CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Title : 5 MW Sahu Hydro Electric Project for a grid connected system in Himachal Pradesh, India
Version : 03
Date : 06/02/2009

Revision History:
Version 04, 03/05/2011: Revised version / amendments in response to the First periodic verification findings

A.2. Description of the small-scale project activity:

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The main purpose of the project is to generate clean form of electricity using the potential energy available in the water flows of sahu river and supply the same to Himachal Pradesh State Electricity Board (HPSEB) grid.

The project activity is a run of the river scheme constructed across Sahu Nallah, a tributary of river Ravi in Chamba district of Himachal Pradesh in India. The project activity is proposed with an installed capacity of 5MW with an annual gross energy generation of 22.56 GWh. A total of 20.75 GWh will be exported to the Himachal Pradesh State Electricity Board (HPSEB) grid. The electricity would be generated at 6.6 kV and the same will be evacuated to 33 kV Bhuri Singh substation located at a distance of 9 km from the project site.

The project activity utilises potential energy available in water flows for power generation. The process of electricity generation involves in converting the potential energy available in the flowing water into mechanical energy using hydro turbines, which drives the alternators to generate electricity.

The project operation substitutes fossil fuel generated power in the regional grid, thereby reducing emissions of GHGs. Hence it will contribute to sustainable development. The generated power will be fed to the nearest 33kV HPSEB substation which will be helpful in meeting the increasing energy demand on the regional grid.

Contribution of the project activity to Sustainable Development

Ministry of Environment and Forests(MoEF), Government of India, has stipulated social well being, economic well being, environmental well being, technological well being as the indicators for sustainable development in the interim approval guidelines for CDM projects. The project activity contributes to the above indicators in the following manner.

Social and Economic Well-Being:

- The project activity would increase the availability of power in the local area. Further, it would contribute to the creation of employment opportunities to the local people during the construction of the project besides providing regular employment opportunities during project operation.
- Power generated from this project can be used for setting up of small scale industries, thus would generate self employment opportunities.
- The project activity would help in alleviation of poverty in the area as it creates additional employment opportunities to the local populace.
- Since, the project feeds the generated power to the nearest HPSEB substation, energy availability and quality of the power improves significantly under the service area of the substation.
- The project activity improves the quality of life in the project area, since it would contribute to the local area development by way of construction of additional roads and other infrastructure developments.

Environmental Well-Being:

- The proposed project activity utilises hydro potential available for power generation. The state of Himachal Pradesh is part of Northern regional grid system. Power generation in the Northern Grid is dominated by fossil fuels and the project activity will not result in increase of GHG emissions and cause no negative impact on the environment both at local as well as at the global level.
- The project activity does not result in degradation of any natural resources, health standards, etc. at the project area. The project will not cause any air, water, or noise pollution.

Technological Well-Being:

- The project uses the best available technology in the small hydro power sector in India during the project.
- The project would utilize environmentally safe and sound technologies in small scale hydroelectric power sector. Further the project demonstrates harnessing hydro potential in small rivulets and encourages setting up such new projects in future.

In view of the above, the proposed project activity strongly contributes to the sustainable development.

A.3. Project participants:

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Name of the party involved ((Host) indicates a host party)	Private and/or public entity (ies) project participants	Whether party involved wishes to be considered as project participant
India (Host)	**Private Entity:** M/s Him Kailash Hydro Power Pvt ltd	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party (ies):

>>
India

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

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State: Himachal Pradesh

A.4.1.3. City/Town/Community etc:

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District : Chamba
Tehsil : Chamba
Village : Paleur

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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The project is located near village Paleur, which is located at a distance of 18km from Chamba. The project site is located 390km from State Head Quarters Shimla. The project site can be accessed through Shimla-Chamba road or Pathankot-Chamba road. The nearest railway station is at Pathankot / Chakki Bank, at a distance of 134 kms. The nearest airport is at Gaggal at a distance of 185 kms.

The project area lies between latitude 32° 31' 56" to 32° 39' 44" North and longitude 76° 12' 30" to 76° 22' 58" East.

