year y	NREB/NRLDC/CEA	tons	Calculated	Once at the time of submission of PDD	100%	Electronic	Calculated based on the Total power generation, Average Net Calorific Value of the Fuel used and the Designed Station Heat Rate data of power plants of NR grid
6	COEFi,j,y : CO2 emission factor of each fuel type i,	IPCC	t CO2 / ton of fuel	Standard /Calculated	Once at the time of submission of PDD	100%	Electronic	Calculated based on the IPCC default value of the Emission Factor, Net Calorific Value and Oxidation Factor of the Fuel used by the power plants of NR grid
7	GENj,y : Electricity delivered to the grid by power source j in year y	NREB/NRLDC/CEA	MWh/ annum	Measured	Once at the time of submission of PDD	100%	Electronic	Obtained from authentic and latest local statistics.
8	Plant Name	Identification of power source/plants for the OM	Text	Estimated	Simple OM, Once at the time of PDD submission	100%	Electronic	Identification of power plants for simple OM
9	Plant Name	Identification of power source/plants for the BM	Text	Estimated	BM, Once at the time of PDD submission	100%	Electronic	Identification of power plants for BM

Data will be archived for crediting period + 2 years.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Calculation of baseline emission factor

The baseline emission factor ($EF_{,y}$) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps. Calculations for this combined margin are based on data from an official source.

STEP 1: Calculate the Operating Margin emission factor

Simple OM approach is the most appropriate calculations method because in the NR grid mix, the low-cost/must run resources constitutes less than 50% of total grid generation. Simple OM factor is calculated as under.

$EF_{OM,simple,y}$ is calculated as 3-year average (2002-03, 2003-04, 2004-05), based on the most recent statistics available at the time of PDD submission,

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \, x \, COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

Where

$GEN_{j,y}$	:	The electricity (MWh) delivered to the grid by source j
$COEF_{i,j\,y}$	:	The CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as described below and
$F_{i\,,j,\,y}$	:	The amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as described below

J, Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

Where

NCV_i	:	The net calorific value (energy content) per mass or volume unit of a fuel i
$EF_{CO2,I}$	:	The CO_2 emission factor per unit of energy of the fuel i (IPCC default value)
$OXID_i$	:	The oxidation factor of the fuel (IPCC default value)

The amount of fuel Fi,j,y is obtained as

$F_{i,j,y} = GGEN_{j,y} * DSHR_{y} \div NCVi$

where:
$GGEN_{j,y}$ = Gross Power Generation from the power source j in the year y (MWh)
$DSHR_{j,y}$ = Design Heat Rate of the power source j in the year y
NCV_{i} =Net calorific value per mass or volume unit of a fuel i

For most of the power plants design heat rate is taken wherever information is available. For other plants regional average regional design heat rate is taken.

STEP 2: Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of NR grid, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \, x \, COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Where

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - Are analogous to the variables described for the simple OM method above for plants m.

Calculation of the Build Margin emission factor $EFBM,_{y \text{ ex-ante}}$ are based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently)
.
Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of NR grid mix.

STEP 3: Calculate the baseline emission factor $EF_{,y}$ as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = W_{OM} \otimes EF_{OM,y} \oplus W_{BM} \otimes EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,Simple,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

<u>Calculation of Baseline Emissions</u>

$$BE_y = EF_y \; x \; EG_y$$

Where

BE_y : Baseline emissions due to displacement of electricity during the year y in tons of CO_2

EG_y : Electricity supplied to the grid by the project activity during the year y in MWh, and

EF_y : CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity. They are therefore neglected.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

There are no emission sources as leakage in the project activity. 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. However according to ACM0002 Project participants do not need to consider these emission sources as leakage in applying this methodology.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Formula used for estimation of the total net emission reductions due to the project activity during a given year *y* is as under.

$$ER_y = BE_y - PE_y - L_y$$

Where

ER_y : Emissions reductions of the project activity during the year y in tons of CO_2
BE_y : Baseline emissions due to displacement of electricity during the year y in tons of CO_2
PE_y : The project emissions associated with the project activity (none for the project activity)
L_y : The emissions sources as leakage (none for the project activity)

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. EG_y - Electricity supplied to the grid by the project activity	*Low*	Electricity meters are properly maintained with regular testing and calibration schedules developed as per the technical specification requirements to ensure accuracy. Electricity supply data to the grid could also be cross-checked with the invoices for sale of electricity to the consumers.
2,3,4	*Low*	This is calculated based on the formula described in ACM0002
5,7, 8,9	*Low*	Authentic grid data is used
6	*Low*	IPCC default values used

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

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 seniors 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. Detailed monitoring plan attached in annex-4.

D.5 Name of person/entity determining the monitoring methodology:

Ashutosh Pandey
Emergent Ventures India Pvt Ltd (not a project participant)
II C-141 Ridgewood Estate, DLF Phase IV

Gurgaon, Haryana – 122 002, India
Phone: 91-124 5102980
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Email: ashutosh@emergent-ventures.com

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

There are no project emissions in the project activity. PEy = 0

E.2. Estimated leakage:

There are no emission sources as leakage in the project activity. 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. However according to ACM0002/ version04, Project participants do not need to consider these emission sources as leakage in applying this methodology.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Total project activity emissions are zero over entire crediting period.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

SN	Operating Years	Baseline Emission Factor (tCO_2 / GWh)	Baseline Emissions (tCO_2)
1.	June, 08 – May, 09	737~~50.10~~	494668~~503616~~
2.	June,09 – May, 10	737~~750.10~~	494668~~503616~~
3.	June, 10 – May, 11	737~~750.10~~	494668~~503616~~
4.	June, 11 – May, 12	737~~750.10~~	494668~~503616~~
5.	June, 12 – May, 13	737~~750.10~~	494668~~503616~~
6.	June, 13 – May, 14	737~~750.10~~	494668~~503616~~
7.	June, 14 – May, 15	737~~750.10~~	494668~~503616~~
8.	June, 15 – May, 16	737~~750.10~~	494668~~503616~~
9.	June, 16 – May, 17	737~~750.10~~	494668~~503616~~
10.	June, 17 – May, 18	737~~750.10~~	494668~~503616~~

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

SN	Operating Years	Baseline Emissions (tCO2)	Project Emissions (tCO2)	CO2 Emission Reductions (tCO2)
1.	June, 08 – May, 09	494668~~503616~~	0	494668~~503616~~
2.	June,09 – May, 10	494668~~503616~~	0	494668~~503616~~
3.	June, 10 – May, 11	494668~~503616~~	0	494668~~503616~~

SN	Operating Years	Baseline Emissions (tCO2)	Project Emissions (tCO2)	CO2 Emission Reductions (tCO2)
4.	June, 11 – May, 12	494668~~503616~~	0	494668~~503616~~
5.	June, 12 – May, 13	494668~~503616~~	0	494668~~503616~~
6.	June, 13 – May, 14	494668~~503616~~	0	494668~~503616~~
7.	June, 14 – May, 15	494668~~503616~~	0	494668~~503616~~
8.	June, 15 – May, 16	494668~~503616~~	0	494668~~503616~~
9.	June, 16 – May, 17	494668~~503616~~	0	494668~~503616~~
10.	June, 17 – May, 18	494668~~503616~~	0	494668~~503616~~

E.6. Table providing values obtained when applying formulae above:

SN	Operating Years	Baseline Emissions (tCO2)	Project Emissions (tCO2)	Leakages (tCO2)	CO2 Emission Reductions (tCO2)
1.	June, 08 – May, 09	494668~~503616~~	0	0	494668~~503616~~
2.	June,09 – May, 10	494668~~503616~~	0	0	494668~~503616~~
3.	June, 10 – May, 11	494668~~503616~~	0	0	494668~~503616~~
4.	June, 11 – May, 12	494668~~503616~~	0	0	494668~~503616~~
5.	June, 12 – May, 13	494668~~503616~~	0	0	494668~~503616~~
6.	June, 13 – May, 14	494668~~503616~~	0	0	494668~~503616~~
7.	June, 14 – May, 15	494668~~503616~~	0	0	494668~~503616~~
8.	June, 15 – May, 16	494668~~503616~~	0	0	494668~~503616~~
9.	June, 16 – May, 17	494668~~503616~~	0	0	494668~~503616~~
10.	June, 17 – May, 18	494668~~503616~~	0	0	494668~~503616~~
Total					4946684~~5,036,160~~

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including trans boundary impacts:

Considering the size of the project activity its environmental impacts have been studied in detail. Original documentation for Environment Impact Assessment (EIA) was done to meet the regulatory requirements of Ministry of Environment and Forest, Government of India (MoEF) and was again conducted in the later years to meet the requirements of IFC and to comply with the procedural requirements of MoEF.

