Project design document form
(Version 11.0)

~~*Complete this form in accordance with the instructions attached at the end of this form.*~~

BASIC INFORMATION	
Title of the project activity	Chutak Hydroelectric Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	12~~11~~
Completion date of the PDD	~~31/03/2009~~05/11/2020
Project participants	NHPC Limited. ~~(earlier known as National Hydroelectric Power Corporation Ltd.)~~
Host Party	India
Applied methodologies and standardized baselines	ACM0002: Grid-connected electricity generation from renewable sources --- Version 06.0
Sectoral scopes	Sectoral Scope 1 : Energy industries (renewable - / non-renewable sources)
Estimated amount of annual average GHG emission reductions	166,831 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>> The project activity involved the construction of a hydroelectric run-of-river plant of 44 MW in India. Four turbines of 11 MW were installed to generate clean and reliable electric power that was sent to the National~~orthern~~ Grid. As power from the project displaces power generation using fossil fuels elsewhere on the grid, the project activity would lead to a reduction in greenhouse gas emissions.

NHPC Limited. (earlier known as National Hydroelectric Power Corporation Ltd.) has developed the project. NHPC is a Government of India Enterprise that was incorporated in 1975. Its objective is to plan, promote and organise an integrated and efficient development of hydroelectric power in all aspects. ~~Later on NHPC expanded its objectives to include other sources of energy like Geothermal and Tidal, among others.~~
Later on NHPC expanded its objectives to include other renewable sources of energy like Solar and Wind power.

The implementation of the project activity will contribute to

1. The replacement of fossil fuel based power generation (from coal and diesel) elsewhere on the grid. This will reduce emissions from fossil fuels combustion.
2. The improvement of basic living conditions (due to availability of electricity) and educational standard (people working on the project will be educated and trained) in such a remote area
3. The economic development of the region.

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As a conclusion, the project activity will bring several environmental and socioeconomic benefits thus contributing to the sustainable development of the region.

Relevant dates for the project activity:

Project Promoter	Start Date of Project	Commissioning date
NHPC Limited.	23/09/2006	Unit -1 22/11/2012 Unit -2 08/11/2012 Unit -3 11/11/2012 Unit -4 01/02/2013

Sustainable Development
The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment, Forest and Climate Change (MoEFCC), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India. Thus, the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

Social well being
The project activity will provide job opportunity to local people during erection, commissioning and maintenance of the power project. Frequency of visiting to villages and nearby areas by skilled, technical and industrialist has increased due to installation /site visit/operation and maintenance work at plant site. This directly and indirectly positively effects the economy of nearby populace.

Environmental well being
Hydro power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions. The impact on land, water, air and soil is negligible. Thus, the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

Economic well being

The project activity generates permanent and temporary employment opportunity within the vicinity of the project. The electricity supply in the nearby area improves which directly and indirectly improves the economy and life style of the area.

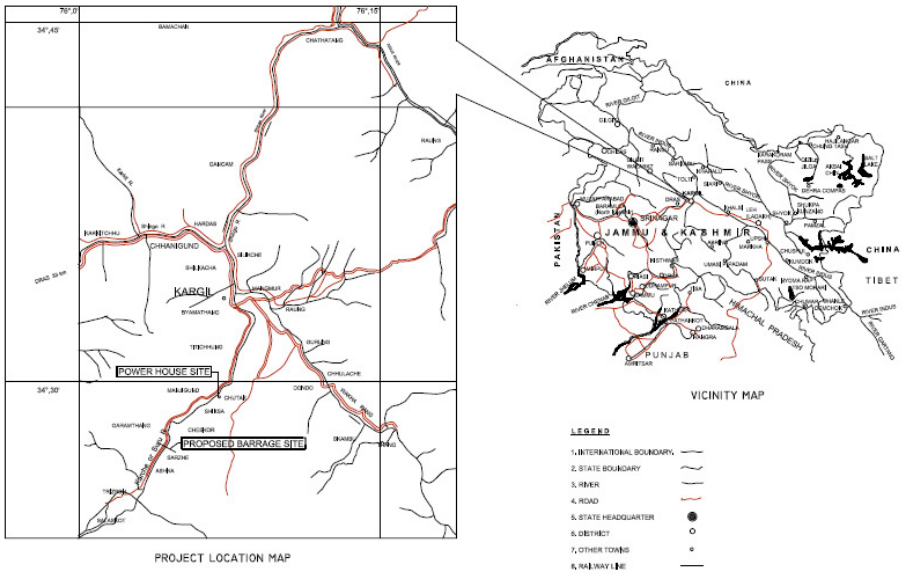
Technological well being

The project activity is step forward in harnessing the hydro potential and further diffusion of the technology in the region. The project activity leads to the promotion and demonstrates the success of hydro projects in the region which further motivate more investors to invest in hydro power projects. Hence, the project activity leads to technological well-being.

A.2. Location of project activity

>> India
Union Territory (U.T.) of Ladakh
Minjee Village in Kargil District

Map of U.T. of J&K and Ladakh



Chutak Power Station in Minjee, Kargil

A.3. Technologies/measures

>> Chutak Hydroelectric Project would harness the hydropower potential of river Suru in Kargil, Ladakh. The barrage of the project is located near Sarzhe Village and the power house will be located on the right bank of river Suru near Chutak Village.

For the project activity, the water flow in the rivers was measured at Kargil, at Kochik, near Ashana and at Chelong on Suru and Chelong rivers. The hydrology data available from Central Water Commission1, Government of India for a period of 22 years from 1978-79 to 1999-2000 was used to carry out the optimization study of the project with the objective of maximizing the average yearly energy production and the firm power during the lean season within economical limits. The average of 10 daily discharge series has been obtained to compute the average annual yield.

The analysis arrived at an optimized capacity of 44 MW with a generation of 216.41 MU
(MU= million units = GWh).

While conducting the Environmental Impact Assessment2 for the project, University of Jammu and the consultants proposed that minimum quantity of water required for sustenance of aquatic life downstream of the proposed barrage should be released. Accordingly, NHPC considered it necessary to release 1 cumec (m^3/s) in the lean season. Based on the release of 1 m^3/s of water, the revised energy generation was calculated to be 212.93 MU (GWh).

This figure of 212.93 GWh is the total (gross) power generation by the project and after subtracting the auxiliary consumption and transformer losses, net power exported to the grid comes to 210.38 GWh.

The project envisages utilizing a gross head of 63.4 m to generate 210.38 GWh in a 90% dependable year with an installed capacity of 44 MW. Each of the four 11 MW generating units will operate under a rated head of 52 m and a rated discharge of 24.05 cubic metres per second.

Technical features of the hydroelectric power station are listed below:

1. Barrage: 45.647.5 m long and 15 m high above crest level.
2. Water conductor system consisting of:
    a. Two intake tunnels of 4.5 m diameter and 295 m length including cut & cover section.
    b. Head Race Tunnel: Horse Shoe shaped 5.9 m diameter and 4767370 m long.
    c. Orifice type Underground Surge Shaft: 19 m diameter and 59 m high.
    d. Two vertical Pressure Shafts with 3.25 m diameter.
    e. Four horizontal Penstocks of 2.3 m diameter & 31 m long each.
3. Underground Powerhouse: 4 Francis Turbines of 11 MW each.
4. Tail Race Tunnel: Horse Shoe shaped 5.9m diameter and 55.560m long.
5. Switch Yard.

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The project is a run-of-river hydro project. The barrage diverts water from the river and involves a flooding of only 0.048135 km^2. Thus the power density is 44 MW per 0.0481135 km^2 i.e. very high 915326 W/m^2, compared to dam-based hydroelectric projects.

The turbines would be vertical shaft type (Francis type), with an efficiency of 91.25%. The generator will be vertical shaft suspended type, salient pole type and directly coupled to a turbine. It would be rated for an output of 11 MW at a power factor of 0.90 and rated voltage of 11 KV.

The project is connected to the National orthern Grid by the 220 kV Leh-Srinagar transmission line. which is to be scheduled for commissioning along with project's commissioning.

The hydroelectric project has is to be provided with emergency D.G Sets (diesel) for emergency power requirement at the site. to be used when none of the units is operating. This condition is foreseen in case of tripping of the station on fault and not for any routine use. Even during winter season, the station shall run, but on reduced capacity. The following is the size of D.G. Sets provided at the project: 2x630KVA at Power house (one main and one standby) and 1x500KVA at Barrage.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host Party)	NHPC Limited. (earlier known as National Hydroelectric Power Corporation Ltd.)	No

Commented [P1]: Is this the part of name reflected in revised LoA?
CCX: No, the name reflected in the LoA is NHPC Limited. It has been revised accordingly.

A.5. Public funding of project activity

>> No funds from international multilateral or bilateral assistance will be involved in any aspect of the proposed CDM project activity. No ODA funding is sought.

A.6. History of project activity

>> 1. The PP hereby confirms that:

a) The CDM project activity is a registered as a CDM project activity (UNFCCC CDM Project 2025 : Chutak Hydroelectric Project; Registration Date is 01/04/2009) but is NOT included as a component project activity (CPA) in a registered CDM programme of activities (PoA); and

b) The proposed CDM project activity is not a project activity that has been deregistered.

2. The PP would like to declare that:

a) The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA;

~~a)~~b) The project is not "A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity".

A.7. Debundling

>> Not Applicable

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

>> The project activity uses an existing consolidated baseline and monitoring methodology. The methodology is designated ACM0002: *"Consolidated methodology for grid-connected electricity generation from renewable sources – version 6".*

According to the methodology, the assessment of additionality shall be done by applying the "Tool for demonstration and assessment of additionality - version 4."

B.2. Applicability of methodologies and standardized baselines

>> ACM0002 (version 6) is applicable to grid-connected renewable power generation project activities under the following conditions: The proposed project activity meets all applicability conditions required by the methodology, as follows:

~~1. The project involves the construction of a run-of-river hydro power plant. Its power density is 326 W/m2 (as shown in section A.4.3).~~

~~2. The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.~~

~~3. The geographic and system boundaries for the Northern Region can be clearly identified and information on the characteristics of the grid is available.~~

Applicability	**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. • New hydro-electric power projects with reservoirs having power densities (installed power generation capacity divided by the	The project involves the construction of a run-of-river hydro power plant. Its power density is 915 W/m^2

surface area at full reservoir level) greater than 4 W/m2 . • Wind sources; • Geothermal sources; • Solar sources; • Wave and tidal sources.	
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;	The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available	The geographic and system boundaries for the Northern Region can be clearly identified and information on the characteristics of the grid is available.
Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001)	The project does not involve electricity generation from landfill gas capture.

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Therefore, the proposed project activity complies with the applicability conditions of the methodology.

B.3. Project boundary, sources and greenhouse gases (GHGs)

>> The project boundary comprises the physical site of the power plant and the reservoir area. The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the project is connected to.