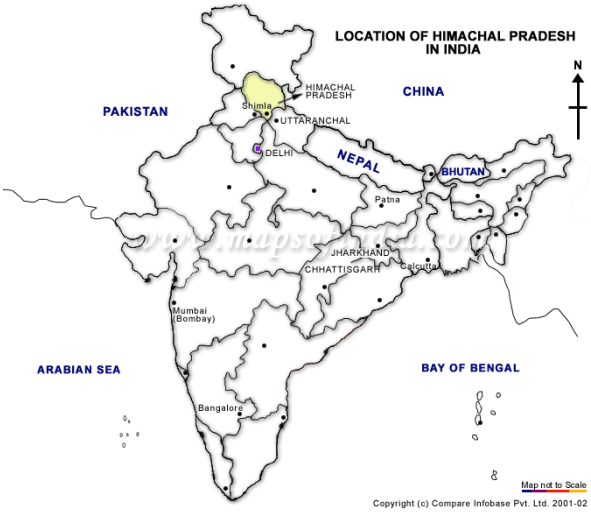

Fig A.1 : Location of Himachal Pradesh in India

Fig A.2 : Road network of Himachal Pradesh

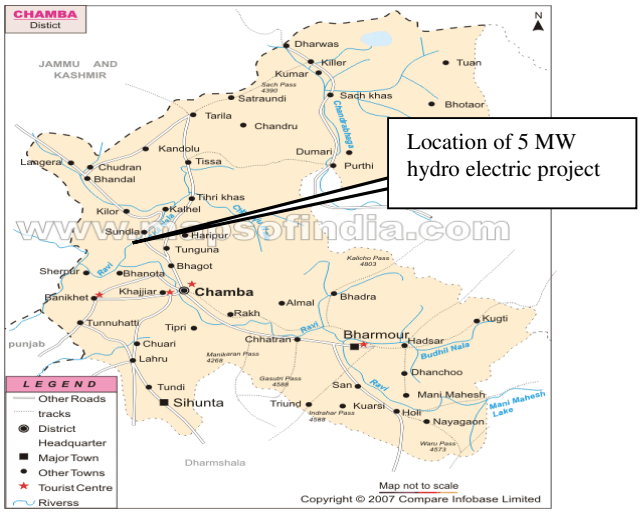

Fig A .3: Location of the project in Chamba district

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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According to the Appendix B to the simplified modalities and procedures for small-scale CDM project activities, the proposed project activity falls under the following type and category.

Project Type: I - Renewable energy projects
Category: I.D - Grid connected renewable electricity generation
Reference: AMS.I.D, version 13, EB 36

The project activity utilizes renewable hydro energy for electricity generation and exports the generated electricity to the regional grid system. Accordingly, the applicable methodology for the project activity shall be AMS I.D, which includes small hydro electric power generation for a grid system.

Application of environmentally sound and safe technology

The project activity does not involve in any greenhouse gas emissions or burning of any fossil fuels during the process of power generation. The technology employed for the project activity is the current best practice in small hydro power sector in India Thus electricity generation using the best available technology through sustainable means without causing any negative impacts on the environment. Hence, the technology applied for the project activity is environmentally safe and sound.

Technical details of the project activity

No technology transfer is envisaged for the proposed CDM project activity. The project activity uses technology that is locally available in the country.

The proposed project shall use the potential energy in a flowing river by diversion weir for running Horizontal Francis Turbines to generate electricity. The components involved in the hydro electric scheme consists of construction of a trench type diversion weir, intake chamber, desilting chamber, power channel in the form of an underground free-flow pressurized tunnel, forebay, penstock with saddles, anchor blocks and the power station with the tail race for discharging the water back into the river. Electricity will be generated at a lower voltage, which will be stepped up to higher voltage level within the project boundary to facilitate export of power to Himachal Pradesh State Electricity Board.

The expected annual gross electricity generation of the project is 22.56 GWh and exports 20.75 GWh, after the auxiliary consumption of 1.81 GWh.

Table A.1: ***Brief Technical details of the project design***

Parameter	Specifications
Hydrology	
Gross Head	174.0 m
Design Head	153.8 m
Turbine	
Type of hydro turbine	Horizontal Francis Turbine
No. of generating units	2
Capacity of each generating unit	2.5 MW
Generator	
Type	Synchronous Brushless, self cool
Rated speed	1000 rpm
Generation voltage	6.6 kV
Power Factor	0.8 (lag)
Frequency	50 Hz
Power Evacuation	
Transmission Voltage	33 kV
HPSEB Substation	33 kV Bhuri Singh HEP

Substation distance from site	9 kms
Electricity generation capacity	
Gross Energy	22.56 GWh
Auxiliary Consumption, outage, transmission losses etc., @ 8%	1.81 GWh
Net Energy Export to HPSEB grid	20.75 GWh

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The expected emission reductions are calculated based on the net electricity export and combined margin emission factor of the Northern grid – 793 tCO_2/GWh. Annual estimates of emission reductions and total emission reductions for the chosen fixed crediting period of 10 years are furnished below.