The EIA identified key issues that project developers need to address & resolve in project planning and implementation. The following environmental and social resources will have some minor impact during the pre-construction, construction and operational phases:

- Land Use, Topography, Soil Erosion/ Sedimentation
- Water Resources and Quality- Hydrology, Hydro-geology and Surface and Groundwater quality
- Ambient air quality
- Ambient noise quality and ground vibrations
- Ecology-Forests, terrestrial wildlife, aquatic biology and fisheries
- Health and sanitations
- Local culture and tourism
- Socio economic- Land, assets and livelihood

In addition natural hazards like flood, cloudburst, forest fire, earthquake, landslides/ avalanches and safety issues may be aggravated. Summary of potential impacts of the project activity across all these areas have been given in following section.

Land Use & Soil

Impact Area	Nature of Impact	Targets/ Interests	Magnitude and Extent	Overall Significance
Land use	Change in original land use, land degradation	Reduction of vegetation, loss of top soil	Within project component areas, ***small***; beneficial effect in terms of compensatory afforestation with higher success percentage expected	Minor
Topography	Excavation of tunnels, development of other areas and construction of roads (irreversible)	Physiography of area	Within project components areas: ***small***, long term impact: ***irreversible***	Minor
Soil Quality	Cumulative contamination with	Soil quality, flora and fauna, including	Local ***small*** contribution to existing	Minor

	dust, surface run-off during construction phase (reversible)	grazing livestock	background levels provided dust control and overburden is managed	
	Physical effects on soil due to top soil removal, nutrient loss (irreversible)	Soil quality, flora	Site location only	Minor

Hydrology, Hydro-geology and Water Quality

Impact Area	Nature of Impact	Targets/ Interests	Magnitude and Extent	Overall Significance
Surface Water:				
Physical Impact	Long term submergence of land in the vicinity of barrage	Local wildlife and ecology on nearby flat land	Local, submergence area is small in size	Minor
	Change in Hydrological Regime - Long term Flow modification due to diversion of water and installation of structures on the river streams	Local inhabitants depending on the downstream water of Allain and Duhangan streams	Local	Moderate
	Increase in siltation load due to construction activities	Allain and Duhangan Streams within the catchments area	Regional	Moderate
	Short term contamination of surface water flows due to de-siltation and thermal Stratification.	Tailrace outlet at Allain stream	Local, small scale	Minor
Potential for Decreased dissolved Oxygen	Short term depletion of DO in reservoir due to reduced turbulence	Tailrace Discharge point at Allain stream	Local, small scale; ***Reversible***	Minor
Ground Water:				
Ground water quality	Long term, medium reaction	Aquifers along Allain stream beds stretch (5.6km) between diversion point and tailrace outlet; and Duhangan stream	Local/Regional	Minor

		beds stretch (6.5km) between diversion point to confluence of Beas River		

Air Quality:

Impact Area	Nature of Impact	Targets/ Interests	Magnitude and Extent	Overall Significance
Air quality	Potential impacts would largely be reversible. Emissions of SPM (dust) and to a smaller extent SO2, NOx, would occur during all stages of the project construction phase (of 66 months); and increase in traffic on Nagar – Manali Road	Nearby villages. Workers onsite. Vegetation and Wildlife.	Generally Local/Regional impact. Dust emissions should be quickly suppressed to insignificant levels. Impact on site accommodation some distances from project Component locations.	Moderate during construction/ Minor otherwise

Noise Quality:
During construction phase project activity is expected to generate noise level of 65 dB at a distance of 150 m from the source while 55dB will be achieved at a distance of 300 m from the source. There will not be any noise impact form the project activity during night time as construction activities will be restricted to two shifts and no machinery operation will take place in night time.

Ecology:
Minor impact on wildlife is expected due to construction. However, in effect there shall be a positive impact of the project activity as there is an afforestation program drafted and planned by the developers.

Impact on Fish:
The baseline fish catch attempted twice showed no presence of fishes in both Allain and Duhangan streams except for few fish fingerlings as a result of migration from river Beas to Duhangan. The Allain and Duhangan streams flow with many abrupt falls leaving fewer chances for migrating fishes to traverse upstream. However, during peak flow or monsoon season, there is a possibility of fish migrating upstream for some distances.

Tourism and Cultural Property:
None of the project component falls under areas of known tourism interest. The project during construction phase may have some minor impacts on trekking for which adequate mitigating measures are to be followed.
Problems could also arise due to differences in customs of outside workers and local residents. This risk could be reduced by providing adequate facilities in worker's camp and employing local workers preferably.

Natural Hazards:

Adequate provisions need to be taken up right at the design stage of the project, particularly to counter natural hazards like earthquake, cloudburst, risk due to forest fire, landslides, and avalanches.

International Waterways:
Allain and Duhangan rivers are tributaries of River Beas, River Beas is a tributary of River Satluj which is again a tributary of Indus River. As per Indus Water Treaty, 1960 undertaken by India and Pakistan any project on western rivers of Indus system of rivers requires prior intimation to Pakistan authorities. The present project activity is a run-of-the-river-stream project on eastern River Beas therefore no such formalities are required as per treaty.

F.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:

All impacts of the project activity have been analysed in the detailed EIA study and their impacts have been classified based on the significance. To mitigate and control the impacts project proponents have developed a detailed ***Environmental and Social Management and Monitoring Plan***. In this plan due care has been taken for each and every aspect affected by the project activity and steps are defined necessary to minimize the negative impacts.

Detailed draft of this plan will be made available at the time of validation. However main highlights of this action plan are narrated in the following points to provide an idea of view and vision for the project activity.

1. **Entitlement for loss of land**
   Compensation for acquired land and assets shall be paid at the cost negotiated on the basis of government norms.

2. **Rehabilitation for loss of livelihood**
   Rehabilitation criteria have been set up and assistance shall be provided to effected families accordingly by following provisions:

   - *Transition Allowance*
     For a limited period of time for loss of income and livelihood as defined in entitlement framework
   - *Income restoration programs*
     Income restoration programs shall be developed on the basis of classification of affected people on land based or non-land based livelihood.
   - *Broader Community development programs*
     Small and low cost initiatives to generate support to meet immediate needs of the village, development of village specific micro-plans, development village funds

3. **Land Management, Afforestation & Soil Erosion**
   Afforestation on 800 ha of double degraded forest land, to prevent soil erosion 9 spurs, 77 check walls and 65 check dams , proper compaction of dumps and rip-rap stabilization of areas reduced of vegetation.

4. **Construction Labour Management Plan**
   - Labour accommodation through a short term lease of Government land

- Fuel arrangement with construction phase purchase agreement with state agencies like IOCL, BPCL etc.
- Arrangement of coal supply during peak labour period
- Construction of sheds using non-forest products

5. **Health Management for Construction Labour and people in vicinity**
   Arrangement of one doctor with 5 health personnel with at least ten bed facilities, 3 mobile dispensaries, construction of building for housing a permanent hospital and separate field hospital

6. **Traffic Management Plan**
   Detailed traffic management plan and management of traffic flow on daily basis to spread traffic evenly during the day so as to avoid congestion

7. **Muck Disposal Plan**
   Retaining-walls or wire crates to retain the muck in the activity area itself, provision for adequate drainage, plantation at the muck disposal sites

8. **Emergency Response Plan**
   In order to take care of various hazards/ disasters, suitable safety and control measures and action plan, along with reporting requirements are drawn up according to the recommendations in the ESMMP report.