Source		GHG	Included?	Justification/Explanation
Baseline	Grid connected electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	Greenfield Hydro Power Project Activity	CO_2	No	As the project power density of 915~~326~~ W/m^2 of flooded area is higher than 10 W/m^2, project emissions from the reservoir may be neglected, according to EB 23 Annex 5.
		CH_4	No	
		N_2O	No	

B.4. Establishment and description of baseline scenario

>> As required by the Tool for demonstration and assessment of additionality (version 4), the baseline scenario identification consists of completing three steps. They are analyzed below.

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

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

The identified baseline alternatives are:
Alternative 1- Implementation of the project activity without being registered as a CDM project activity: The project activity would be connected to the public grid and, therefore, displaces an equivalent amount of electricity of the grid mix. This is a possible baseline alternative that is discussed further in Section B.5.

Alternative 2- Continuation of current situation (no project activity implementation): As described in ACM0002 – version 06.0, for project activities that do not modify or retrofit an existing electricity generation facility, which is the case of Chutak Hydroelectric Project, the baseline scenario is the following:

> *"Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations".*

The proposed power plant is located within the Northern Region Grid. The capacity additions for this Grid are shown in Appendix 4~~Annex 3~~ to the PDD. Most of the installed capacity is from thermal plants that use coal or oil as fuel. There are also plants that use natural gas, hydroelectric or nuclear generation.

This is a possible baseline alternative and is discussed further in Section B.5.

Alternative 3: Other renewable generation sources, where an equivalent of electricity would be generated using other renewable energy sources, such as biomass, wind, and solar energy. The project site is a high altitude location, about 4,000 metres above sea level, with very little rainfall. This cold, desert climate provides little biomass resource that is used for food, fodder, and some use as household fuel. There is no surplus biomass resource to generate electricity in this climate, nor any possibilities of biomass plantations. While there are some wind resources in India, none of the favourable locations listed are in Ladakh. (http://www.windpowerindia.com/statwind2.html) There are no known wind generators in Ladakh, and certainly no plans for 44 MW installed capacity, equivalent to the proposed hydro project. While there have been some wind farm development in India, especially through the CDM, these are located in the South or West of the country. Electricity can also be generated directly from solar energy through thermal and photovoltaic (PV) routes. Solar thermal electricity generation is not yet a mature technology and there are no large scale installations in India. Solar photovoltaic conversion remains expensive, with virtually no scale economics so that these systems are suitable for supplying small amounts of electricity to locations far from the power grid. Grid-connected PV systems with installed capacity of 44 MW are far from cost effective compared to other power generation options. Therefore, other renewable sources of energy cannot be considered as plausible baseline alternatives.

Alternative 4: Project proponent implements fossil-fuel fired power plants. The specific project proponent is a company, called National Hydro Power Corporation, which only develops hydro projects. This can be verified in the Memorandum of Association of NHPC, which can be downloaded from their website www.nhpcindia.com from the sub link under management. The main object of the company is listed as "Development of hydroelectric power." Thus construction of fossil fuel power plants by the project proponent is not a permissible technological choice or a possible baseline alternative.

"Outcome of Step 1a: Identified realistic and credible alternative scenario(s) to the project activity."

As alternative 3 faces barriers to its implementation, and alternative 4 is not a permissible option for the project proponent, these cannot be considered as possible baseline alternatives. Then, the remaining alternatives are Alternatives 1 and 2:

Alternative 1: Implementation of the project activity without being registered as a CDM project activity.

Alternative 2: Continuation of current situation (no project activity implementation).

Both Alternatives 1 and 2 are considered further below.

Sub-step 1b. Consistency with mandatory laws and regulations:

The remaining alternative from sub-step 1.a. is in compliance with legal requirements as it is the continuation of the current situation.

"Outcome of Step 1b: Identified realistic and credible alternative scenarios to the project activity which is in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations."

The alternatives remain the same as in sub-step 1.a:

Alternative 1: Implementation of the project activity without being registered as a CDM project activity; and

Alternative 2: Continuation of current situation (no project activity implementation)

"Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3)"

As this analysis is part of the additionality demonstration, it will be conducted in Section B.5.

The following table shows all key data used to determine the baseline scenario:

Table 1: Key Data

Parameter	Data Sources
Combined margin emission factor	Central Electricity Authority Database (Official source)
Variables	**Data Sources**
Net electricity generation of the hydroelectric plant per year	NHPC

For further information on key data used for baseline scenario, refer to Appendix 4~~Annex 3.~~

B.5. Demonstration of additionality

>> Version 7 of the "Guidelines for Completing the Project Design Document" states the following:

"If the starting date of the project activity is before the date of validation, provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available at, or prior to, the start of the project activity."

"In such cases project proponents shall provide an implementation timeline of the proposed CDM project activity. The timeline should include, where applicable, the date when the investment decision was

made, the date when construction works started, the date when commissioning started and the date of start-up (e.g. the date when commercial production started). In addition to this implementation timeline project participants shall provide a timeline of events and actions which have been taken to achieve CDM registration, with description of the evidence used to support these actions. These timelines will allow the DOE to assess the serious consideration of the CDM in the project decision making process and project implementation."

The chronology of key events and dates involving CDM project development is summarized in Table below.

Table 2: Key events, dates, and supportive evidence

S.No.	Events	Date	Evidence (File name)
1	Task Force on CDM proposed by Executive Director (R&D) of NHPC (It clearly states that NHPC was exploring the possibilities of making the projects more viable by considering CDM revenues. Chutak Project is also mentioned on the same page)	17/10/2005	NHPC-Task Force on CDM.pdf (Page 3)
2	Minutes of Meeting taken by Secretary (Power) to discuss CDM (NHPC informed that they are preparing CDM projects in respect of NImoo Bazgo HE Project and Chutak project with assistance of the World Bank).	15/12/2005	MoM-Ministry of Power.pdf (Page 3; para 3)
3	In a letter to Additional Secretary, Ministry of Power the Executive Director (R&D) of NHPC has sought assistance for undertaking formulation of Project Design Document (PDD) and Appropriate Baseline methodology for these three projects which includes Chutak Project.	28/02/2006	Assistance for CDM.pdf (Page 1)
4	Draft MOU for the year 2006-07 between Ministry of Power and National Hydroelectric Power Corporation Ltd. (NHPC) (Activity "initiating process to obtain CDM benefits for the most suitable NHPC Projects" was changed to "Approval of designated National Authority for CDM benefits" with no change in the target dates.)	08/03/2006	Draft MoU NHPC & GoI.pdf (Page 4)
5	MoU between Ministry of Power, GoI and NHPC Ltd. (In this MoU, different performance parameters and their weightages for the year 2006-07 were	28/03/2006	MoU NHPC & GoI.pdf (Date is stated on page 9 of document and p. 11 of PDF file.

	listed. One of the performance indicators was to seek approval of Designated National Authority for CDM benefits for Nimoo Bazgo / Chutak unit)		DNA is mentioned in page 10 of document and p. 12 of PDF file)
6	Offer Submitted for Development of Chutak & other Hydroelectric projects as CDM Projects	24/07/2006	MGM-IDBI Offer.pdf.
7	Implementation approval for Chutak Hydroelectric Project	24/08/2006	Proof -Equity Chutak Project.pdf
8	**Start date of the project Activity**	23/09/2006	Chutak Construction start date.pdf
9	Bids Invited for providing CDM consultancy Services for Chutak & other hydroelectric Projects	23/10/2006	Tender Document CDM.zip/Global Invitation to applicants.doc
10	Revised Offer for Development of Chutak & other Hydroelectric projects as CDM Projects	26/02/2007	Revised MGM-IDBI Offer.pdf.
11	Award of contract for developing Chutak and other Hydroelectric project as CDM Projects	06/03/2007	NHPC-LOI.pdf
12	PDD, version 1, dated 01/07/2007 submitted to DNV for validation	11/07/2007	

Note that items 1 through 6 (inclusive) demonstrate awareness and serious consideration of CDM, all prior to project start date shown as item 8. Items 9 through 12 refer to events and dates related to CDM project developed, which start on 23/09/2006, one month after project start date and is still in process.

The above chronology of events proves beyond doubt the prior consideration of CDM for the project activity and that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

As explained in section B.4, the "Tool for demonstration and assessment of additionality" version 4 is used to identify the baseline scenario and to demonstrate the additionality of the project activity. According to **Step 1**, possible alternative baseline scenarios are

Alternative 1: ***Implementation of the project activity without being registered as a CDM project activity;*** *The project activity would be connected to the public grid and, therefore, displaces an equivalent amount of electricity of the grid mix. This is a possible baseline alternative that is discussed further in Section B.5.*
and

Alternative 2: Continuation of current situation (no project activity implementation).
Alternative 1 implies that the proposed project scenario is indeed the baseline scenario, i.e. it is not additional. As per ACM0002 version 06, the "Tool for the demonstration and assessment of additionality-version 03" has to be applied to demonstrate the additionality of the project, i.e. that Alternative 1 is not a valid baseline scenario. To continue with the assessment of the project's additionality, Step 2 (investment analysis) and/or Step 3 (barrier analysis) and Step 4 (common practice analysis) are to be applied. The project participant chooses Step 2 followed by Step 4.

Step 2: Investment Analysis

Sub-step 2a: Determine appropriate analysis method
Three methods to perform the investment analysis are presented in the "Tool for demonstration and assessment of additionality". These are:

Option I: Simple Cost Analysis
Option II: Investment Comparison Analysis
Option III: Benchmark Analysis

Option I can be used if the project activity generates no financial or economic benefits other than CDM related income, i.e. CERs. This option is not applicable because the proposed project would have revenues from electricity sale as well as CDM revenues.

Investment comparison analysis method (Option II) can only be used if the project and the alternatives to the project activity are all investment projects. However, this option is not applicable to the project because the alternative to the project activity is equivalent annual electricity supplied by the Northern Region Power Grid. The latter alternative is not a new investment project.

Therefore, the only applicable analysis method to the project is benchmark analysis (Option III).

Sub-step 2b: Option III. Apply benchmark analysis
The additionality tool requires an identification of the most appropriate financial indicator. For the case of a power plant that would supply energy to the grid, the most appropriate indicator is the internal rate of return (IRR). As indicated in the Additionality Tool, version 4, the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). We use the project IRR. Table presented below lists all the parameters, values used for carrying out the investment analysis along with their respective sources.