Table A.2: Annual estimation of Certified Emission Reductions (CERs)

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2009	16,457
2010	16,457
2011	16,457
2012	16,457
2013	16,457
2014	16,457
2015	16,457
2016	16,457
2017	16,457
2018	16,457
Total estimated reductions (tCO_2 e)	164,570
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	16,457

In the above table the year 2009 corresponds to 01.06.2009 to 31.05.2010. Similar interpretation shall apply for remaining years.

A.4.4. Public funding of the small-scale project activity:

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The project activity does not involve any public funding from Annex 1 countries.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

As per debundling guidelines specified in Appendix C to the Simplified Modalities and Procedures for Small Scale CDM project activities, a proposed small scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small scale project activity or an application to register another small scale project activity under the CDM

- with the same project participants;
- in the same project category and technology / measure;
- registered within the previous 2 years; and
- whose boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point

The project activity is not debundled component of a larger project activity, since there is no registered or no request for registration of CDM project activity in the same project category and technology/measure by the same project participants within 1km of the present activity in last two years.

SECTION B. Application of a baseline and monitoring methodology

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

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Title: **Type I** - Renewable Energy Project
Reference: **AMS I.D** - Grid connected renewable electricity generation
Version: **13, EB 36**

B.2 Justification of the choice of the project category:

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The project involves installation of a grid-connected hydropower plant with a capacity of 5 MW, which is well below the qualifying limit for small scale project under CDM i.e.15 MW, as described in the CDM modalities and procedures for small scale CDM projects and the project activity exports the generated electricity to the Himacal Pradesh state grid system. Hence, the project qualifies to apply methodology AMS-I.D – Grid connected renewable electricity generation.

Demonstration for being with in the limits of SSC through out the crediting period

The water and power studies carried out for this project demonstrate that the project activity will remain under the limits of SSC throughout the crediting period. The hydrology studies carried out have established the envisaged capacity of the project. The design discharge has been found out to 4.5 cumecs and gross head available has been estimated as 174 m. Based on the head available and discharge, the optimum capacity of the power project has been determined as 5 MW.

Keeping the above considerations in view, and also the maximum electricity generating capacity limited by the design of the plant and machinery and the license issued by the state authorities, there is no possibility of exceeding the limits of small-scale CDM project activities during the crediting period and the project activity will remain as a small scale project activity throughout the crediting period.

B.3. Description of the project boundary:

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In accordance with AMS I.D, the project boundary encompasses the physical, geographical site of the renewable generation source.

The project boundary is therefore the physical boundary, which includes diversion weir, intake chamber, de-silting chamber, power channel, forebay, headrace tunnel, penstock, powerhouse, tailrace and the transmission system till the evacuation point. The power generated from the project would be metered and accurately quantified. The electricity would be exported to the Himachal Pradesh State Electricity Board (HPSEB) grid.. Hence for the purpose of baseline calculations, Northern regional grid of India is also included in the project boundary.

B.4. Details of baseline and its development:

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As per the Para 9 of approved methodology AMS. I.D, Version 13, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as :

a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "**Tool to calculate the emission factor for an electricity system**".

OR

b) The Weighted average emissions (in kg CO_2e/kWh) of the current generation mix.

The project proponent has opted for approach 'a' i.e. combined margin emission factor and desired to keep the emission factor constant throughout the crediting period for the sake of adopting more simple approach for calculation of emission reductions.

The key parameters used to determine the baseline emissions are furnished below:

Key Parameter	Value	Data Source	Website
EF	Baseline emission factor for the Northern region grid	CEA published baseline emission factor for Northern region grid (CM)	www.cea.nic.in
EGy	Net power export to the grid per annum	From Plant and HPSEB Records. Ex-post determination.	------

The Emission factor for Northern region is taken from CEA published Grid Emission Factors for Indian grid systems, which are made publicly available on CEA website. The Emission factors have been calculated according to the guidelines of CDM UNFCCC website. The emission factor published by CEA for the latest year 2005-06 is 793 tCO2/GWh, based on combined margin approach.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The project is a small scale project activity. As such, the provisions of Attachment A to Appendix B of the *simplified modalities and procedures for small-scale CDM project activities* will apply to this project. The '*indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*' require the project proponents to show that the project activity would not have occurred anyway due to *at least one* of the following barriers:

(a) Investment barrier
(b) Technological barrier
(c) Barrier due to prevailing practices / common practice
(d) Other barriers

The barriers specified in Attachment A to Appendix B are:

a) **Investment barrier**: A financially more viable alternative to the project activity would have led to higher emissions.

b) **Technological barrier**: A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.

c) **Barrier due to prevailing practice:** Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

d) **Other barriers**: Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organisational capacity, financial resources, or capapcity to absorb new technologies, emissions would have been higher.