9. **Fisheries Monitoring Plan**
   Flow measuring devices both on electronic and manual measurement basis shall be installed on both Allain and Duhangan streams.

10. **Transmission Line Impact Mitigation Framework**
    Impact of transmission line over homesteads, sensitive areas, cultural and ecological sites shall be minimized through appropriate changes in the design and route of the line wherever feasible.

Detailed draft of the plan shall be made available at the time of validation.

SECTION G. Stakeholders' comments

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

Proposed project activity is a large scale hydro power project. Due to size of the project activity it has drawn attention of a large section from stakeholders. But as it is a run-of-river project there is no substantial displacement of people. However, considering it as social responsibility project proponents have undergone a social impact survey with the help of professional experts and consulted with different sections of stakeholders and invited them to provide their opinion on the project activity.
SIA was based on a variety of information collected from primary as well as secondary sources.

Primary Information:

The primary information was collected through visits to the affected villages for meetings with the Gram Panchayat, household survey, consultations with villagers and focussed group discussions with women and below poverty line (BPL) persons. At each village a pre-determined set of information was collected.

At the Gram Panchayat level following information was sought to be extracted through discussion.

- Demographic profile
- Average land holding and asset ownership pattern, income levels, occupation
- Accessibility and linkages
- Key development issues
- Opinion on the proposed project

The Sarpanch (Village Chief) was present in the meetings.

Consultations with villagers and focussed groups were also designed to seek the following information:

Socio-economic Impacts

- Loss of income, livelihood
- Access to fuel wood
- Job prospects
- Development of the area
- Influx of additional people in the area
- Opportunity for infrastructure development through the project
- Opportunities for social and economic development of the area

Public Health

- Common diseases
- Access to health facilities
- Any epidemic/ outbreak

Religious/ Archaeological

- Religious sites in the vicinity
- Archaeological sites
- Access/ influence

Gender

- Role and status of women in the community
- Division of labour within the households
- Potential impact on the women

At the household level also information were sought out about social classification, family details at individual level, project impacts, loss of common property resources etc.

Secondary Information:

The secondary sources of information included various documents published by the government of Himachal Pradesh such as district census handbook, statistical abstract, economic survey report and relevant laws/acts and policies. The National Thermal Power Corporation (NTPC)'s scheme for rehabilitation and resettlement of the Kol Dam project was also referred since it was accepted by the Himanchal Pradesh (HP) government as a benchmark for projects undertaken by other agencies. Un-published material included land records at the Patwari's office and land use records at the District Collector's office. Field visits included visit to office of the Sub Divisional Magistrate (SDM) and Block Development Officer (BDO) to know about the development initiatives being planned for the area, to Patwari's office to understand procedure of land transfers, land acquisition and procure for calculating the land prices. Visit to state capital Shimla included meetings with horticulture department to understand the procedure for valuation of apple trees, cropping pattern across the Tehsil/ district and maximum/ minimum yield. Meetings with Tribal development department were held for understanding special provisions for Schedule Tribe in project area.

G.2. Summary of the comments received:

Various stakeholders associate with the project provided their comments and opinions about project activity.

Land Owners-
Major concern of people who have to lose large part of their land was the availability of alternate land at appropriate place for cultivation. They were expecting good compensation for loss of land and also sought assistance in shifting of apple trees wherever possible.

It was felt that delay in payment of compensation can increase uncertainty about the project and might affect the incomes from these affected parcels.

Non-legal Cultivators-
A large part of land has been used for cultivation by non-legal cultivators called “Devta”. Their major concern was loss of land as well as source of income. They wanted to treat them at par with legal land owners.

Sharecroppers-
With the loss of land shareholders stands to lose source of their family income. They expected to be compensated for this loss.

Labour-
Few families in the villages are landless and earn their livelihood by working as labour. The labour community is concerned about losing a more reliable source of work and wanted to be compensated for loss of income.

Women's Group-
Women fear that they might lose their freedom if the people from outside come to live in their village and their movements within the village might be restricted at some hours of the day. An impact on their social culture and customs was a major concern.

Tribal Communities-
The tribal community expects a fair compensation for the affected land and additional financial support.

Common Property Resources users-
People were apprehensive that by trapping the water from the streams water available for irrigation downstream would be severely reduced. Lack of irrigation facility would then affect their crops. They wanted the project to ensure that adequate flow is maintained for irrigation.

People affected by Transmission Lines-
One of the common concerns was that their standing crops might be affected in all the three phases of erection. Affected people were therefore expecting compensation for loss of standing crops for all the three phases.

Gram Panchayat-
The GP are concerned about the impact of large number of outsiders coming and living in their villages and the impact on local resources like water, fuel wood etc. They expect the project to enhance the existing infrastructure or provide basic amenities that might be required in the village.

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

A detailed Resettlement Action Plan was made before start of the project on the basis of comments received from various stakeholders. The objective of this plan was to avoid or minimize, to the extent possible, of any adverse impacts of the project activity.

These plans and actions drafted by project proponents are detailed and are being well executed with the progress of project work. Here is a snapshot of such steps suggested-

Loss of livelihood, income or land to farmers, cultivators or non-legal cultivators-
Income through loss of land, and other assets, whether they have a legal right over the land/ structure/ asset or not, are to be recognized as project affected families and will be covered in the entitlement framework. For non-legal cultivators, no compensation will be paid for loss of land to which they do not have legal titles, but rehabilitation assistance shall be provided for loss of livelihood and income. Compensation for loss of land will be paid to the owner of that land.

Cut-off Dates-
Cut-off dates will be established to determine eligibility of persons and their assets. These are the dates on which the census of the affected families and their assets will be done. Assets like structures and other which are created or groups claiming to be affected, after the cut off dates, will be ineligible for compensation.

Transition Allowance-
For vulnerable families, including families losing more than 25% of their total land holding after land acquisition, the project will provide rehabilitation assistance in form of a monthly Transition Allowance for a period of 1 year. In addition Transition Allowance would be provided to sharecroppers and employees for loss of income for an appropriate period of time.

Land Purchase Agreement-
The project proponents, through their land purchase assistance program shall make an assessment of the availability of land prices of different categories in a few selected areas and provide such information to those land losers willing to purchase replacement land. The land purchase assistance will therefore:

- Assist the family in identifying alternate lands
- Provide information on market prices

Tree Shifting Assistance-
Wherever demanded, and technically feasible, the project proponents will assist the affected families in shifting their apple trees to another part of their land holding not affected by the project or in new plots of land purchased.

Women's Welfare-
In order to address the concerns of project-affected peoples regarding women's security and safety due to the influx of migratory labor for project implementation, the Company will fund the establishment of a

police station in village Prini. The Government will be requested to depute women staff atthe Prini Police station to register local complaints related to women. Additional security staff with instructions to ensure women's safety will be provided at the project sites by the Company. If requested by the villagers, the Company will also consider provision of security at additional locations.

Thus project proponents have developed a well planned and detailed resettlement action plan which is being executed with the gradual development in the project work.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant

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Represented by:	
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Represented by:	Director General of the Department for Global Environment, International and Regional Conventions
Title:	Mr.
Salutation:	
Last Name:	Clini
Middle Name:	
First Name:	Corrado
Department:	Ministry for the Environment and Territory, Department for Global Environment, International and Regional Conventions
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

International Finance Corporation (IFC), Washington has taken an equity share in the project and has invested in debt capital as well. However this financing is not part of an International Official Development Assistance (ODA) effort. Details of investments are available to DOE for validation.