Table 3: Input values used for investment analysis

Parameter	Value (Note 1 crore = 10 million)	Source	File Name
Costs			
Investment	INR 6212.6 million	Abstract of Cost (Implementation approval letter for Chutak hydroelectric project (44 MW) dated 23/11/2006 from Ministry of Power, Government of India.)	Proof Sub Loan & Project Cost Chutak.pdf, page 1, applied in Chutak IRR.xls, sheet "SR Chutak" Row 13.
Equity	INR 1863.8 million	Implementation approval letter for Chutak hydroelectric project (44 MW) dated 24/08/2006 from Ministry of Power, Government of India.	Proof -Equity Chutak Project.pdf, p. 1, applied in Chutak IRR.xls, sheet "SR Chutak" Row 15.
Subordinate Loan	INR 3640 million	Implementation approval letter for Chutak hydroelectric project (44 MW) dated 23/11/2006 from Ministry of Power, Government of India.	Proof Sub Loan & Project Cost Chutak.pdf, p. 1, applied in Chutak IRR.xls, sheet "SR Chutak" Row 16.
Loan	INR 708.8 million	Determined as difference between total investment	Calculation shown in Chutak IRR.xls, sheet "idc chutak"

		and (Equity + Subordinate loan).	cell L37.
O&M Costs	INR 93.2 million	Calculated in accordance with Central Electricity Regulatory Commission Guidelines of 26 March 2004, as shown in IRR calculation workbook.	finalregulations_terms&condition.pdf/ Page 39. Calculation shown in Chutak IRR.xls, sheet "SR Chutak" Row 36.
Depreciation Charges	INR 157.8 million	Calculated in accordance with Central Electricity Regulatory Commission Guidelines of 26 March 2004.	finalregulations_terms&condition.pdf/Pages 37, 38, applied in Chutak IRR.xls, sheet "SR Chutak" Row 35.
Interest on working capital	INR 17.1 million	Calculated in accordance with Central Electricity Regulatory Commission Guidelines of 26 March 2004.	finalregulations_terms&condition.pdf/ Page 40, applied in Chutak IRR.xls, sheet "SR Chutak" Row 38.
Interest rate on Loan	8%	As per Rural Electrification Corporation limited applicable for all public sector projects	REC-Interest Rates.pdf/ Page 2, applied in Chutak IRR.xls, sheet "SR Chutak" Row 34.
Financial Benchmark	10.25%	Reserve Bank of India, Annual report 2005-2006	http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/72286.pdf
Benefit			
Power generation	210.38 MUs [1 MU (million Units) = 1 GWh]	Salient Features of Chutak Hydroelectric Project (4x11 MW) in J&K by NHPC, Annexure I of the Ministry of Power, Government of India document F.No. 22/1/2001-DO (NHPC)	Chutak annexure 1.pdf/ Page 2 shows Gross generation. Net generation is Gross generation less auxiliary consumption and transformer losses. Calculation of net generation is shown in Chutak IRR.xls, sheet "SR Chutak" Rows 19-27.
Electricity sales price	INR 2.77/kWh	Calculated in accordance with Central Electricity Regulatory Commission Guidelines of 26 March 2004.	finalregulations_terms&condition.pdf/Chapter 3, Page 30-49, applied in Chutak IRR.xls, sheet "irr chutak", col. K.

The benchmark chosen for analysis is fully consistent with the choice of approach. The CDM-PDD contains clear and transparent arguments to demonstrate how the parameters were derived.

Benchmark prime lending rate for public sector banks as of December 2005 (when IRR calculations were made and reported in Table 4 below): 10.25-11.25%
(Source: Reserve Bank of India, Annual Report 2005-06, Table 1.58: Movements in Deposit and Lending Rates. http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/72286.pdf).

Cash Reserve Ratio and Interest Rates: 2005-06" of the same report indicates a PLR range of 10.25 – 10.75%, considering five major banks.

Thus, a benchmark IRR of 10.25% has been chosen as conservative.

The IRR of the project is 6.5%, far below the benchmark IRR.

Sub-step 2c. Calculation and comparison of financial indicators
The IRR of the project is 6.5%, far below the benchmark IRR. The economic analysis is shown in Table 5.

Table 4: IRR calculation for Chutak Project
All values in Crore (10^7) Rupees, except for Generation and Sales Rate

	OUTFLOW				INFLOW			
					Generation	Sales Rate		Net
Year	Investment	O&M	W/C	Total	GWh	Rs/kWh	Sales	Revenue
1	114.85			114.85				-114.85
2	131.62			131.62				-131.62
3	187.55			187.55				-187.55
4	155.2			155.2				-155.2
5	12.92	9.32	1.71	23.95	210.38	2.77	58.38	34.43
6		9.32	1.71	23.95	210.38	2.77	58.38	47.35
7		9.32	1.71	23.95	210.38	2.77	58.38	47.35
8		9.32	1.71	23.95	210.38	2.77	58.38	47.35
9		9.32	1.71	23.95	210.38	2.77	58.38	47.35
10		9.32	1.71	23.95	210.38	2.77	58.38	47.35
11		9.32	1.71	23.95	210.38	2.77	58.38	47.35
12		9.32	1.71	23.95	210.38	2.77	58.38	47.35
13		9.32	1.71	23.95	210.38	2.77	58.38	47.35
14		9.32	1.71	23.95	210.38	2.77	58.38	47.35
15		9.32	1.71	23.95	210.38	2.77	58.38	47.35
16		9.32	1.71	23.95	210.38	2.77	58.38	47.35
17		9.32	1.71	23.95	210.38	2.77	58.38	47.35
18		9.32	1.71	23.95	210.38	2.77	58.38	47.35
19		9.32	1.71	23.95	210.38	2.77	58.38	47.35
20		9.32	1.71	23.95	210.38	2.77	58.38	47.35
21		9.32	1.71	23.95	210.38	2.77	58.38	47.35
22		9.32	1.71	23.95	210.38	2.77	58.38	47.35
23		9.32	1.71	23.95	210.38	2.77	58.38	47.35
24		9.32	1.71	23.95	210.38	2.77	58.38	47.35
25		9.32	1.71	23.95	210.38	2.77	58.38	47.35
26		9.32	1.71	23.95	210.38	2.77	58.38	47.35
27		9.32	1.71	23.95	210.38	2.77	58.38	47.35
28		9.32	1.71	23.95	210.38	2.77	58.38	47.35

29		9.32	1.71	23.95	210.38	2.77	58.38	47.35
30		9.32	1.71	23.95	210.38	2.77	58.38	47.35
31		9.32	1.71	23.95	210.38	2.77	58.38	47.35
32		9.32	1.71	23.95	210.38	2.77	58.38	47.35
33		9.32	1.71	23.95	210.38	2.77	58.38	47.35
34		9.32	1.71	23.95	210.38	2.77	58.38	47.35
35		9.32	1.71	23.95	210.38	2.77	58.38	47.35
36		9.32	1.71	23.95	210.38	2.77	58.38	47.35
37		9.32	1.71	23.95	210.38	2.77	58.38	47.35
38		9.32	1.71	23.95	210.38	2.77	58.38	47.35
39		9.32	1.71	23.95	210.38	2.77	58.38	47.35

Sub-step 2d: Sensitivity Analysis

The factors that are likely to have an impact in the IRR calculation are:

- The cost of the project (investment) could be higher due to unforeseen delays in commissioning. It is unlikely to fall, so only increases of 5% and 10% are considered.
- Electricity sales (revenues) could be higher or lower due to changes in electricity sales rate. Increases and decreases of 5% and 10% in electricity sales rate are considered.
- Electricity sales (revenues) could also be higher or lower due to changes in power generation as a result of changes in water availability and/or equipment availability. Increases and decreases of 5% and 10% are considered.
- & M costs could be higher or lower. Since there is greater uncertainty in O&M rates, increases and decreases of 10% and 20% are considered.

Table 5 shows how variations in those key factors affect the IRR of the project activity. Changes that would reduce project economics are shown in red, while those that would improve project economics are shown in green.

Table 5: Sensitivity analysis for Chutak Hydroelectric Project

Factor					
Project investment change:	**+10%**	**+5%**	**0%**		
Project IRR, %	5.77	6.12	6.50		
Change in electricity sales rate:	**+10%**	**+5%**	**0%**	-5%	-10%
Project IRR, %	7.43	6.97	6.50	6.02	5.52
Change in electricity generation:	**+10%**	**+5%**	**0%**	-5%	-10%
Project IRR, %	7.43	6.97	6.50	6.02	5.52
O&M change:	**+20%**	**+10%**	**0%**	**-10%**	**-20%**
Project IRR, %	6.19	6.35	6.50	6.65	6.80

The sensitivity analysis shows that, within the range of variability considered, project economics is more sensitive to changes in revenue. However, even with a 10% increase in revenue, the IRR only rises to 7.43%, far below the benchmark IRR. If capital cost were 35% lower, or if electricity sales rate were 43% higher, IRR would increase to 10.25%, the benchmark value. Even if O&M costs fell to zero, the IRR

would only increase to 7.96%. This confirms that the project continues to be not economically attractive without CDM benefits, except in the case of a substantial increase in the electricity sales rate. Since the electricity sales rate is determined by a government agreement at the time of power plant planning stage, and not by market forces, a large increase such as 43% is unlikely in the Indian context. Therefore, the financial unattractiveness of the project is robust to reasonable variations in the critical parameters.

Step 3: Barrier analysis
Barrier analysis has not been used.

Step 4: Common practice analysis
Sub-step 4a: Analyze other activities similar to the proposed project activity:

The prevailing practice in Indian power investment scene is investing in medium or large scale conventional power projects, as the projects that are arising are mostly large scale fossil fuel-based power generation stations. This is mainly due to a better return on investment, economies of scale and easy availability of finances and fuel resources.

While hydroelectric power generation is one of the earliest forms for generating electricity, all regions of the world with hydroelectric potential have built hydro power plants and the technology is well understood, the costs of power generation at individual sites can vary widely, given that the power generation potential depends on available stream flow and head (pressure difference) and these are highly site dependent. The investment requirements can also vary substantially in some cases. This plant has a high investment requirement because the Chutak Hydroelectric Project is situated in a remote area (Kargil) which is more than 4000 metres above sea level, where temperatures drop below -35 to -40 degrees Celsius in winter, the atmospheric pressure is low and accessibility for half the year is poor due to road blockages. As a result, the performance efficiency of men and machines in the area is low and the project costs and risks are high. None of the other projects in the Northern Region faces such barriers or have been constructed under such conditions.

The hydrological circumstances together with the high investment requirements reduces the return on investment for this power plant to very low levels, as is documented (above) in the PDD, and is the basis for the determination of additionality.

To justify that establishing hydroelectric power project of similar capacities is not a common practice either in the state or the region two approaches have been used:

Approach 1: Contribution of hydroelectric power plants with capacity less than 50 MW in terms of energy generated (GWh) as compared to the net electricity generation (GWh) in both Ladakh and Northern Region grid of India.

The power generation through renewable energy sources is not common which is evident from the fact that the share of renewable energy generation is only around 4.2%. The energy generation from hydro projects with installed capacity below 50 MW represents only 1.6% of the total generation in Ladakh and Jammu and Kashmir Union Territories (where the project is located) as shown in Table 6, and only 0.8% of total generation of the Northern Grid, as shown in Table 7. This confirms that hydro projects such as the proposed project activity are not common practice in the region

Table 6: Net Generation (hydro below 50 MW and total) for Ladakh Union Territory, for period 2000-2005
Source: Table 43.3 in Appendix~~nnex~~ 43, based on official data

Average total grid generation during period	30,351	GWh

Average hydro<50MW generation during period	494	GWh
Percentage of hydro<50MW generation over total	1.6%	

Table 7: Net Generation (hydro below 50 MW and total) for Northern Region Grid, for period 2000-2005
Source: Table 43.3 in Appendix~~nnex~~ 43, based on official data

Average total grid generation during period	147,615	GWh
Average hydro<50MW generation during period	1,109	GWh
Percentage of hydro<50MW generation over total	0.8%	

Approach 2: Comparing the project activity to "similar" projects (assuming a capacity range of ± 50%, i.e. 20 - 65 MW) in the U.T. of Ladakh and the Northern Region grid of India.