The project proponent has considered to prove the additionality using investment barrier, other barriers and barrier due to prevailing practice. The same is shown in the following sections:

a) Investment Barrier:

Low return on investment:

The project costs and PLF directly influence the project Internal Rate of Return. An IRR analysis has been prepared for the project activity to determine the project IRR, its attractiveness and the effect of GHG income using the information of the existing hydro projects in the state of Himachal Pradesh.
The energy generation is uncertain as the hydrology data on which the energy estimation made is only collected for two seasons as no gauge data was available. The estimation of energy generation is made depending upon simulation studies and it is a well known fact that such studies may always lead to either under or over estimation of the output. Hence, more reliable basis would be the energy generated by the up stream project (Sal II) which have indicated a PLF which is less than the average PLF of 35 % in the region. However, maximum average PLF enjoyed by the small hydro projects is found to be 50%. Though

estimation of investment analysis is based on 35% PLF is appropriate, however, for conservative calculation of IRR, a 51.50% PLF is assumed.

The PP has considered weighted average cost of capital as benchmark for the purpose of comparison with IRR. The benchmark is computed considering cost of debt and required rate of return on equity based on Capital Asset Pricing Model. The Benchmark is estimated at 14.20% and detailed calculations made to estimate the benchmark are furnished in the financial analysis statement.

The IRR works out to 12.21% in the baseline case and is less than the benchmark of 14.20%. IRR improves to 15.36% after considering CDM revenues. The soft copy of financial analysis together with assumptions considered while estimating profitability and cash flows are provided as annexure to the PDD.

Appropriateness of choosing benchmark:

As per the guidance note issued by CDM EB at its 41st meeting *"In case where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average cost of capital (WACC) are appropriate benchmarks for a project IRR" (annex 45, page No.3, item 11 Selection and Validation of Appropriate Benchmarks - EB 41). Based on this the PP* has taken into account the Weighted Average Cost of capital as the Benchmark Return. Project IRR is used to demonstrate the Additionality of the project. Since the project is financed by *both* equity and loan, the appropriate benchmark is WACC, since WACC represents the weighted average of the costs of various sources of financing in the financing structure. In other words, WACC represents the minimum rate of return, which the project should earn to merit consideration, as failure to earn the minimum rate of return is indicative of unattractiveness of the investment.

As regards Equity IRR, Additionality Tool Ver. 05 states that benchmark/discount rate should be derived from *inter alia* "Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects". Accordingly PP has chosen the required return on capital based on private equity investor required return on comparable projects. The PP has used the CAPM model to determine the expected return on equity by private investors. Based on the model, the expected return on equity has been arrived at 24.36%.

Justification for choosing the Beta value to arrive expected return on equity:

The un-levered Beta Value of the power companies for one year period ended March 2004 i.e., at the time when the investment decision to go ahead with the project activity are furnished below:

- Neyveli Lignite Corporation : 1.012
- BF Utilities : 1.348
- Tata Power : 0.983
- Reliance infrastructure : 0.811

The least un-levered beta value of Reliance infrastructure i.e., 0.811 is considered as conservative and the same is used to arrive at expected return on equity for this project activity.

Sensitivity analysis

The robustness of the conclusion drawn above has been tested with reasonable variations in the critical assumptions. Annex 45 "Guidance on the Assessment of Investment Analysis" issued by the EB in its 41st Meeting covers two aspects on sensitivity analysis, viz., subjecting only those variables which constitute more than 20% of either total project cost or total project revenue to sensitivity analysis and considering a ± 10% variations in the selected variables. Accordingly, two sets of scenarios have been identified, viz., variation in project cost and revenue by 10% on either side. The sensitivity analysis for the project activity, performed after considering the two scenarios is furnished below:

Details	**+10%**	**Base Case**	**-10%**
Project cost	10.63%	12.21%	14.06%
Generation (PLF)	13.89%	12.21%	10.46%

The sensitivity analysis proves beyond doubt that the project is unlikely to be financially attractive even under the most unrealistic optimistic conditions of project cost going down by 10% or PLF going up by 10%. In either case, the project IRR remains at 14.06% and 13.89% respectively in contrast to the benchmark return of 14.20%. This proves with no uncertainty that the project activity is not a business-as-usual scenario. CDM benefits go to improve the financial attractiveness of the project activity, as evident from the fact that with CDM benefits, the project IRR in the baseline scenario improves to 15.36%. Hence, the project requires CDM benefits to make it financially attractive.

Further IRR reaches benchmark under the following scenarios:

1. Project Cost decreases by 10.70%,
2. Generation (PLF) increasing by 12.0%

The two scenarios are not possible for the following reasons:

The project has already commenced its operations and has not made any savings in the implementation. Therefore there is no scope for reduction in the project cost.