Annex 3

BASELINE INFORMATION

Power Generation in Northern Region for the year 2004-05

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWH
Centre Owned				
Coal - NTPC				
Badarpur TPS	720	705	5462.4	4917.8
Singraulli STPS	2000	2000	15803.3	14693.9
Rihand TPS	1500	1500	7988.1	7354.6
Dadri TPS	840	840	6830.9	6328.2
Unchahar TPS I	420	420	3342.8	3056.3
Unchahr TPS II	420	420	3438.3	3143.6
Tanda TPS	440	440	3296.1	2902.6
Gas				
Anta GPS	419.33	419.33	2785.7	2716.0
Auraiya GPS	663.36	663.36	4119.7	4016.7
Dadri GPS	829.78	829.78	5528.7	5390.5
Faridabad GPS	431.57	431.57	3173.3	3093.9
Hydro				
Bairasule HPS	180	180	689.7	686.2
Salal HPS	690	690	3443.3	3426.1
Tanakpur HPS	120	94.2	495.2	492.7
Chamera HPS	840	840	3452.5	3435.3
Uri HPS	480	480	2206.7	2195.7
Nuclear				
RAPS A	440	300	1355.2	1204.7
RAPS B	440	440	2954.4	2626.2
NAPS	470	440	2760.0	2453.4
Hydro - Jointly owned				
Bhakra Complex	1480.3	1480.3	4536.0	4513.3
Dehar HPS	990	990	3150.5	3134.8
Pong HPS	396	396	882.6	878.2
SJVNL HEP	1500	1500	5170.3	5144.4

Power Generation in Northern Region for the year 2004-05

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWH
State Owned				
Delhi				
Indraprastha TPP	247.5	247.5	920.2	837.4
Rajghat TPP	150	135	697.3	613.5
Gas Turbine	282	282	1539.6	1501.1
Pragati Gas Turbine	330	330	2551.8	2488.0
Chandigarh				
Diesel	2.0	1.4	0.0	0.0
Haryana				
WYC - Hydro	62.4	62.4	290.1	288.6
Magnum Diesel	25.2	25.2	74.6	71.7
Ambala/ Faridabad Diesel	3.92	3.92	0.0	0.0
Faridabad TPP	180	165	867.8	769.4
Panipat TPP	1360	1360	5816.3	5214.9
HP				
Bhabha-Sanjay	120	120	582.4	579.5
Giri	60	60	152.9	152.1
Bassi	60	60	270.0	268.6
Binva-Baner	18	18	74.8	74.4
Rongtong	2	2	46.4	46.2
Micro hydel+killar+Thirot	8.75	8.75		0.0
Nogli	2.5	2.5		0.0
Sal 2	2	2		0.0
Andhra	16.95	16.95	56.6	56.4
Gaj	10.5	10.5	50.6	50.3
Gumma	3	3	4.4	4.4
Ghanvi	22.5	22.5	74.3	73.9
Malana HEP	86	86	267.3	265.9
Baspa U-1,2,3	300	300	1198.4	1192.4
Diesel	0.13	0.13	0.0	0.0
JK				
Nichli Jhelam	105	105	428.0	425.9
Upper Sindh I	22.6	22.6	178.7	177.8
Upper Sindh II	105	105	0.0	0.0
Ganderbal	15	15	25.6	25.4
Mohra	9	9	0.0	0.0
Chenani	32.8	32.8	84.4	84.0
Stakna	9.75	9.75	0.0	0.0
Small Hydro	3.54	3.54	5.7	5.7
Sewa	9	9	0.0	0.0
Pampore GT	75	75	0.0	0.0
Pampore GT II	100	100	23.5	22.9
Diesel Gen Set	8.94	7.18	0.0	0.0

Power Generation in Northern Region for the year 2004-05

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWH
Punjab				
Shanan	110	110	515.5	512.9
UBDC	90	90	379.7	377.8
Mukerian	207	207	811.6	807.6
Anandpur Sahib	134	134	389.3	387.4
Ranjit Nagar HPS	600	600	1144.2	1138.4
Small Hydro	4.1	4.1	3.8	3.7
Guru nank Dev TPS	440	440	1992.5	1768.5
Guru Gobind Singh TPS	1260	1260	9083.7	8260.7
GHTPS	420	420	3309.2	3003.8
Jhalkeri Rice Straw	10	10	107.1	94.2
Rajasthan				
Mahi Bajaj sagar	140	140	250.0	248.8
Rana Pratap sagar	172	172	377.3	375.4
Jawahar Sagar	99	99	281.0	279.6
Anoopgarh	9	9	10.0	9.9
Small Hydro	14.85	14.85	10.6	10.6
Kota TPS	1045	1045	7731.0	6987.3
Suratgarh TPS	1250	1250	9362.3	8499.1
Ramgarh GT	110.5	110.5	360.7	351.7
Wind Turbine	303	303	348.6	348.6
Biomass	7.8	7.8	34.8	30.6

Power Generation in Northern Region for the year 2004-05

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWH
Uttaranchal				
Khatima	41.4	41.4	183.5	182.5
Ramganga	198	198	211.8	210.7
Ganga Canal	32.7	32.7	210.4	209.3
Yamuna I & IV	114.75	114.75	834.1	829.9
Chibro	240	240	635.4	632.2
Khodri	120	120	301.5	300.0
Chilla	144	144	746.1	742.3
Maneri	90	90	0.0	0.0
Sobla+small hydro	18.2	18.2	0.0	0.0
UP				
Rihand	300	300	481.9	479.5
Obra	99	99	201.1	200.1
Matatila	30	30	146.3	145.6
Khara	72	72	279.2	277.8
Obra	250	160	5513.5	4932.9
Obra Ext I	300	282		
Obra Ext II	1000	1000		
Panki	32	32		
Panki Ext	220	210	1045.7	926.8
Hardauganj A	90	0		
Hardauganj B	220	150		
Hardauganj C	230	225	637.9	549.3
Paricha	220	220	952.2	825.4
Anpara A	630	630		
Anpara B	1000	1000	11559.7	10519.4

Power Generation in Northern Region for the year 2003-04

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
State Owned				
Delhi				
Indraprastha TPP	247.5	247.5	769.1	705.3
Rajghat TPP	150	135	773.8	684.8
Gas Turbine	282	282	1214.6	1184.2
Pragati Gas Turbine	330	330	2406.1	2345.9
Chandigarh				
Diesel	2.0	1.4	0.0	0.0
Haryana				
WYC - Hydro	48	48	252.6	251.3
Magnum Diesel	25.2	25.2	27.5	26.4
Diesel	3.92	3.92	0.0	0.0
Faridabad TPP	180	165	793.9	694.6
Panipat TPP	860	860	5948.2	5401.0
HP				
Bhabha-Sanjay	120	120	580.1	577.2
Giri	60	60	168.0	167.2
Bassi	60	60	315.8	314.2
Birva-Baner	18	18	74.5	74.1
Rongtong	2	2	22.7	22.6
Andhra	16.95	16.95	69.6	69.2
Micro Hydel + Thirot	8.75	8.75		0.0
Nogli	2.5	2.5		0.0
Gaj	10.5	10.5	48.1	47.8
Sal 2	2	2		0.0
Gumma	3	3	14.8	14.7
Ganhvi	22.5	22.5	66.4	66.1
Malana HEP	86	86	363.8	361.9
Baspa U-1,2,3	300	300	2273.1	2261.7
Diesel	0.13	0.13	0.0	0.0
JK				
Nichli Jhelam	105	105	512.9	510.3
Upper Sindh I	22.6	22.6	256.2	254.9
Upper Sindh II	105	105		0.0
Ganderbal	15	15	23.4	23.3
Mohra	9	9	0.0	0.0
Chenani	32.8	32.8	70.9	70.5
Stakna+Kargil+Kanah	9.75	9.75	0.0	0.0
Small Hydro	3.54	3.54	1.4	1.4
Sewa III	9	9		0.0
Pampore GT	75	75	1.79	1.7
Pampore GT II	100	100	15.3	14.9
Diesel	8.94	7.18	0.0	0.0