Hydro projects of capacity in the range of 20-65 MW (i.e. ±50% of the proposed project activity) were considered in the U.T. of Jammu and Kashmir and Ladakh, where the project is located, as well as in the Northern Region, which is the power grid to which Ladakh, Jammu and Kashmir belongs.

The source of the data for the common practice analysis is the Carbon dioxide database (CO2 baseline database version 02 dated June 2007), which is publicly made available by Central Electricity Authority, Government of India

The proposed project is located in the U.T. of Ladakh and ~~state of~~ Jammu and Kashmir. Table 8 below shows similar hydro projects (i.e. in the range 20 – 65 MW).

Table 8: Hydroelectric Projects in the capacity range of 20-65 MW in the U.T. of Ladakh and ~~state of~~ Jammu&Kashmir

S.No.	Name of the plant	Unit	Date of commissioning	Capacity as on 31/03/2006 (MW)	Region	State	Type
1	**WY.CANAL A -D**	**0**		**62.4**	**NR**	**HARYANA**	**HYDRO**
	WY.CANAL-A	1	29-May-86	8	NR	HARYANA	HYDRO
	WY.CANAL-A	2	13-Jun-86	8	NR	HARYANA	HYDRO
	WY.CANAL-B	3	15-May-87	8	NR	HARYANA	HYDRO
	WY.CANAL-B	4	1-Jun-87	8	NR	HARYANA	HYDRO
	WY.CANAL-C	5	27-Mar-89	8	NR	HARYANA	HYDRO
	WY.CANAL-C	6	18-Apr-89	8	NR	HARYANA	HYDRO
	WY.CANAL-D	7	16-Apr-04	7.2	NR	HARYANA	HYDRO
	WY.CANAL-D	8	20-Apr-04	7.2	NR	HARYANA	HYDRO
2	**BASSI**	**0**		**60**	**NR**	**HIMACHAL**	**HYDRO**
	BASSI	1	13-Sep-70	15	NR	HIMACHAL	HYDRO

	BASSI	2	24-Dec-70	15	NR	HIMACHAL	HYDRO
	BASSI	3	15-Jul-71	15	NR	HIMACHAL	HYDRO
	BASSI	4	3-Feb-81	15	NR	HIMACHAL	HYDRO
3	**GIRI BATA**	**0**		**60**	**NR**	**HIMACHAL**	**HYDRO**
	GIRI BATA	1	16-Apr-78	30	NR	HIMACHAL	HYDRO
	GIRI BATA	2	30-Jun-78	30	NR	HIMACHAL	HYDRO
4	**GHANVI**	**0**		**22.5**	**NR**	**HIMACHAL**	**HYDRO**
	GHANVI	1	7-Dec-00	11.25	NR	HIMACHAL	HYDRO
	GHANVI	2	30-Jul-00	11.25	NR	HIMACHAL	HYDRO
5	**CHENANI I&III**	**0**		**30.8**	**NR**	**JAMMU & KASHMIR**	**HYDRO**
	CHENANI-I	1	1-Sep-71	4.66	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-I	2	1-Sep-71	4.66	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-I	3	1-Oct-71	4.66	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-I	4	1-Apr-75	4.66	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-I	5	1-Jun-75	4.66	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-III	6	30-Jun-00	2.5	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-III	7	30-Jun-00	2.5	NR	JAMMU & KASHMIR	HYDRO
	CHENANI-III	8	30-Jun-00	2.5	NR	JAMMU & KASHMIR	HYDRO
6	**MATATILLA**	**0**		**30.6**	**NR**	**UTTAR PRADESH**	**HYDRO**
	MATATILLA	1	28-Feb-65	10.2	NR	UTTAR PRADESH	HYDRO
	MATATILLA	2	30-Jun-65	10.2	NR	UTTAR PRADESH	HYDRO
	MATATILLA	3	30-Sep-65	10.2	NR	UTTAR PRADESH	HYDRO
7	**DHAKRANI**	**0**		**33.75**	**NR**	**UTTARANCHAL**	**HYDRO**
	DHAKRANI	1	15-Nov-65	11.25	NR	UTTARANCHAL	HYDRO
	DHAKRANI	2	31-Mar-66	11.25	NR	UTTARANCHAL	HYDRO
	DHAKRANI	3	10-Jan-70	11.25	NR	UTTARANCHAL	HYDRO
8	**DHALIPUR**	**0**		**51.00**	**NR**	**UTTARANCHAL**	**HYDRO**
	DHALIPUR	1	10-Dec-65	17	NR	UTTARANCHAL	HYDRO
	DHALIPUR	2	25-Mar-66	17	NR	UTTARANCHAL	HYDRO
	DHALIPUR	3	31-Mar-70	17	NR	UTTARANCHAL	HYDRO

9	**KULHAL**	**0**		**30.00**	**NR**	**UTTARANCHAL**	**HYDRO**
	KULHAL	1	11-Apr-75	10	NR	UTTARANCHAL	HYDRO
	KULHAL	2	26-Sep-75	10	NR	UTTARANCHAL	HYDRO
	KULHAL	3	24-Dec-75	10	NR	UTTARANCHAL	HYDRO
10	**PATHRI**	**0**		**20.40**	**NR**	**UTTARANCHAL**	**HYDRO**
	PATHRI	1	25-Jul-55	6.8	NR	UTTARANCHAL	HYDRO
	PATHRI	2	18-Sep-55	6.8	NR	UTTARANCHAL	HYDRO
	PATHRI	3	14-Dec-55	6.8	NR	UTTARANCHAL	HYDRO
11	**KHATIMA**	**0**		**41.40**	**NR**	**UTTARANCHAL**	**HYDRO**
	KHATIMA	1	30-Apr-55	13.8	NR	UTTARANCHAL	HYDRO
	KHATIMA	2	2-Apr-56	13.8	NR	UTTARANCHAL	HYDRO
	KHATIMA	3	3-Aug-56	13.8	NR	UTTARANCHAL	HYDRO

In conclusion, the project activity is not a common practice in the region.

It can be seen from Table 10 that all the projects in the entire Northern Region were commissioned prior to 2001 and mainly during the period 1955 to 1989.

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

There are very few hydro projects below 50 MW within the Union Territories of Ladakh and ~~State of~~ Jammu ~~and~~ & Kashmir. All except one of these are substantially smaller, below 15 MW.

As all steps are successfully completed, therefore the proposed project activity is additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

>> The project activity involves the generation of electricity through the construction of a hydroelectric plant. Methodology ACM0002 (version 6) is applied to the proposed project. The project activity mainly reduces carbon dioxide emissions by displacing other generation sources connected to the electricity grid.

The electrical transmission in India is divided in five regions: Northern Region, North-Eastern Region, Eastern Region, Southern Region and Western Region. The Northern Region comprises Delhi, Punjab, Haryana, Chandigarh, Rajasthan, Jammu and Kashmir, Uttaranchal, Uttar Pradesh and Himachal Pradesh. Baseline emissions are the product of carbon dioxide grid emission factor for the Northern Region of India (EF_y in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities ($EG_{baseline}$ in MWh), as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_y \quad (1)$$

As this project is a new plant, it does not involve any retrofit, so $EG_{baseline}$ shall not be calculated. As a consequence, equation (1) is:

$$BE_y = EG_y \times EF \quad (1a)$$

The emissions factor EF is determined from two components: an Operating Margin (OM) and a Build Margin (BM). In each case there are alternative procedures specified in ACM0002.

The Simple Operating Margin is applicable for OM, when low-cost/must-run constitute less than 50% of the total grid generation, which is the case here.

According to ACM0002 (version 6) it is necessary to choose a calculation criteria for the Simple OM used to calculate the Combined Margin (CM). The options for data vintages are:

- *(ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,*
- *The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring. The first option is chosen for the proposed project activity.*

Thus the value of OM will remain fixed during the first crediting period. The two options that ACM0002 (version 6) provides to calculate the Build Margin (BM) are:

- *Option 1: calculate the BM emission factor ($EF_{BM,y}$) ex-ante 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 either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options, the sample group that comprises the larger annual generation.*
- *Option 2: for the first crediting period, the BM emission factor ($EF_{BM,y}$) must be updated annually ex-post for the year in which annual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above. The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.*

The project participant chooses Option 1 to conduct the BM calculation. Thus the value of BM will remain fixed throughout the first crediting period.

According to ACM0002 neither project emissions nor leakage effects are to be considered in the emission reductions calculation. Therefore, baseline emissions are equal to emission reductions.

$$ER_y = BE_y \ (tCO_2 / yr)$$

Where,

ER_y = Emission reductions during year y in tonnes of CO_2 per year.
BE_y = Baseline emissions during year y in tonnes of CO_2 per year. Basing on equation

(1a), baseline emissions are equal to:

$$BE_y = EG_y \times EF$$

Where,

BE_y = Baseline emissions corresponding to equivalent energy generation from the grid during year y (tCO_2/year)

EG_y = Electricity generated by the project activity and displaced from the grid during year y (MWh)

EF = CO_2 emission factor for the electricity grid (tCO_2/MWh)

B.6.2. Data and parameters fixed ex ante

~~*(Copy this table for each piece of data or parameter.)*~~

Data/Parameter	EF
Data unit	tCO2/MWh
Description	Carbon dioxide emission factor of the electricity grid
Source of data	Calculated from official data sources (CEA Database)
Value(s) applied	0.793 for ex-ante estimate of emission reductions
Choice of data or measurement methods and procedures	Calculated according to ACM0002, ver. 06.0.
Purpose of data	
Additional comment	Calculation is shown in Appendix 4~~Annex 3~~. EF will remain fixed throughout the first crediting period

B.6.3. Ex ante calculation of emission reductions

>> According to ACM0002 version 06 no leakage emissions are to be considered. Project emissions are not envisaged for the proposed project activity, so emission reductions are equal to baseline emissions.