The project activity has just commenced its operations and has not made any savings in the implementation. The actual cost incurred is Rs.323 million as against the project cost of Rs 279.42. million considered for financial analysis. A certificate from Chartered Accountant which is furnished to the DOE for verification evidences the fact that project cost has gone up. Therefore the possibility of reduction in project cost will not occur.

Unlike conventional thermal power projects, PLF achieved by hydroelectric power projects is lower. It varies from place to place and season to season. While thermal power projects can yield a PLF of 80 to 85%, hydroelectric power projects yield a PLF of anywhere between 30 to 60%. The PLF assumed for Small Hydro Power Projects by some of the State Electricity Regulatory Commissions for determination of tariff is given below[1]:

[1] Collated from Tariff Orders of various State Electricity Regulatory Commissions

State	PLF
HPERC	45%
UPERC	35%
UERC	45%
APERC	35%
Kerala ERC	30%
KERC	30%
MERC	30%

Achieving the stated PLF is also subject to vagaries of monsoon. Apart from this, as already explained under the investment barrier, the average PLF achieved by hydro projects in the State is only 35%(Source: HPSEB analysis, in the report Himachal Pradesh Hydro electric potential).

There are 22 hydro power plants in operation with varying capacities ranging from 0.05 MW to as high as 120 MW. Out of the 22 plants 3 projects are large hydro projects. Based on the statistics published by HP State Government, the average PLF of all these plants is less than 35%. However there are three plants with an average PLF of 50% and their details are:

- 120 MW Bhaba : 52.75%
- 60 MW Bassi : 53.05%
- 6 MW Binwa : 51.50%

Thus out of the above three projects two are large hydro. Further out of 19 small hydro power plants with data on PLF, only one small hydro project, namely 6 MW Binwa is yielding a PLF of 51.5%. It is also necessary to produce an extract from HPERC tariff order:

"The Commission is of the view that for many of the SHPs, an accurate determination of the design energy and in turn saleable primary energy is difficult due to problems of reliability of available water discharge data. The DPRs of such projects do give estimated projections of the energy likely to be generated and the annual fixed cost (AFC) could indeed be distributed over the projected generation. However, there is an additional risk that if in a particular year water availability reduces, which is not unusual, the developer will not be able to fully recover the AFC as the comfort provided by capacity charge in the two part tariff structure applicable to Large Hydro Projects is not present in single part tariff structure contemplated for SHPs".

Based on the above facts since there is one plant with a PLF of 51.5% the PP has considered it appropriate to take the same PLF (51.5%) for the purpose of IRR analysis as a conservative approach.

The EB in its 35th Meeting had issued '*Non-binding best practice examples to demonstrate additionality for SSC project activities*', wherein EB had given best practice *examples* of each of the aforementioned category of barriers. The project activity under consideration suffers from the barriers (b) (c) and (d) above, which are discussed in the following paragraphs:

b) Other Barriers

The project activity is located in the interiors of Himachal Pradesh. As mentioned earlier, the project site is located 390 km from Shimla, the capital of Himachal Pradesh. The project site can be accessed only through Shimla-Chamba road or Pathankot-Chamba road as the nearest railway station - Pathankot / Chakki Bank, - is at a distance of 134 kms. The nearest airport is at Gaggal at a distance of 185 kms. The location of the project itself is a major barrier for the project. This is because not only that the location lacks infrastructure but Himachal Pradesh is prone to geological risk. Equally, if not more, important is the uncertain hydrology, which actually determines the power generation capacity of the project activity and its financial attractiveness. The project activity faces all the three barriers, viz., geological risk, lack of infrastructure and uncertain hydrology. These are discussed in the following paragraphs.

i) Geological Risk

Himachal Pradesh is exposed to various geological risks. Frequent natural disasters of various intensity and their impact on society and land are one of such problems which has been hampering the development of the state. Earthquakes, landslides, cloudbursts, flashfloods, avalanches….. etc, have caused tremendous loss to the state. On the basis of the damage caused by the disasters and their wide spread nature, Himachal Pradesh can be called as one of the most unstable and disaster prone states of India[2]. Of the geological risk affecting the project activity, the most important are

a) Landslides
b) Earthquakes and
c) Flash Floods

a) Land Slides: Landslide is the most common disaster in Himachal Pradesh which causes immense loss of life and property. The fragile nature of the rocks forming the mountains along with climatic conditions and various anthropogenic activities had made the State vulnerable to the vagaries of nature. In the rainy season, due to heavy rain falls, which are common in the area[3], invariably causes land slides, which could damage the access to roads, transmission lines and project infrastructure such as RCC laggings, steel ribs etc. The resulting damages would result in not only loss of revenues as a result of reduced plant operation period, but also cause delays in the construction, repair of physical damages. The remote access is likely to add to the cost as the material has to travel by road for a long distance.