Power Generation in Northern Region for the year 2003-04

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Centre Owned				
Coal - NTPC				
Badarpur TPS	720	705	5429.0	4940.4
Singraulli STPS	2000	2000	15641.6	14476.3
Rihand TPS	1000	1000	7956.3	7296.0
Dadri TPS	840	840	6181.2	5663.8
Unchahar TPS I	420	420	3198.2	2907.8
Unchahr TPS II	420	420	3251.7	2956.5
Tanda TPS	440	440	2906.2	2644.6
Gas				
Anta GPS	419.33	419.33	2776.1	2706.7
Auraiya GPS	663.36	663.36	4243.8	4137.7
Dadri GPS	829.78	829.78	5058.8	4932.3
Faridabad GPS	431.57	432	2792.1	2722.3
Hydro				
Bairasule HPS	180	180	687.8	684.4
Salal HPS	690	690	3497.1	3479.6
Tanakpur HPS	120	94.2	511.0	508.4
Chamera HPS	840	840	2464.0	2451.7
Uri HPS	480	480	2873.8	2859.4
Nuclear				
RAPS A	440	300	1311.6	1165.9
RAPS B	440	440	2971.4	2641.2
NAPS	470	440	3041.3	2703.4
Hydro - Jointly owned				
Bhakra Complex	1490.15	1490.15	7060.7	7025.4
Dehar HPS	990	990	3337.3	3320.6
Pong HPS	396	396	1112.3	1106.7
SJVNL HEP	1500	1500	1181.4	1175.4

Power Generation in Northern Region for the year 2003-04

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Punjab				
Shanan	110	110	564.2	561.4
UBDC	90	90	427.5	425.3
Mukerian	207	207	1029.2	1024.1
Anandpur Sahib	134	134	816.4	812.3
Ranjit Nagar HPS	600	600	1547.6	1539.9
Small Hydro	4.1	4.1	5.7	5.6
Guru nank Dev TPS	440	440	2551.3	2307.4
Guru Gobind Singh TPS	1260	1260	8303.8	7707.5
GHTPS	420	420	3380.5	3095.8
Jhalkeri Rice Straw	10	10	23.6	20.8
Rajasthan				
Mahi Bajaj sagar	140	140	191.6	190.7
Rana Pratap sagar	172	172	240.5	239.3
Jawahar Sagar	99	99	203.5	202.5
Annopgarh	9	9	8.5	8.5
Small Hydro	14.85	14.85	11.7	11.6
Kota TPS	1045	1045	6957.7	6261.9
Suratgarh TPS	1250	1250	8303.1	7523.4
Ramgarh GT	38.5	38.5	239.3	233.3
Wind Turbine	14.01	14.01	104.7	104.7

Power Generation in Northern Region for the year 2003-04

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Uttaranchal				
Khatima	41.4	41.4	173.4	172.5
Ramganga	198	198	209.1	208.1
Ganga Canal	32.7	32.7	131.0	130.4
Yamuna 1 & 4	114.75	114.75	574.2	571.3
Chibro	240	240	824.4	820.3
Khodri	120	120	387.8	385.9
Chilla	144	144	690.0	686.5
Maneri	90	90	460.0	457.7
Sobla	6	6	0.0	0.0
Small Hydro	12.2	12.2	0.0	0.0
UP				
Rihand	300	300	1112.2	1106.6
Obra	99	99	442.5	440.3
Matatila	30	30	126.9	126.3
Khara	72	72	389.9	388.0
Obra	250	200	0.0	0.0
Obra Ext I	300	282	0.0	0.0
Obra Ext II	1000	1000	6343.4	5654.5
Panki	32	32	0.0	0.0
Panki Ext	220	210	1065.3	962.1
Hardauganj A	90	90	0.0	0.0
Hardauganj B	220	200	0.0	0.0
Hardauganj C	230	225	730.6	656.0
Paricha	220	220	653.7	546.8
Anpara A	630	630	0.0	0.0
Anpara B	1000	1000	11979.5	10901.4

Power Generation in Northern Region for the year 2002-03

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Centre Owned				
Coal - NTPC				
Badarpur TPS	720	705	5267.1	4795.2
Singraulli STPS	2000	2000	16155.6	14758.1
Rihand TPS	1000	1000	7735.4	7139.8
Dadri TPS	840	840	6031.7	5511.8
Unchahar TPS I	420	420	3053.4	2792.7
Unchahr TPS II	420	420	3100.3	2835.6
Tanda TPS	440	440	2222.5	1920.5
Gas				
Anta GPS	419.33	419.33	2748.6	2679.9
Auraiya GPS	663.36	663.36	4259.7	4153.2
Dadri GPS	829.78	829.78	5202.8	5072.7
Faridabad GPS	431.57	431.57	2702.0	2634.5
Hydro				
Bairasule HPS	180	180	671.7	668.3
Salal HPS	690	690	3142.1	3126.4
Tanakpur HPS	120	94.2	421.6	419.5
Chamera HPS	540	540	2253.5	2242.3
Uri HPS	480	480	2448.2	2435.9
Nuclear				
RAPS A	440	300	1539.4	1368.4
RAPS B	440	440	3460.4	3075.9
NAPS	470	440	3572.1	3175.2
Hydro - Jointly owned				
Bhakra Complex	1490.15	1490.15	6531.0	6498.4
Dehar HPS	990	990	3253.1	3236.8
Pong HPS	390	390	763.9	760.0

Power Generation in Northern Region for the year 2002-03

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
State Owned				
Delhi				
Indraprastha TPP	247.5	247.5	621.2	546.9
Rajghat TPP	150	149	850.1	741.0
Gas Turbine	282	282	1214.0	1183.7
Pragati Gas Turbine	330	330	822.6	802.0
Chandigarh				
Diesel	2.0	1.4	0.0	0.0
Haryana				
WYC - Hydro	48	48	245.8	244.5
Magnum Diesel	25.2	25.2	81.7	78.5
Faridabad TPP	180	165	972.2	878.8
Panipat TPP	860	860	4978.0	4520.0
HP				
Bhabha-Sanjay	120	120	540.5	537.8
Giri	60	60	169.9	169.0
Bassi	60	60	272.5	271.1
Birva-Baner	18	18	57.8	57.5
Rongtong	2	2	24.5	24.4
Micro Hydel+Killar+Thirot	8.75	8.75		
Nogli	2.5	2.5		0.0
Andhra	16.95	16.95	70.5	70.2
Gaj	10.5	10.5	40.0	39.6
Sal 2	2	2		
Gumma	3	3	12.2	12.1
Ganhvi	22.5	22.5	80.8	80.4
Malana HEP	86	86	329.5	327.9
JK				
Nichli Jhelam	105	105	10.0	9.9
Upper Sindh I	22.6	22.6	310.6	309.0
Upper Sindh II	105	105		0.0
Ganderbal	15	15	22.8	22.6
Mohra	9	9	0.0	0.0
Chenani	32.8	32.8	63.8	63.5
Stakna	9.75	9.75	0.0	0.0
Small Hydro	3.54	3.54	0.0	0.0
Sewa III	9	9		0.0
Pampore GT	75	75	19.84	19.2
Pampore GT II	100	100	67.4	65.7
DG sets	8.94	8.94	0.0	0.0