Estimation of Baseline Emissions

Equation (1a) is used to calculate baseline emissions:

$$BE_y = EG_y \times EF$$

Where

BE_y = Baseline emissions corresponding to equivalent energy generation from the grid during year y (tCO_2/year)

EG_y = Electricity generated by the project activity and displaced from the grid during year y (MWh)

EF = CO_2 emission factor for the electricity grid (tCO_2/MWh)

The estimated electricity generation by the proposed project activity for the chosen crediting period is:

Table 9: Estimated Electricity Generation

Year	Estimated Electricity Generation (MWh)
31/01/2012 -30/01/2013~~Feb 2011- Jan 2012~~	210, 380
31/01/2013 -30/01/2014~~Feb 2012- Jan 2013~~	210, 380
31/01/2014 -30/01/2015~~Feb 2013- Jan 2014~~	210, 380
31/01/2015 -30/01/2016~~Feb 2014- Jan 2015~~	210, 380
31/01/2016 -30/01/2017~~Feb 2015- Jan 2016~~	210, 380
31/01/2017 -30/01/2018~~Feb 2016- Jan 2017~~	210, 380
31/01/2018 -30/01/2019~~Feb 2017- Jan 2018~~	210, 380
Total	**1,472, 660**

Estimation of Emission Reductions As indicated above, emission reductions are equal to baseline emissions. Then,

ERy = EGy × EF

B.6.4. Summary of ex ante estimates of emission reductions

The ex-ante emission reductions are estimated to be 166,831 tonnes of CO2 equivalent per year. However, actual emission reductions will be based on monitored data, thus, ex-post emission reductions are likely to be different from the ex-ante estimate

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
31/01/~~Jan~~ 2012 -30/01/~~Jan~~ 2013	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2013 -30/01/~~Jan~~ 2014	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2014 -30/01/~~Jan~~ 2015	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2015 -30/01/~~Jan~~ 2016	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2016 -30/01/~~Jan~~ 2017	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2017 -30/01/~~Jan~~ 2018	1,66,831	0	0	1,66,831
31/01/~~Jan~~ 2018 -30/01/~~Jan~~ 2019	1,66,831	0	0	1,66,831
Total	11,67,819	0	0	11,67,819
Total number of crediting years	7			
Annual average over the crediting period	1,66,831	0	0	1,66,831

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

~~(Copy this table for each piece of data or parameter.)~~

Data/Parameter	EGy
Data unit	MWh
Description	Net electricity generation by the project activity and displaced from the grid.
Source of data	NHPC Limited.
Value(s) applied	1,472,660 MWh for ex-ante estimate of emission reductions was used. This is the estimated generation for the 7-year crediting period
Measurement methods and procedures	This value will be measured by using energy meters. The monitored values will be stored in non-volatile memory. These meters are integrated type with storage of data. For monitoring of the generation and transmission of power, a metering system using digital meters and recorders shall be provided for generators, for all lines and feeders of Switchyard, Unit transformers, Station Service Transformers, Step Down transformer etc. All parameters such as voltage, current, power, energy, etc., shall be measured. All the energy meters used for measurements shall have an accuracy of 0.2%. All CT's and PT's shall be provided with a measuring core of accuracy class of 0.2. A system of main meter and check meters both for interface tariff and energy audit shall be provided.
Monitoring frequency	Monthly
QA/QC procedures	Since the metering is done at a number of pf points, the method of measurement of power generation is free from errors as several points of check and counter check are available.
Purpose of data	Calculation of Baseline emissions
Additional comment	Monitored data will be kept for two years after the end of each crediting period or the last issuance of CERs, whichever occurs later.

B.7.2. Sampling plan

>> Sampling is not required for the given project activity

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B.7.3. Other elements of monitoring plan

>> The monitoring of baseline emissions implies the application of an operational and management procedure that shall assure the correct and proper measurement and control of all variables involved in the calculation of emission reductions.

The necessary structure is characterised in the table given below

Table 10: Operational and management structure

Department	Responsibility	Monitoring	Methodology
Chutak Hydroelectric Project	Head of the Project (HOP)	Net Electricity Generation *(EGy)*	Energy meters are provided to measure Power Generation. These are: 1. Main Meter for tariff – provided at line terminal. Accuracy of CT, PT, Energy meter 0.2% 2. Check Meter for tariff - provided at line terminal. Accuracy of CT, PT, Energy meter 0.2% 3. Stand-by meter for tariff – provided on HV side of Generator transformer. Accuracy of CT, PT, Energy meter 0.2% The meters are integrated in nature and as per the latest

			technology and shall provide the following information stored in non-volatile memory: ➢ Average frequency for each 15-minutes block (integrated for each 0.02 Hz in linear step). ➢ Net active energy (Wh) for each 15-minutes block with sign (+/-). ➢ Cumulative active energy (Wh) at each mid-night. ➢ Cumulative reactive energy (VARh) each 15-minutes block for low voltage (below 97%) condition. ➢ Meter data storing capacity is 10 days. Meters for energy accounting & audit- provided at HV&LV sides of Unit auxiliary transformer & Station auxiliary transformer. Accuracy of CT, PT, Energy meter 0.2%.
CDM Cell, NHPC Limited.	Chief Engineer (CDM)	Follow-up of CDM Project	There will be a person in charge of following the development of the project activity.

Monitoring activities that complement the Maintenance Plan (see section A.3):

Monitoring tests like Partial Discharge of generators, Dissolved Gas Analysis of Transformer oil, Insulation Resistance, capacitance, tan delta tests, and many others are also done to complement the monitoring. Procedures for regular testing and calibration of gauges, panel relays, relays, meters and other instruments are also defined to ensure proper working. The frequency for calibration and other tests are defined as per need following national standards and rules.

Staff Training that complements the Monitoring Plan and Maintenance Plan:

Staff training for proficiency in use of the monitoring instruments is taken care of by the power station management. The HRD cell also conducts training regularly to enhance the skills of personnel attached with such equipment in the operating stations.

The EPC contract includes the supply of the operation and maintenance manuals by the contractor with drawings of the facilities as built. This shall be in such detail as to enable NHPC to operate, maintain, adjust and repair all parts of the facility.

For Chutak specific plans and documents will be available at the time of commissioning of the plant.

Data and Information Management of the plant:

A system shall be provided at central control room that shall be equipped with storage media for real time data storage. The data logger shall be provided to receive, update, print out and show on the VDU's all signals, events, alarms, status, status change, abnormalities and history data of plant and ambient conditions either periodically, on request or immediately in case of alarm.

Redundant Network Attached Storage (NAS) systems of high performance and high capacity to store the plant history data up to the power plant's lifetime shall be provided. The information stored by these storage appliances shall also be available on-line with automatic "hot" backup of on-line data and ready to be shared by servers on the Central Control Room Network and associated LAN. The NAS devices shall have open system architecture to connect them to other equipment. This centralized data storage system shall also use fast read/write optical backup medium such as re-writable CD-RW media using CD writers or high performance tape drives. Storage media is provided for 20 years of storage.

Database Management System based on latest available version of ORACLE RDBMS database software shall be provided.

High reliability of communication shall be realized by double bus (redundant) system. The two systems shall continuously operate separately and only in case of traffic interruption on one bus, the other shall take over the traffic.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>23/-09/-2006 (Date construction work was awarded to contractor)

C.2. Expected operational lifetime of project activity

>>35 years

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>> Renewal crediting period

C.3.2. Start date of crediting period

>> 31/01/2012 ~~01-02-2011~~

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C.3.3. Duration of crediting period

>> 7 Years (31/01/2012 – 30/01/2019)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>> The project is consistent with environmental criteria of the Indian Government. An Environmental Impact Assessment (EIA) has been undertaken for the proposed project activity.

During the public hearing that was conducted to promote the project, the Chief of Environment of NHPC informed the public about the importance of Environmental studies undertaken for this project activity by the Centre for Environmental Education & Training (CEET), University of Jammu.

He stressed the importance given to NHPC to conserve the environment in the surroundings of the project area. He said all care has been taken during the EIA studies to protect the interest of local people as well as the environment. The issues evaluated in the EIA are:

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~~4.~~ Physiography and Hydrometeorology
~~5.~~ Geology
~~6.~~ Land requirement
~~7.~~ Floristic and Vegetation types
~~8.~~ Terrestrial Fauna
~~9.~~ Aquatic Ecology
~~10.~~ Soil Characteristics
~~11.~~ Air Quality
~~12.~~ Socio-economics

To mitigate the impacts that the project could have on each issue, an Environmental Management Plan (EMP) was designed and included in the EIA.

D.2. Environmental impact assessment

>> The grievances of people affected by the project have been listened to. As mentioned above, an Environmental Management Plan (EMP) was prepared to mitigate and prevent possible impacts of the project. The measures taken in the EMP are:

Rehabilitation and Resettlement: families that have to be moved are to be compensated for the loss of their land. Scholarships to meritorious students, infrastructure facilities, irrigation facilities and other programmes are included in the R&R plan.

Afforestation programme: no forest land is involved in the project construction. An 80 ha area has been proposed to be brought under afforestation.

Catchment Area Treatment (CAT): An Engineering and biological works are to be undertaken for the CAT Plan.

Biodiversity Conservation Plan: The Plan consists of two methods: Ex-situ Conservation and In-situ Conservation. It is also proposed to develop a Biodiversity Park that will include endangered and endemic species.

Reservoir Rim Treatment, Green Belt and Landscaping: There is an adequate potential for creating a green belt and recreation under the Reservoir Rim Treatment Plan, following Engineering and biological measures, which are based on topography, vegetation, soil types, climate and requirement of protection for the landslides, structures and dwellings.

Restoration of borrow pits area: This includes construction of retaining walls and stabilization with vegetation cover.

Control of Air and Noise pollution: Many measures that mitigate air and noise pollution are applied during construction phase. They are listed in the EMP.

Waste disposal plan: Approximately, 5% of the total generated waste is expected to be used for infrastructural development works of the project. For the rest, three dumping sites were identified near the project area for waste disposal. These will be stabilized with vegetation cover.

Sewage and Solid Waste Management: A proper sewerage and drainage plan will be designed and a landfill area will be installed for garbage disposal also.

Reservoir Fisheries Development: To conserve the endemic fish species of Suru River, supplementary stocking has been suggested to augment the existing population. It is recommended not to allow fish catches. It is proposed to develop a fish seed farm near the barrage site with an area of 1 ha for the purpose of reservoir fisheries development.

Fuel Arrangements: Project contractors should be advised to develop community kitchens at the construction sites and shall only use LPG, kerosene or electricity/solar cookers/pressure cookers.

Health and hygiene: Sheds are constructed for the workers. They include electricity, ventilation, water supply and community toilets. A mobile health care unit is to be used to visit the stations twice a week.

Disaster management plan: if a natural disaster occurs it is necessary to have an action plan designed to face that situations.

Environmental monitoring programme: it includes monitoring of environmental indicators to detect potential problems. An attempt is made to establish early warning of indicators of stress on the environment.

The project Authorities shall send an Annual Progress report of implementation of EMP to State Pollution Control Board for monitoring.

In addition to the activities of the EMP, various community development works were carried out by the project for welfare of the people living in the region. These include construction of three bridges for the people to cross the rivers (only one was needed to set up the project), free medical treatment for local people, construction of roads, etc. CDM revenues would help in further strengthening such activities.

Regular interaction with stakeholders is done to monitor, share and resolve the environmental and socio-economic issues. A multi-disciplinary committee meets periodically and takes decisions as needed and monitors progress. The multi-disciplinary committees have been constituted including members of various agencies (NHPC Environmental Wing, Ministry of Environment & Forests, Agriculture Dept., Horticulture Dept, Soil Conservation Dept, Wildlife Dept and NGOs)

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>> An Environmental Public Hearing Meeting was performed at Village Sarzhe, District Kargil, on 30th August 2005, as per EIA notification. The main aim of the Public Hearing is to observe the views of public regarding the project.