b) Earthquakes: The project area lies in a complicated geology with number of thrusts and faults. It is seen from the seismic zoning map of India that the project area lies within seismic zone V[4] which denotes high seismic intensity region in India. The project area lies in the zone where earthquakes of high intensity are expected. Large earthquakes have occurred in all parts of Himachal Pradesh, the biggest being the Kangra Earthquake of 1905. The 17 June 1962 - Chamba-Udhampur earthquake was one more. There were major earthquakes in the project area in the past[56].Hence, Suitable seismic coefficient commensurate may have

[2] Further evidence on the geological risks can be found from a Report prepared by Planning Commission, Government of India in "Himachal Pradesh Development Report" (http://www.planningcommission.gov.in/plans/stateplan/sdr_hp/sdr_hpch3.pdf).

[3] http://www.tribuneindia.com/2007/20070301/himachal.htm#1

[4] http://asc-india.org/maps/hazard/haz-himachal-pradesh.htm

[5] http://asc-india.org/seismi/seis-himachal-pradesh.htm

to be adopted in the designing of the proposed project infrastructure to sustain in the seismic activity. The following maps show that the project lies in a highly hazardous seismic zone.

Figure **B.1**
Seismic Map of India

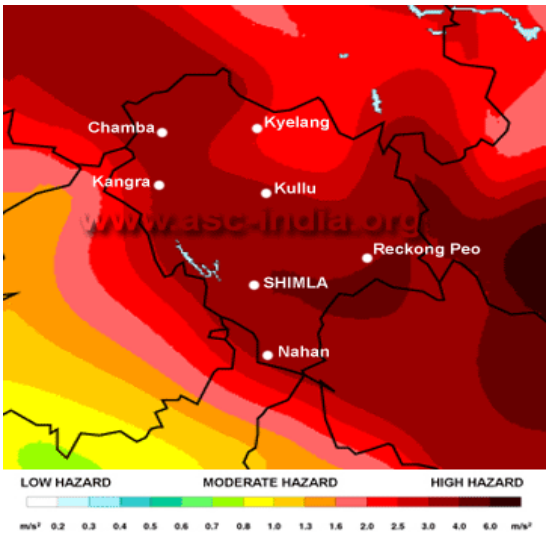
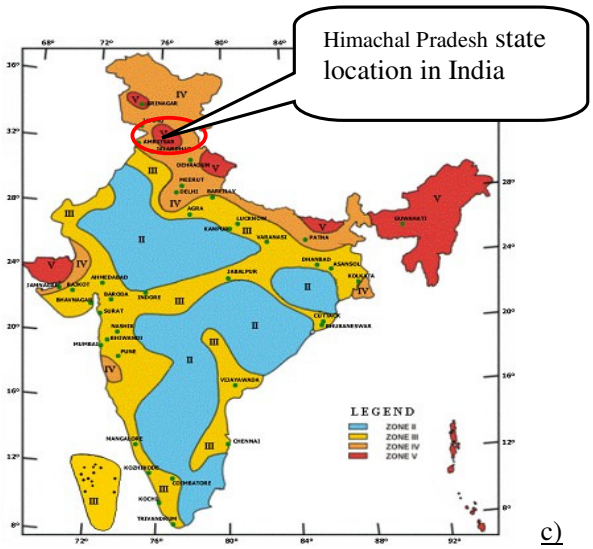


Figure **B.2.**
Seismic hazard map of Himachal Pradesh



c)

c) Flash Floods: Flashfloods - short lived extreme events - which usually occur under slowly moving or stationary thunder storms lasting less than 24 hours are a common disaster in the state. The high velocity of current can wash away all obstacles in its way. This phenomenon has resulted in enormous loss of life and property in various parts of the region of Himachal Pradesh in the past. The flood is due to various reasons: cloudburst in the catchments area intense and prolonged rainfall, downstream blocking of river channels by landslides, avalanches or sudden breach or burst of artificial/ natural lakes are some of them. In the State, since the rivers are snow-fed, flooding of rivers mostly occurs in summer due to snowmelt coupled with heavy rain. Flash floods due to cloud burst are a common phenomenon in the project area. Past history of the project area shows the project area had experienced flash floods quite frequently. There were 8 flash floods in the area during past 32 years. This cannot be predicted and to that extent, the project runs a great risk.