Power Generation in Northern Region for the year 2002-03

Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Punjab				
Shanan	110	110	456.8	454.5
UBDC	90	90	394.3	392.3
Mukerian	207	207	787.9	784.0
Anandpur Sahib	134	134	736.0	732.3
Ranjit Nagar HPS	600	600	1141.9	1136.2
Small Hydro	4.1	4.1	8.6	8.6
Guru nank Dev TPS	440	440	2526.2	2290.7
Guru Gobind Singh TPS	1260	1260	8259.8	7539.5
GHTPS	420	420	2848.8	2593.8
Jhalkeri Rice Straw	10	10	0.0	0.0
Rajasthan				
Mahi Bajaj sagar	140	140	22.0	21.9
Rana Pratap sagar	172	172	9.8	9.8
Jawahar Sagar	99	99	16.7	16.6
Annopgarh	9	9	5.0	5.0
Mangrol	14.86	14.86	7.2	7.1
Kota TPS	850	850	6553.1	6553.1
Suratgarh TPS	1000	1000	7286.9	7286.9
Ramgarh GT	38.5	38.5	219.1	213.6
Wind Turbine	14	14	42.4	42.4

Power Generation in Northern Region for the year 2002-03

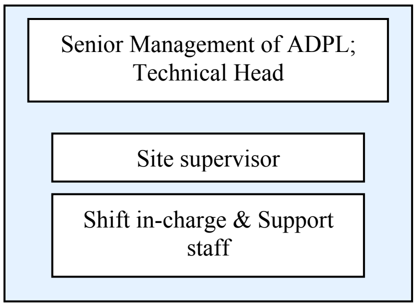
Plant Name/Ownership	Installed Capacity	Effective Capacity	Gross Generation	Net Generation
	MW	MW	GWh	GWh
Uttaranchal				
Khatima	41.4	41.4	163.1	162.3
Ramganga	198	198	183.7	182.8
Mohamedpur	32.7	32.7	138.3	137.6
Yamuna I & IV	114.75	114.75	596.6	593.6
Chibro	240	240	821.3	817.2
Khodri	120	120	408.6	406.6
Chilla	144	144	607.3	604.3
Maneri	90	90	457.4	455.1
UP				
Rihand	300	300	623.7	620.6
Obra	99	99	256.6	255.3
Matatila	30	30	99.5	99.0
Ganga Canal	10.7	10.7		0.0
Khara	72	72	411.5	409.4
Sobla & small hydro	18.2	18.2		0.0
Obra	250	160	0.0	0.0
Obra Ext I	300	282	0.0	0.0
Obra Ext II	1000	1000	6544.5	5848.8
Panki	32	32	0.0	0.0
Panki Ext	220	210	1013.3	886.7
Hardauganj A	90	0	0.0	0.0
Hardauganj B	220	150	0.0	0.0
Hardauganj C	230	225	768.3	698.8
Paricha	220	220	895.6	764.5
Anpara A	630	630		0.0
Anpara B	1000	1000	11624.0	10544.1

Annex 4

MONITORING PLAN

Project Management Plan:

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 seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it shall be informed to the concerned person for necessary actions. On monthly basis, these reports shall be forwarded at the management level.



Senior Management of ADPL/Technical Head: Overall responsibility of compliance with the CDM monitoring plan.
Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
Shift In-charge: Responsibility of daily report generation

Data Monitoring:

The methodology requires monitoring of the following:

- Electricity generation from the project activity;

Completeness-

For Electricity generation data: The project activity will install the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection will happen using these control systems. An hourly log of data will also be prepared by the shift in-charge. A daily report of aggregation of these data will also be prepared. Parameters monitored are the total power generated, power exported to the grid and auxiliary power consumed (other parameters like head availability, grid issues, frequency etc will also be maintained hourly in the log).

Reliability-

For electricity generation data: automatic control meters for power generation and exports will be regularly maintained. The regular plant operating & maintenance procedures will also include process of regular meter testing, calibration & maintenance. All these meters will be calibrated & tested before installation and after every six months from commissioning. *The calibration of meters is done at Government of India Lab every six months.*

Actual power generation data will also be metered using power output meter at the substation. The billing invoices for the power sold and meter readings could be used to validate the data accuracy.

Frequency-

The measurement is recorded and monitored on a continuous basis. An hourly log is prepared by the shift in-charge. At the end of the day, hourly data is aggregated in a daily report. Project shall be provided with time of day metering with 15-minute time stamping of all parameters including energy. The meters to be provided shall be of 0.2 accuracy class.

Training-

Training needs have been identified in project document; however the group is already operating a plant in Manikaran valley & experienced staff will be available for plant O&M.

Report generation on monitoring-

After verification of the data and due diligence on corrective ness if required an annual report on monitoring and estimations shall be maintained by the CDM team and record to this effect shall be maintained for verification.

Internal audits of CDM project compliance-

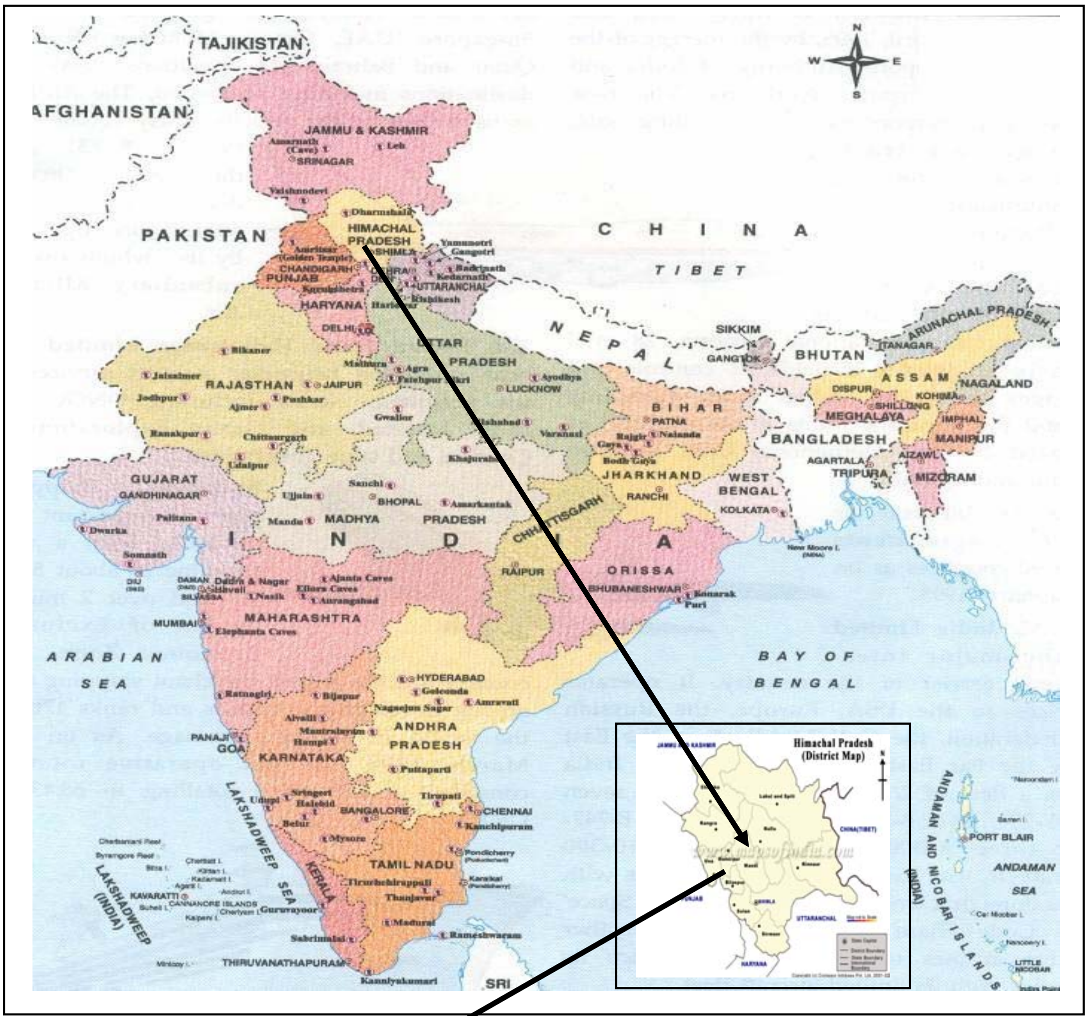
CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