The public Hearing consisted of several presentations. Specifically, the Chief Engineer of Chutak HE Project described the technical details of the project.

Many important people and general public attended the Public Hearing. They all were asked to give their views on the project because they will be useful for a better development of the project.

The following dignitaries/prominent people were present at the meeting:

Table 11: Stakeholders involved in the public hearing

S.No.	Name	Position and Institution or Company
1	Sh. S. K. Sinha	Regional Director, J&KSPCB
2	Jenab Isfandyar Khan	Deputy Commissioner/CEO, LAHDC
3	Sh. Asgar Ali	Superintending Engineer (PDD) J&K
4	Sh. Akhoon Jaffar	Sarpanch, Minji, Panchayat Halqa
5	Sh. Sheikh Hassan	Sarpanch, Kanoor Panchayat Halqa
6	Sh. Mohd Hassan	S/o Moosa, Panch Chutak Halqa
7	Sh. Sheikh Ahmad Mohammadi	R/o Balti Bazar, Kargil
8	Sh. Aga Syed Hadi	R/o Minji
9	Sh. Sneikh Mohd Mohaqiq	R/o Baroo Colony
10	Sh. S.H. Zargar	Chief Engineer, Chutak HE Project, Kargil
11	Sh. Vipin Kumar	Chief (Env.) Region-I, Jammu
12	Haji Mohd Ishaq	Honorable Ex. Councilor, (Rural Development), LAHDC, Kargil
13	Nasir Hussain Munshi	Honarable Ex. Councilor (Works), LAHDC, Kargil
14	Kacho Gulzar Khan	Honorable Ex. Councilor (Agri) LAHDC, Kargil District Panchayat Officer, Kargil Assistant Commissioner Development Kargil
15	Sh. Sentil Kumar	IFS, DFO, Kargil
16	Sh. Chaturbhaj Behra	IFS, Kargil
17	Manzoor Ahmad	AEE, J&KSPCB
18	Sh. Khursheed Ahmad Ganie	J&KSPCB
19	Sh. Ravi Sharma	CEET, University of Jammu
20	List of Local Participants enclosed as Appendix 6~~nnexure 5~~	

E.2. Summary of comments received

>> All comments were favourable to project development. People are in favour of project construction. All people stressed the environmental responsibility that NHPC has.

However, some people requested NHPC to take into consideration the following suggestions:

- Authorities have to make provisions for safeguarding the land.
- Health care, scholarships for poor children and schools were also emphasized. Local
- People for employment should be given preference.
- Fences on road sides were also requested. Proper arrangements for maintenance and uninterrupted water supply for irrigation as well as cattle shed for animals were requested.
- There should be a committee of experts to overcome any adverse arising out of the project implementation.
- Air pollution from tunnelling and hygiene should be given due care.

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E.3. Consideration of comments received

>> EIA & EMP reports along with public hearing report were submitted to Ministry of Environment & Forest (MoEF), New Delhi. The same was discussed by environmental appraisal Committee of MoEF. Based on the recommendations of expert committee, the project was accorded environment clearance by MoEF. All the conditions stipulated in the environmental clearance letter would be complied with.

Suggestions received from the people will be considered and will be given due care. The Chief Engineer of NHPC at Chutak was specially requested to try to minimize the land requirement for the project. It is their duty to fully compensate every family, as the people of villages adjacent to barrage are very poor and agriculture is their main source of livelihood. It was assured that reasonable compensation rates would be provided to people who are likely to be affected/ displaced.

NHPC has given due care in Environmental Management Plan (EMP), for all the issues raised by the public (see Section D.2) above. Furthermore, various social measures proposed in the EMP such as upgrading existing schools, building of community halls, scholarships, etc. were considered. Moreover, priority in employment shall be given to unskilled and semiskilled locals of the area.

SECTION F. Approval and authorization

>> HCA was obtained from DNA, India on 10th, August 2007. DNA also issued the letter on 23rd December 2019 for change of name of project proponent to NHPC Limited.

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Appendix 1. Contact information of project participants

Organization name	NHPC Limited
Country	India
Address	NHPC Office Complex, Sector 33, Faridabad, Haryana 121003
Telephone	0129-2588 110; +91-9717494567
Fax	0129-2277 941
E-mail	envdivnhpc@gmail.com; envdivmgn-co@nhpc.nic.in
Website	www.nhpcindia.com
Contact person	Mr. Ashis Kumar Das~~Sujit Kumar Bajpayee~~, Dy. GM (Environment)

Appendix 2. Affirmation regarding public funding

No diversion of ODA funds. The details regarding public funding for the project activity is provided in section A.5

Appendix 3. Applicability of methodologies and standardized baseline

The details regarding applicability of selected methodology are provided in Section B.2

Appendix 4. Further background information on ex ante calculation of emission reductions

Key data used to estimate the ex-ante baseline scenario emissions are given in Table below

Table 4.1: Key Data

Parameters	Value	Data sources
Combined margin emission factor used for ex-ante estimation of ER	0.793 tCO2/MWh	CEA Database
Variables	**Value**	**Data sources**
Electricity generation of the industrial facility (7-year period)	1,472,660 MWh	NHPC (Project developer)

Calculation of grid emission factor (*EFy*) for Northern Region in India

The Central Electricity Authority (CEA) of India is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948. It was established as a part-time body in the year 1951 and made a full-time body in the year 1975.

As per section 73 of the Electricity Act, 2003, the Central Electricity Authority shall perform certain functions and duties. These functions and duties can be seen in: http://www.cea.nic.in/about_us/functions_cea.html There is a specific section in their website7 where the calculation of the grid emission factor is publicly available. They also provide a User's guide for the CO2 Baseline Database for the Indian Power Sector.

According to the User's guide:

- *The Baseline Carbon Dioxide Emissions from Power Sector have been worked out by CEA based on detailed authenticated information obtained from all the operating Power Stations in the country. The Baseline would benefit all prospective CDM project developers to estimate the amount of Certified Emission Reduction (CERs) from any CDM project activity.*

- *The Indian electricity system is divided into five regional grids, viz. Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. As the regional grids are interconnected, there is inter-state and inter-regional exchange. A small power exchange also takes place with neighbouring countries like Bhutan and Nepal. For each of the five regions, the main emission factors are calculated in accordance with the relevant CDM methodologies.*

For specific assumptions in the calculation please refer to the User's guide.

The calculation made by CEA is done using ACM0002 version 06, considering data up to fiscal year 2005-06. For calculation of Operating Margin the Simple Method is applied.

The steps followed to calculate the combined margin are synthesized below.

STEP 1: Calculate the Operating Margin emission factor *($EF_{OM,y}$)*

The following table shows that LCMR constitute less than 50% of the total grid generation. This is to justify the applicability of the Simple Operating Margin in the Northern Region.

Table 4.2: Share of LCMR Resources

(Source: CEA Database)

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	**25.9%**	**25.7%**	**26.1%**	**28.1%**	**26.8%**	**28.1%**
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.3%	42.1%	45.8%	41.8%	55.4%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Therefore, following option (a) Simple Method, the $EF_{OM,y}$ is given by:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GENj,y} \quad (1)$$

Where,

$F_{i,j,y}$ = Amount of fuel i (in a mass or volume unit) consumed by the relevant power sources j in the year y

j = Power sources delivering electricity to the grid, not including LCMR and including imports to the grid

$COEF_{i,j,y}$ = Is the CO2 emission coefficient of fuel i (tCO2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year y

$GEN_{j,y}$ = Is the electricity (MWh) delivered to the grid by source j

The following tables show the generation of the plants connected to the Northern Region of India for each Fiscal Year.

Table 4.3: Net Generation of Plants connected to the Northern Grid (GWh)

(Source: CEA Database)

S.No.	Name	Capacity MW as on 31/03/2005	State	Type	FUEL 1	FUEL 2	2000-01 Net Generation GWh	2001-02 Net Generation GWh	2002-03 Net Generation GWh	2003-04 Net Generation GWh	2004-05 Net Generation GWh	2005-06 Net Generation GWh
1	BADARPUR	720	DELHI	THERMAL	COAL	OIL	4742	4806	4811	4943	4919	4866
2	I.P.STATION	247,5	DELHI	THERMAL	COAL	OIL	766	711	547	669	806	838
3	RAJGHAT	135	DELHI	THERMAL	COAL	OIL	698	608	739	683	607	495
4	I.P.GT	282	DELHI	THERMAL	GAS	n/a	1113	1148	1187	1189	1503	1697
5	PRAGATI CCGT	330,4	DELHI	THERMAL	GAS	n/a			813	2345	2493	2227
6	F_BAD EXTN.	180	HARYANA	THERMAL	COAL	OIL	716	700	850	689	755	696
7	PANIPAT	1360	HARYANA	THERMAL	COAL	OIL	2416	4184	4486	5350	5137	7330
8	F_BAD CCGT	430	HARYANA	THERMAL	GAS	NAPT	2256	2797	2645	2727	3100	2885
9	GNDTP(BHATINDA)	440	PUNJAB	THERMAL	COAL	OIL	2524	2501	2266	2308	1749	2071
10	GHTP (LEH.MOH.)	420	PUNJAB	THERMAL	COAL	OIL	2940	2794	2646	3079	2998	2864
11	ROPAR	1260	PUNJAB	THERMA	COAL	OIL	7751	8151	7565	7612	8304	8535

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12	KOTA	1045	RAJASTHAN	THERMAL	COAL	OIL	5828	5738	5915	5792	6712	7525
13	N.A.P.S	440	UTTAR PRADESH	NUCLEAR	NUCLEAR		2735	3008	3222	2692	2441	1864
14	R.A.P.S.	740	RAJASTHAN	NUCLEAR	NUCLEAR		3326	4243	4509	3800	3815	3969
15	SURATGARH	1250	RAJASTHAN	THERMAL	COAL	OIL	2927	3725	6490	7419	8492	9041
16	RAMGARH GT	113,8	RAJASTHAN	THERMAL	GAS	DISL	227	116	210	206	336	404
17	ANTA GT	413	RAJASTHAN	THERMAL	GAS	NAPT	2809	2986	2679	2702	2710	2739
18	OBRA-A	1550	UTTAR PRADESH	THERMAL	COAL	OIL	5230	5018	5786	5509	4891	4733
19	PANKI	252	UTTAR PRADESH	THERMAL	COAL	OIL	759	845	937	985	938	864
20	H_GANJ B	450	UTTAR PRADESH	THERMAL	COAL	OIL	584	562	652	615	542	432
21	PARICHA	220	UTTAR PRADESH	THERMAL	COAL	OIL	464	839	765	523	800	679
22	ANPARA	1630	UTTAR PRADESH	THERMAL	COAL	OIL	10522	11136	10690	10997	10524	10547
23	SINGRAULI STPS	2000	UTTAR PRADESH	THERMAL	COAL	OIL	15323	14438	14769	14479	14696	10401
24	RIHAND	1500	UTTAR PRADESH	THERMA	COAL	OIL	7126	7077	7128	7347	7351	9866