Another form of flash flooding in this State is principally associated with small regions. The duration of this phenomenon is short, but can cause extensive damage. The State experienced large incidences of floods in the past. . Though the State has faced severe flood disasters between 1975 and 1988, the last decade (1997-2005) has been one of the worst as both the magnitude and frequency of floods had gone up. There were several incidences of floods/flashfloods during 1997-2005 and of which about five were really gigantic. The flash flood of 1st August 2000, in the Satluj left a trail of destruction in Shimla and Kinnaur district killing more than 150 people and washing away bridges. These floods had claimed a heavy toll in

[6] http://www.iisc.ernet.in/currsci/oct102004/863.pdf

terms of killing several hundreds of people, large number of cattle, causing heavy loss to the State exchequer running into several thousand millions of rupees.[7]

The extent of damage that the flash flood can cause had been experienced by the project activity. The project activity experienced flash floods and incurred heavy damage for three times in a period of two years and suffered heavy losses both in terms of time and finances. The first such event occurred in June 2006, the second in November 2006 and the third as recently as 29th June 2007. The details of the floods, the extent of damage suffered and the pictures depicting the damage are presented in the form of a report as annexure to the PDD.

Project proponent initially proposed to construct an open channel for the water conductor system for the project, which is normal. However due to the nature of terrain, it had to change the plan and construct a tunnel of a length of 1.12 Km for the water conductor system. This obviously led to the delay in the implementation. This could not be anticipated at the planning stage.

Consequent upon delays and modifications required to be made in the project to suit the terrain, the project cost went up. Though based on 2002 price level, the project investment was estimated at Rs.285.1 million including a 3% escalation, due to limited information, IREDA reduced the project cost and firmed it up at Rs.281.7 millions only[8]. As the project implementation progressed, IREDA realized the inadequacy of funds to complete the project and reappraised the cost at Rs 295.6 millions and sanctioned additional loan. Consequent upon delays and modifications in the project (which could never be anticipated at the planning stage), the project cost had gone up further and the final cost is estimated at Rs.320 million - almost a 15% increase over the original cost[9].

ii) Lack of Infrastructure

Apart from the fact that Himachal Pradesh in general and the project activity in particular lack infrastructure, the geological risks add a new dimension to the infrastructure inadequacies. Any natural calamities are capable of throwing even the existing infrastructure into haywire requiring reconstruction. As this is totally dependent on the geological risk, it cannot be anticipated in as much as the geological risks cannot be anticipated. The experience of the project has proved how real the problem can be as the PP had to spend almost a sum of Rs.3.4 millions[10] towards social cost - more than what was envisaged towards construction of village paths, approach roads, construction of foot bridges and various social costs.

ii) Uncertain of Hydrology

[7] Floods and Flash Floods in Himachal Pradesh : A Geographical Analysis Dr. D. D.Sharma ,Himachal Pradesh University, Shimla ,http://nidm.gov.in/idmc/Proceedings/Flood/B2-%206.pdf

[8] Copy of the sanction letter of IREDA dt. 7th June 2004 is enclosed

[9] Cash flow of the company on the amount spent on the project, certified by the company auditor is enclosed for verification

[10] Details furnished for verification

The estimated power generation by the project activity has been based on daily discharge data on Sahu stream measured for a short duration, i.e., for two lean seasons in the year 2001 and 2002 only[11] in the absence of historical published data on the daily discharge. Based on the data, the DPR had estimated a PLF of over 80%. As the estimation of generation has been made based on simulated data, the project activity has been subjected to certain degree of uncertainty in generation. There was no other option for the PP except to base the estimation on collected/simulated data. Due to inadvertent climatic conditions the PLF may vary upwards or downwards in any year.

However, the achievement of the projected PLF is unlikely. This inference is based on the fact the examination of power generation achieved by Sal Mini Hydro scheme operated by HPSEB and Bhurisingh Small Hydro Project of 1 MW – both located on the upstream of the project activity. Both these projects had achieved an average PLF of around 30% only over a period of 7 years[12].

Moreover, an analysis of the operation of small hydro projects in Himachal Pradesh reveal that they had achieved an average PLF of 35% only[13]. Hence, the project activity is likely to face a major barrier in achieving a PLF of 80%. Inability to achieve the expected PLF would adversely affect the project's fortunes.

None of the other barriers described above have a clear and definable impact on the profitability. They cannot be quantified and hence their impact on the profitability of the project activity cannot be ascertained with any degree of certainty at this juncture. It is well nigh impossible to predict when the project would suffer earth quake, face flash flood or suffer damages due to land slide. It is also equally difficult to estimate what would be the loss likely to be suffered by the project activity. Similarly, it is highly difficult to estimate at this juncture what PLF the project would achieve. These barriers prevent entrepreneurs from venturing into this type of project activity. These barriers could be overcome by CDM benefits, as it would help the PP to meet the loss likely to be incurred in case these risks become reality.