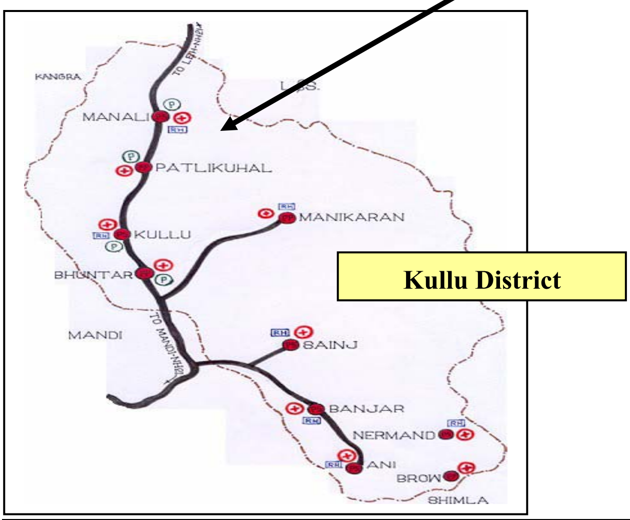
Sustainable Development Indicator Monitoring-

Project has a detailed Environment Management plan, SDI will be monitored as per plan.

Annex 5

LOCATIONAL & PROJECT RESERVOIR DETAILS

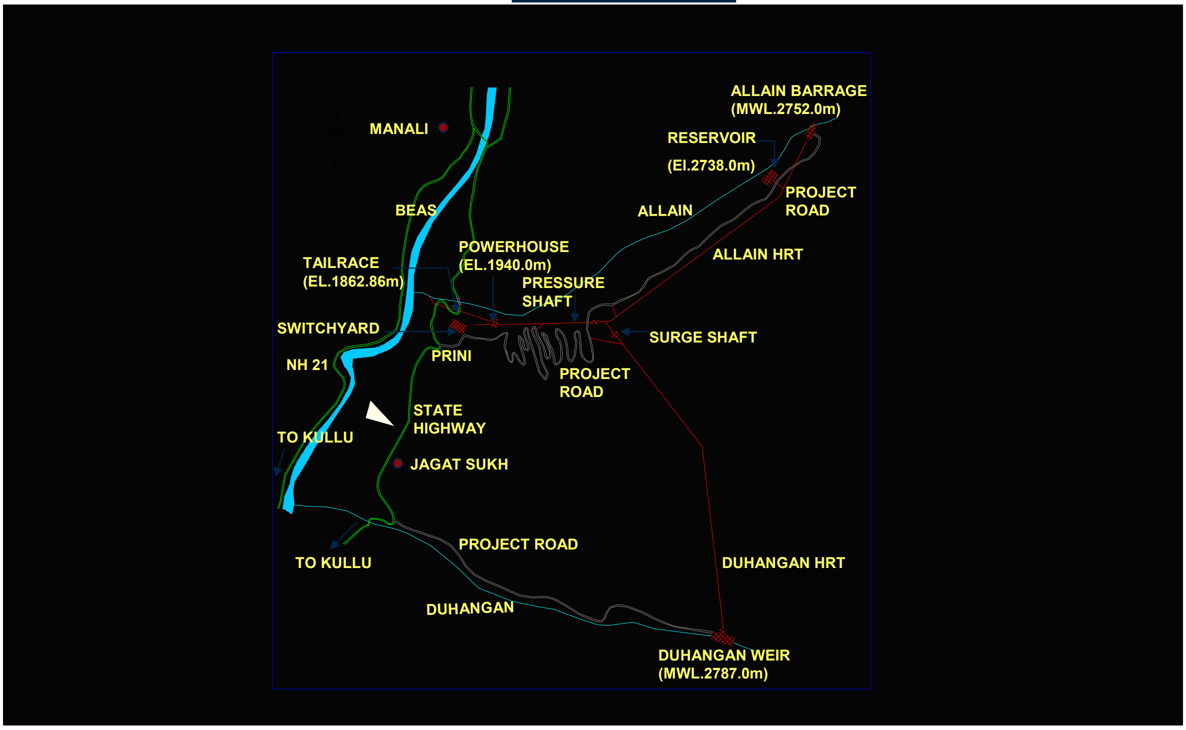




ROADS			
S.NO.	FROM	TO	DISTANCE
1	MANALI	POWER HOUSE SITE	3Km
2	POWER HOUSE	SURGE SHAFT	10Km
3	SURGE SHAFT	ALLAIN BARRAGE	5Km
4	MANALI	JAGAT SUKH	6Km
5	JAGAT SUKH	DUHANGAN WEIR SITE	14Km

ALLAIN DUHANGAN HEP (192 MW)

GENERAL LAYOUT



Project Reservoir Details:

Allain Duhangan HEP is a run of the river project envisaging generation of 192 MW power by utilising the flows in Allain and Duhangan streams. It has been noted that the river flow in these streams varies significantly between 3.5 cumecs and 30 cumecs during high flow and lean flow seasons. Due to snow melt, the river flow in these streams varies hourly with a generally higher discharge during evening/night time. Water stored during the lean season at night can thus be utilised for peak power generation in the early morning when the discharge is at its lowest. The ADHP is designed to provide a peak power generation of 4 hours each day during lean season. During high flow season, the power plant will generate on continuous basis and no storage is required.

For a 4 hour peaking generation, ADHP requires 302,400 cum storage based on an installed flow capacity of 25.3 cumecs and minimum average combined river flow of 4.3 cumecs. The total storage capacity available at ADHP is 302,400 cum comprising of:

- Storage at barrage with 41 800 cum between El 2752m and 2745m;
- Storage at desander with 23 000 cum between El 2752m and 2744m;
- Underground storage in Allain and Duhangan headrace tunnels of 25 000 cum and 7 000 cum respectively between El 2752m and 2734m;
- Storage at intermediate reservoir with 205 600 cum between El 2748m and 2734m.

The barrage is designed to pass a flood discharge of 760 cumecs corresponding to 100 years return period. The spillway crest is at El 2745m which allows the passage of full flood discharge at water El 2752m. During monsoon period the spillway gates will be fully opened to avoid sedimentation occurring in the barrage reservoir.

The water level in the desander is controlled by the downstream sill with crest El 2744m. To ensure good operation of desander during monsoon, the maximum water level is fixed at El 2744.3 m.

During monsoon period, the intermediate reservoir will operate at maximum water level of 2742m.

During non monsoon period, the operating water level will vary between 2752 and 2738 m. The barrage and sluice gates will be closed and head regulator gates will be fully opened and any excess flow will be released through the overflow structures located in the intermediate reservoir. Due to this storage, the full reservoir level is kept identical to the high flood level corresponding to 100 year return period flood. Thus no additional submergence is envisaged due to non monsoon peaking storage.