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25	UNCHAHAR	840	UTTAR PRADESH	THERMAL	COAL	OIL	4922	5987	5626	5868	6200	6451
26	DADRI (NCTPP)	840	UTTAR PRADESH	THERMAL	COAL	OIL	6406	6151	5555	5683	6329	6268
27	TANDA	440	UTTAR PRADESH	THERMAL	COAL	OIL	1084	1933	1921	2650	2923	2935
28	AURAIYA GT	652	UTTAR PRADESH	THERMAL	GAS	NAPT	4545	4543	4140	4122	3994	4204
29	DADRI GT	817	UTTAR PRADESH	THERMAL	GAS	DISL	5507	5583	5068	4930	5319	5269
30	PAMPORE GT	175	JAMMU & KASHMIR	THERMAL	GAS	n/a	5	0	56	28	23	9
31	BHAKRA	1325,00	BBMB	HYDRO			4669	4170	5267	5746	3361	5693
32	GANGUWAL	77,65	BBMB	HYDRO			524	631	612	589	960	578
33	KOTLA	77,65	BBMB	HYDRO			524	631	612	589		488
34	DEHAR	990	BBMB	HYDRO			3146	3042	3322	3283	3135	3107
35	PONG	396	BBMB	HYDRO			1508	1415	804	1179	880	1722
36	BAIRA SIUL	198	HIMACHAL	HYDRO			646	603	677	685	686	787
37	SALAL I & II	690	JAMMU & KASHMIR	HYDRO			2924	2915	3123	3461	3428	3463
38	TANAKPUR	94,2	UTTARANCHAL	HYDRO			433	410	425	509	494	481
39	CHAMERA-I	540	HIMACHAL	HYDRO			2101	1946	2247	2452	2093	2326

40	CHAMERA II	300	HIMACHAL	HYDRO			0	0	0	181	1340	1483
41	URI	480	JAMMU & KASHMIR	HYDRO			1772	2077	2451	2858	2196	2711
42	NATHPA JHAKRI	1500	HIMACHAL	HYDRO			0	0	0	1115	5084	4033
43	WY.CANAL A -D	62,4	HARYANA	HYDRO			243	231	243	255	290	258
44	SANJAY BHABA	120	HIMACHAL	HYDRO			499	480	577	578	580	571
45	BASSI	60	HIMACHAL	HYDRO			261	257	280	313	269	258
46	GIRI BATA	60	HIMACHAL	HYDRO			204	191	167	168	155	192
47	GHANVI	22,5	HIMACHAL	HYDRO			14	40	81	73	74	69
48	ANDHRA	16,95	HIMACHAL	HYDRO			44	60	72	69	52	62
49	BANER	12	HIMACHAL	HYDRO			39	31	37	40	42	43
50	GAJ	10,5	HIMACHAL	HYDRO			49	37	40	48	51	51
51	BINWA	6	HIMACHAL	HYDRO			34	21	25	34	33	33
52	THIROT	4,5	HIMACHAL	HYDRO			16	25	33	31	11	4
53	MALANA	86	HIMACHAL	HYDRO			0	186	331	340	268	336
54	BASPA	300	HIMACHAL	HYDRO			0	0	0	1106	1148	1161
55	LOWER JHELUM	105	JAMMU & KASHMIR	HYDRO			341	311	4	504	427	494
56	UPPER SINDH I& II	127,6	JAMMU & KASHMIR	HYDRO			114	156	232	274	177	213
57	GANDHARBAL	15	JAMMU & KASHMIR	HYDRO			16	30	17	24	29	31

58	MOHARA	9	JAMMU & KASHMIR	HYDRO			1	0	2	0	1	1
59	CHENANI I&III	30,8	JAMMU & KASHMIR	HYDRO			81	39	58	71	78	16
60	KARGIL	3,75	JAMMU & KASHMIR	HYDRO			0	0	9	4	9	6
61	STAKNA	4	JAMMU & KASHMIR	HYDRO			3	2	0	0	0	2
62	SEWA-III	9	JAMMU & KASHMIR	HYDRO			0	0	0	10	10	12
63	SHANAN	110	PUNJAB	HYDRO			487	470	475	560	514	506
64	U.B.D.C. ST.-I& II	91,35	PUNJAB	HYDRO			343	299	388	425	378	529
65	MUKERIAN I -IV	207	PUNJAB	HYDRO			1216	1165	743	1024	807	1233
66	ANANDPUR SAHIB ST- I&II	134	PUNJAB	HYDRO			649	536	738	816	499	718
67	RANJIT SAGAR	600	PUNJAB	HYDRO			431	1223	1154	1541	1139	2003
68	R.P.SAGAR	172	RAJASTHAN	HYDRO			182	258	14	239	374	313
69	J.SAGAR	99	RAJASTHAN	HYDRO			139	199	13	203	281	227
70	MAHI BAJAJ I&II	140	RAJASTHAN	HYDRO			36	69	20	198	277	217
71	ANOOPGARH ST I&II	9	RAJASTHAN	HYDRO			13	9	5	0	0	2
72	RMC MANGROL	6	RAJASTHAN	HYDRO			3	4	1	0	0	0
73	SURAT GARH	4	RAJASTHAN	HYDRO			1	1	0	0	0	0
74	RIHAND	300	UTTAR PRADESH	HYDRO			1043	1036	616	1104	479	544
75	OBRA	99	UTTAR PRADESH	HYDRO			412	389	253	434	200	230

76	MATATILLA	30,6	UTTAR PRADESH	HYDRO			136	134	102	135	152	143
77	KHARA	72	UTTAR PRADESH	HYDRO			343	307	409	381	281	327
78	NIRGAJANI(Ganga Canal)	5	UTTAR PRADESH	HYDRO			143	20	30	80	53	34
79	CHIBRO (YAMUNA)	240,00	UTTARANCHAL	HYDRO			763	736	869	810	633	801
80	KHODRI	120,00	UTTARANCHAL	HYDRO			367	363	407	386	299	377
81	DHAKRANI	33,75	UTTARANCHAL	HYDRO			142	114	174	159	126	164
82	DHALIPUR	51,00	UTTARANCHAL	HYDRO			219	192	258	230	183	235
83	KULHAL	30,00	UTTARANCHAL	HYDRO			145	123	164	153	128	160
84	MANERI BHALI	90,00	UTTARANCHAL	HYDRO			407	389	455	486	456	453
85	CHILLA	144,00	UTTARANCHAL	HYDRO			516	538	559	685	741	656
86	PATHRI	20,40	UTTARANCHAL	HYDRO			0	108	100	97	100	98
87	MOHAMAD PUR	9,30	UTTARANCHAL	HYDRO			0	25	37	0	31	36
88	RAMGANGA	198,00	UTTARANCHAL	HYDRO			471	273	179	198	211	322
89	KHATIMA	41,40	UTTARANCHAL	HYDRO			165	170	161	172	182	164
90	DHAULI GANGA	280	UTTARANCHAL	HYDRO							0	313

The CO2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \times EF_{CO2\,i} \times OXID_i \quad (2)$$

Where,

EF_i = CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ = Oxidation factor of the fuel i

NCV_i = Net calorific value (energy content) per mass or volume unit of a fuel

Since this PDD determines the emissions factor ex ante, to remain unchanged for the first crediting period, the operating margin emissions factor must be calculated from the generation weighted average for the three most recent years for which data are available. The Operating Margin for the most recent three years, for the Northern Region is shown in table below.

Table 4.4: Operating Margin for recent years and three-year average (tCO2/MWh)

(Source: CEA Database)

	2003-04	**2004-05**	**2005-06**	**Three-year average**
North	0.99	0.98	0.99	0.986

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$)

It is calculated as the generation-weighted average emission factor (tCO2/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GENm,y} \quad (3)$$

Where,

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

The Build Margin for the most recent year of data (2005-06), for the Northern Region is 0.600 tCO2/MWh. (Source: CEA Database)

STEP 3. Calculate the baseline emission factor (EF_y)

It is the weighted average of the OM emission factor and the BM emission factor:

$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$

The results are shown below:

Table 4.5: Operating margin, Build margin and combined margin for the Northern Region tCO2/MWh

Operating margin	0.986
Build margin	0.600
Combined margin	0.793

In compliance to what is expressed in the previous paragraphs of the User's guide, Chutak Hydroelectric project uses the published emission factor in the CEA website to estimate the baseline emissions.

As Chutak Hydroelectric project is located in the Northern Region then the combined margin emission factor applied in the present project activity is 0.793 tCO2/MWh**.**

Appendix 5. Further background information on monitoring plan

The Monitoring and Verification Plan describes the procedures followed in order to collect information and auditing required for the project activity development. This plan is necessary to determine and verify emissions reductions achieved by the project activity.

Particularly, this project will require very straightforward collection of data, most of which will be collected by the staff of NHPC where the proposed CDM project is to be implemented.

The Monitoring and Verification Plan (MVP) document fulfills the CDM Executive Board requirements regarding the credibility and accuracy of the monitoring and verification procedures used in CDM projects.

The purpose of these procedures is to manage and support the continuous monitoring process of project performance and periodic auditing, verification and certification activities to determine project outcomes, in particular in terms of greenhouse gas (GHG) emission reductions. The MVP is a vital component of project design and, as such, is subject to a formal third-party validation process —along with the project baseline and other project design features.

Managers of the Project must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to successfully develop and maintain the proper set of information to undergo an audit for a greenhouse gas (GHG) emission reductions investment. These records and monitoring systems are needed to subsequently allow an Operational Entity to verify project performance as part of the verification and certification process. In particular, this process reinforces the fact that GHG reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs). This set of information will be needed to meet the evolving international reporting standards developed by the UNFCCC.

These guidelines must be followed by the project activity implementers and operators of NHPC. Strict adherence to the procedures set out in this monitoring plan is necessary for the project managers and operators to successfully measure and track project impacts for audit purposes. MGM International will provide capacity building to the Technical Departments of NHPC in order to meet the requirements presented in this MVP.

The methodology applied to this project describes the procedure and equations to calculate emissions reductions from monitored data. For the specific project, the methodology is applied through spreadsheet models. The staff responsible for Project monitoring must complete the electronic worksheets. The spreadsheets automatically provide annual totals in terms of GHG reductions achieved through the project activity.

The models contain a series of worksheets regarding different aspects of emission reductions calculation:

- Data entry sheets *(net energy generation)*
- Calculation sheets *(baseline emissions)*
- Result sheet *(emission reductions)*

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There are worksheets where the user is allowed to enter data. Even in these sheets, only those cells where the staff of each plant is required to enter data have been left unblocked. All other cells contain model fixed parameters or computed values that cannot be modified by the staff.

A color-coded key is used to facilitate data input. The key for the code is as follows:

- Input Fields: Pale yellow fields indicate cells where project operators are required to supply data input, as is needed to run the model;
- Result Fields: Green fields display key result lines as calculated by the model.

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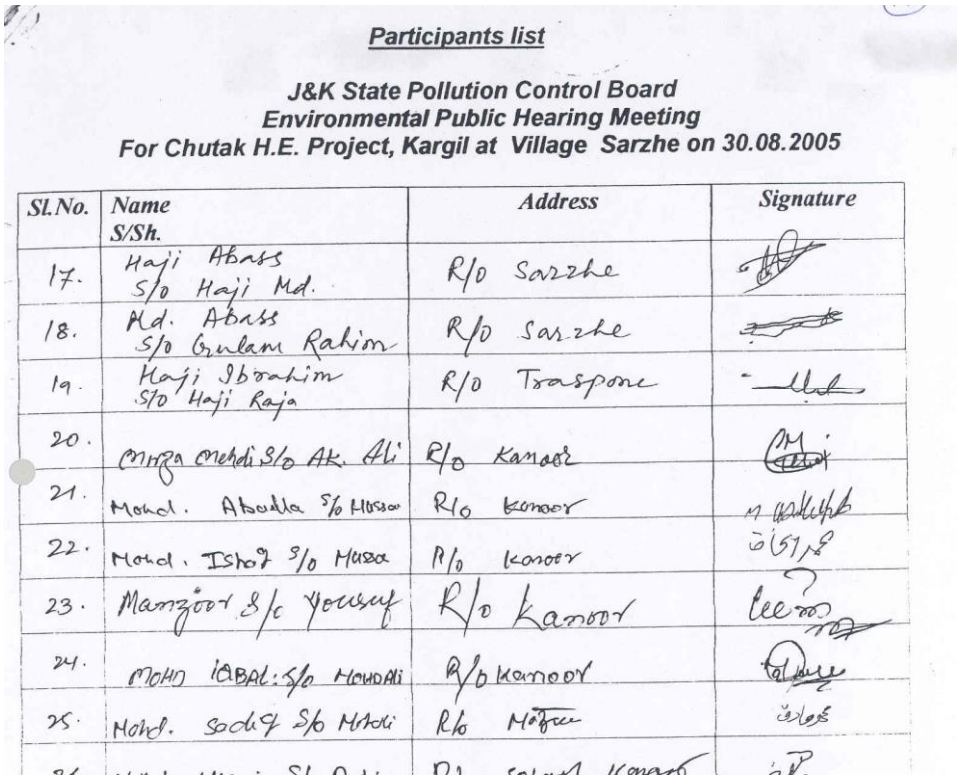
The last sheet shows the results, comparing year-by-year GHG emissions with the project with baseline values in order to determine annual emission reductions, shown in the last column.

All electronic data will be backed up on a monthly basis.

Appendix 6. Summary report of comments received from local stakeholders

List of Local Participants in Public Hearing Meeting



Participants list

J&K State Pollution Control Board
Environmental Public Hearing Meeting
For Chutak H.E. Project, Kargil at Village Sarzhe on 30.08.2005

Sl.No.	Name S/Sh.	Address	Signature
17.	Haji Abass S/o Haji Md.	R/o Sarzhe	
18.	Md. Abass S/o Gulam Rahim	R/o Sarzhe	
19.	Haji Ibrahim S/o Haji Raja	R/o Trasspone	
20.	Mirza Mehdi S/o Ak. Ali	R/o Kanoor	
21.	Mohd. Abdulla S/o Musa	R/o Kanoor	
22.	Mohd. Ishaq S/o Musa	R/o Kanoor	
23.	Manzoor S/o Yousuf	R/o Kanoor	
24.	MOHD IQBAL S/o MOHDALI	R/o Kanoor	
25.	Mohd. Sadiq S/o Mehdi	R/o Matren	

26.	Mohd. Hassain S/o Rehim	R/o Sarzhe	
27.	Mohd. Mustafa	R/o Kanerar	
28.	MUHAMMD HUSEN	R/o SARZHA	
29.	Mohd. Hussain S/o Fachi	R/o Sarzhe	
30.	Zakir Hussain S/o Mohd	R/o Sarzhe	Zakir Hussin
31.	Mohd. Ibrahim S/o Haida	R/o Chehory	
32.	Nasir Hussain S/o M.Ali	R/o Gramkha	

Participants list

J&K State Pollution Control Board
Environmental Public Hearing Meeting
For Chutak H.E. Project, Kargil at Village Sarzhe on 30.08.2005

Sl.No.	Name S/Sh.	Address	Signature
33.	Tahira S/o Mohd Bakir	R/o Sarzhe	
34.	Zahra Batool S/o Abdul Karim	R/o Turmik	
35.	Mohd Magsu S/o Ali Ghulam	R/o TV Station, Kashkum	
36.	Mohd Hussain S/o Ghulam Mohdi	R/o Chutak	
37.	Ghulam Abbas S/o Sheikh Ghulam	R/o Mayee	
38.	Ghulam Mohd S/o Ali	R/o Troespone	
39	Haje Hadir	R/o Troespone	
40	KBAR Ahmad Ali	R/o Troespone	
41	Fatima Bano	R/o Rattak	
42	Jamil Ahmad	R/o Mayee	

43	Sajad ..	R/O Gund.	Sajad ..
44	Abdul Gaffar	R/o Minjee	
45	Mohd Ibrahim	R/o Sankoo	
46	Mustafa @ L.K. Atv.	R/o Minjee	
47	Mohd Ushale	R/o Tricklom	
48	Iqbal Ali	R/o Kanoor	

Participants list

J&K State Pollution Control Board
Environmental Public Hearing Meeting
For Chutak H.E. Project, Kargil at Village Sarzhe on 30.08.2005

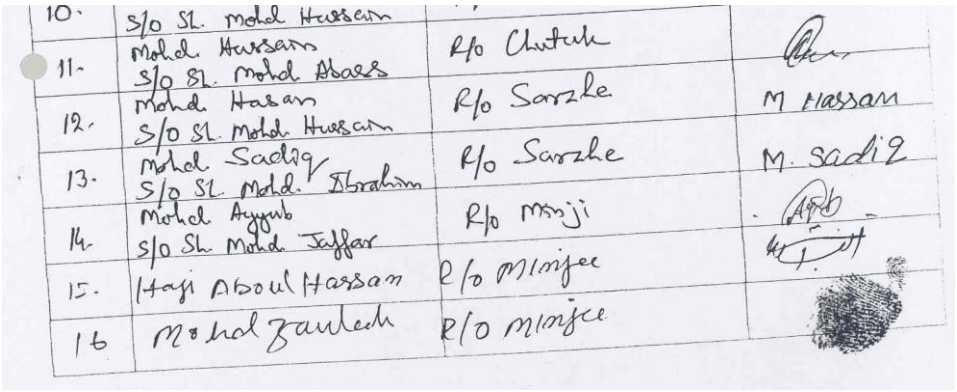
Sl.No.	Name S/Sh.	Address	Signature
33	Mohd Ibrahim Sun.	Sarzhey	
34	Ali Asgar S/o Hussa	Kanoor	
35	G. Mohd S/o Raza	School Kanoor	
36	Hg Haji Raza S/o Ibrahim	School Kanoor	
37	Mohd. Abass S/o Fadi	School	
38	Zakir Hussain S/o Mohd.	Minfec.	
39	G. Mohd S/o Ibrahim	Trespone	
40	Mohd. Ishaq S/o Mussa	Trespone	
41	G. Mohd Haji G. Ali	Trespone	
42	Moh G. Mohd S/L G. Huss	Trespone	

43	Sadi Hussain S/o Sd Hadi	Trespore	
44	Mohd. Hussain S/o Mohd. Ali	Trespore	
45	Mohd Hassain S/o Ali Raza	Schary	
46	Mohd. Hassain S/o Hussain	Schary	
47	Mohd. Hussain S/o Hassain	Kanoor	
48	Mohd. Jafar S/o Mahdi	Kanoor	

Participants list

J&K State Pollution Control Board
Environmental Public Hearing Meeting
For Chutak H.E. Project, Kargil at Village Sarzhe on 30.08.2005

Sl.No.	Name S/Sh.	Address	Signature
1	Asgar Ali S/o Sh. Mohd. Hussain	Vill – Minji	
2	Mohd. Saleh S/o Sh. Ghulam Mehdi	Vill – Stickeley	
3.	Mohd. Tohen S/o Sh. Akbare Hadi	Vill – Stickeley	
4.	Ghulam Mohd. S/o Sh. Mohd. Hussain	Vill – Trespone	
5.	Ghulam Haider S/o Sh. Haji Hussain	R/o Trespone	
6.	Mohd. Moosa S/o Sh. Mohd Ibrahim	R/o Sarzhe	
7.	Mohd Bakir S/o Sh. Mohd Hussain	R/o Sarzhe	M. beneyfe
8.	Inayat Ali S/o Sh. Mohd Hussain	— do —	anayethali
9.	Mohd Hussain S/o Sh. Mohd Ibrahim	R/o Sarzhe	M Hussain
	Mohd Hamza	R/o Sarzhe	HAMZA Ali



10.	S/o Sh. Mohd Hussain		
11.	Mohd. Hussain S/o Sh. Mohd Abass	R/o Chutuk	
12.	Mohd. Hasan S/o Sh. Mohd. Hussain	R/o Sarzhe	M Hassan
13.	Mohd. Sadiq S/o Sh. Mohd. Ibrahim	R/o Sarzhe	M. Sadiq
14.	Mohd. Ayyub S/o Sh. Mohd. Jaffar	R/o Minjee	
15.	Haji Abdul Hassan	R/o Minjee	
16	Mohd Zaheer	R/o Minjee	

Appendix 7. Summary of post-registration changes

S.No.	Post Registration Change	Type of Change	Reason
1	The latest format of the CDM-PDD-FORM (Version 11.0) is used	General requirement: New PDD template has been used	The latest format of the CDM-PDD-FORM (Version 11.0) is used
2	Additions to the Section A.1	Permanent changes: Additions to description	The relevant dates and Sustainable development component has been added.
3	Changes in the section A.2	Permanent changes: Corrections	The latest map of the location of the project activity has been updated since Ladakh is now a Union Territory.
4	Section A.3: Technologies/measures	Permanent changes: Corrections	The head race tunnel and tail race tunnel lengths have been corrected. The area and the power density have also been changed.
5	Section A.6: History of project activity and Section A.7: Debundling	Permanent changes: Corrections	The sections have been added as per the requirement of the new version of the CDM-PDD-FORM (Version 11.0)
6	Section B.2: Applicability of methodologies and standardised baselines	Permanent changes: Corrections	The table has been added as per the requirement of the new version of the CDM-PDD-FORM (Version 11.0)
7	Change in the name of project location	Permanent changes: Corrections	The name of the project location is changed to Union Territory of Ladakh.
8	Change in the name of project proponent	Permanent changes: Corrections	The name of the project proponent is changed to NHPC Ltd.
9	Change in the start date of crediting period	Permanent changes: Corrections	The start date of crediting period is changed to 31/01/2012

Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).

Version	*Date*	*Description*
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document