The operation rules for the peaking storage reservoir operation depend on both the seasons during the year and on daily flow variations. The following operation rules are adopted for run of the river type ADHP project:

- Priority for Peaking Energy - The reservoir water level is kept at the maximum level possible in order to generate the maximum energy during the peaking hours: for ADHP during the non-monsoon seasons, the maximum water level – El 2752m; during monsoon season, the maximum water level for barrage is fixed at El 2745 m and the intermediate reservoir operation was fixed as El. 2742.0 m;

- During the flood season, the target water level in the intermediate reservoir is fixed at El. 2 742.0 m. This permits storing a small quantity of the excess flow in the river during lean season;
- The ecological discharge is deducted from the river flow.
- The spillway will be fully opened when the combined river flow (Allain and Duhangan river flows) is greater than 13.5 m3/s, normally between May and September and the water level will be restricted to El 2745m.
- The spillway gates will be full closed when the combined river flow is less than 13.5 m3/s (Normally between October and April);
- When the combined river flow is less than 7.2 m3/s, the storage of the barrage reservoir of 41 800 m3 will be needed for peaking generation. In this case the head regulator gates will be closed.
- About one half hour after starting the peaking generation, one gate of the head regulator will be opened to discharge about 5.8 m3/s in two hours. After 2.5 hours, the barrage storage will be empty.
- It is assumed that two gates of the head regulator will be heated: one for normal operation; and one as stand-by. The gates will be operated from the powerhouse

Annex 6

SUSTAINABLE DEVELOPMENT ASPECTS

Environmental Well Being

In India coal is the primary source of energy for power generation and production processes. The demand for electrical energy has been steadily increasing. Expansion of the electrical supply to new areas and rapid industrialization are the main reasons for the growth in demand for power. The project activity contributes to the welfare of environment at large considering the carbon emissions that would have been generated by a thermal power plant of equal capacity. The project hence decreases the future needs for coal based power generation by the grid and thereby reducing the CO_2 emissions from the electricity sector. Associated SPM, SO_x, NO_x emissions and emissions related to transportation and excavation of fossil fuel are also avoided.

Social Well Being

NR Grid is witnessing major shortage of power. On an average there was a shortage of supply over demand by 6 % during 1995-2005. During year 2004-05 the region witnessed energy shortage of 10.06% and a peak shortage of 9.69%[9]. This energy shortage is expected to continue for next few years. The project activity is augmenting grid supply that is necessary for the sustenance and development of the society.

The proposed project activity intends to operate as a peaking power supplier in the region. The peaking power shortage mostly hurts economic activities in the region; supply during this period will enhance productivity leading to income creation for the community and hence better quality of living for the community.

In India most of the electricity generation is done using thermal energy, the project will help in removing this imbalance of thermal-hydro share in power generation.

Infrastructure facilities developed for the project (roads, housing, medical facility etc) would also be used by the local community.

Economic Well Being

The project implementation will provide a fillip to economic activity in the region. Direct & indirect employment has been generated in the plant for the project implementation & management. The project activity is expected to directly employ1000 people during plant construction and 100 people during plant operations. There will also be multiplier effect on in-direct job creation due to investment in the project.

Technological Well Being

Despite having a huge hydro power potential in India, not many projects have been implemented by the private corporates. Only 2 % of India's hydel capacity is with private entities. The only two hydro IPPs in

[9] Data Source NREB Annual Report 2004-05

India are Tata Power, India's oldest private power generator owning about 448 MW of hydro capacity (most of which was developed by 1930s) and Malana Power Company Limited (MPCL), (one of the investors in ADPL) owning 86 MW which was set up in 2001 . The main reason for lack of private sector participation is the inherently risky nature of hydro projects. Successful implementation of the project activity will encourage other private companies to implement hydro power projects.

Due to lack of power evacuation facility in the nearby area of the power plant, project promoters are proposing to construct a 185 km transmission line from the project site to the substation at Nalagarh. This transmission network could be shared with other companies implementing power projects in the nearby area and thus removing technical infrastructural barrier for other project.

The project involves use of conventional technology for generation of power. Turbine and generator are the key components of the plant. The type of turbine has been selected after a detailed study of the hydrology and other technical details. The project envisages using 6 Jet Pelton turbines with 96 MW, 11kV, 0.9 PF, 3-phase, 50 Hz, 600 rpm vertical shaft hydro-generator with air coolers, static Excitation & braking equipment. As this is a commonly used turbine, all domestic turbine manufacturers are in a position to supply them without any additional design, as model test are already available with them.

Annex 7

Project Financials

Assumptions taken for IRR calculations:

Key Assumptions			
SN	**Parameter**	**Value**	**Remarks**
1	Power Generation	678.18 GWh	Based on 90% Dependability and 95% plant availability. (Based on 40 years hydrological data analysis)
2	Power supply to the users	579.01 GWh	After auxiliary power consumption of 0.5%, Transformation losses of 0.5%, Free power supply to HP State Electricity Board (First 12 years-12%, after 12th year 18%)
3	Project Cost	INR 4.68 Crores/MW	
4	Debt/Equity Ratio	35%/65%	
5	Income Tax relief	First 10 years	To be availed over 15 years from commissioning
6	O&M Costs	1.5% of project cost	Escalation factor of 6%
7	Debt Cost	8%	
8	Tariff	Rs. 2.47/kWh	
9	WACC	12.06%	Calculated based on Capital Asset Pricing Model (CAPM)
10	Project Life	30 years	

Annex 8

GLOSSARY

ADHP	Allain Duhangan Hydroelectric Project
ADPL	AD Hydro Power Limited
BDO	Block Development Officer
BEF	Baseline Emission Factor
BM	Build Margin
BPCL	Bharat Petroleum Corporation Limited
BPL	Below Poverty Line
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction
CM	Combined Margin
CO_2	Carbon Di Oxide
DNA	Designated National Authority
DOE	Designated Operational Entity
EIA	Environmental Impact Assessment
GHG	Green House Gases
GWh	Giga Watt Hour
HP	Himachal Pradesh
HPSEB	Himachal Pradesh State Electricity Board
IFC	International Finance Corporation
IOCL	Indian Oil Corporation Limited
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Producers
IRR	Internal Rate of Return
kg / kWh	Kilo Gram per Kilo Watt Hour
kg CO_2 equ/kWh	Kilo Gram Carbon Di Oxide equivalent per Kilo Watt Hour
KP	Kyoto Protocol
kV	Kilo Volt
kW	Kilo Watt
kWh	Kilo Watt Hour
M	Meter
M & P	Modalities and Procedures
M & V	Monitoring and Verification
MNES	Ministry of Non-Conventional Energy Sources

MoEF	Ministry of Environment and Forests
MU	Miilion Units
MW	Mega Watt
NCV	Net Calorific Value
NHPC	National Hydroelectric Power Corporation
NREB	Northern Region Electricity Board
NRLDC	Northern Regional Load Despatch Center
NR Grid	Northern Region Grid
NTPC	National Thermal Power Corporation
OECD	Organisation for Economic Co-operation and Development
OM	Operating Margin
O & M Expenses	Operation and Maintenance Expenses
PCF	Prototype Carbon Fund
PGCIL	Power Grid Corporation of India Ltd
PPA	Power Purchase Agreement
Rs.	Indian Rupees
SDM	Sub-divisional Magistrate
T & D	Transmission and Distribution
UNFCCC	United Nations Framework Convention on Climate Change
WACC	Weighted average cost of capital

Annex 9

LIST OF REFERENCES

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Website of Indian Designated National Authority - www.envfor.nic.in/cdm

UNFCCC, Clean Development Mechanism, CDM Project Design Document (CDM-PDD) version 02 (in effect as of: 1 July 2004)

UNFCCC, Clean Development Mechanism, Approved consolidated baseline methodology ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" ACM0002 / Version 03; Sectoral Scope: 1, 30th September 2005.

UNFCCC, Clean Development Mechanism, Annex 1, Tool for the demonstration and assessment of additionality EB 16 Report;

Detailed project report on ADHP

EIA and Stakeholder Consultation for the project activity

Website of Central Electric Authority (CEA), Ministry of Power, Govt. of India- www.cea.nic.in

Northern Region Electricity Board Annual reports 2001-02, 02-03, 03-04, 04-05 www.nreb.nic.in

Northern Regional Load Despatch Centre Annual reports 2001-02, 02-03, 03-04, 04-05 www.nrldc.org

Communications with various agencies involved in CDM (project developers, PCF, Financial institutes etc)

Website of Ministry Non-Conventional Energy Sources (MNES), Government of India, www.mnes.nic.in

IPCC-Good Practice Guidance

ADHP Power generation projection