Conclusion

From the foregoing, it could be seen the barriers faced by the project activity. It is neither possible nor feasible to ascertain the timing and extent of geological risks likely to occur or the financial implications and halt in generation. The difficulty in quantification of such risks renders them a serious barrier for the project. Small hydro power projects have been a learning-by-doing exercise for both the project developers and financiers. With limited information, both project developers and financiers have to take a decision on setting up and financing the project, which is a major constraint in this project. Thus, the project is not a business -as –usual scenario. The project is, therefore additional and requires CDM benefits to overcome the barriers.

Early consideration of CDM

EB issued a Guidance on the demonstration and assessment of prior consideration of CDM (Annex 46 of EB 41), wherein it has been stated that the prior consideration of CDM can be demonstrated by PP through indication awareness of the CDM prior to the project activity start date and that the benefits of the

[11] Detailed Project Report, P. 1 of 7

[12] Statistics on power generation from Sal Mini Hydro project had been provided to DOE

[13] Analysis of operation of Hydro projects in HP based on statistics from HPSEB is being furnished to DOE

CDM were a decisive factor in the decision to proceed with the project. The Guidance states that the evidence to support this would include, *inter alia*, minutes and/or notes related to the consideration of the decision by the Board of Directors of the PP to undertake the project as a CDM project activity.

A copy of the resolution passed by the Board of Directors in their meeting held on 17th March, 2004, much before the start date of the project activity is enclosed, in which the Board anticipated the problems likely to be faced by 5 MW Sahu hydro project namely, hydrology risk, long gestation period and geological risks. The Board further discussed about the additional revenues from the sale of emission reductions which would support to address the concerns likely to be faced by the project activity. This decision of the board is further strengthened by another resolution of the Board of Directors at their meeting held on 30 th September 2004, which provided conclusive evidence on the necessity of CDM revenue. A copy of the resolution is furnished to the DOE. The Guidance also requires the project participant to indicate, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. To support this contention, the Guidance requires PP to submit as evidence contracts with consultants for CDM services, appointment of DOE, among others.

The project activity took more than 7 years for completion due to the envisaged problems in Himachal Pradesh. Though an MoU was signed with the State in May 2001, the final approval from Forest department came only in 2005. Actual implementation with respect to placement of orders etc was completed by July 2006. The PP is basically a rice miller and was not experienced with respect to the intricacies of hydro project implementation and faced severe financial crunch as the money sanctioned by IREDA was not sufficient for implementation. Even though the PP was in touch with the consultant at an early stage (April 2006), to take their services for CDM, no contract could be finalized for various reasons such a higher fee quotation, subsequent negotiations etc besides the fact that the situation was such that he was not having sufficient funds to hire a CDM consultant and pay money to the DOE as the priority was for the project under implementation. As soon as the negotiation is completed with the consultant and firm agreement is reached with respect to the fee which was much reasonable compared to original offer and simultaneously when IREDA sanctioned additional loan in May 2007, the PP immediately appointed a consultant for CDM. As soon as the PDD was ready the DOE was hired for validation in August 2007. Thus the PP has no intention to delay the validation process and was genuinely affected by various factors and has also demonstrated that CDM revenue is significant for the financial viability of the project activity as well as mitigation of other barriers. The correspondence with the consultants is furnished to the DOE for verification.

The project activity is commissioned on 22nd April 2008. The chronology of events for the project activity is provided below:

Chronology of events:

1. MoU with Govt of HP for DPR preparation : 17/5/2001
2. Preparation of DPR : January 2003
3. Agreement with HP state Government for project implementation :03/9/2003
4. Board Resolution on consideration of CDM revenues : 17/3/2004
5. Power Purchase Agreement : 28/4/2004
6. NOC from Sahu village Panchayat : 20/09/2004
7. Board resolution about discussion on hydrology and its impact on Project viability : 30/09/2004
8. HPPCB consent for establishment : 15/12/2004

9. HP.Forest department letter for diversion of forest land : 24/01/2005
10. Civil construction Agreement : 08/07/2005
11. E & M equipment purchase order : 02/11/2005
12. Enquiry for appointment of consultant : 17/04/2006
13. Agreement for transmission line work : 10/07/2006
14. Sanction letter of additional term loan from IREDA : 10/05/2007
15. Appointment of CDM consultant : 01/08/2007
16. Appointment of DOE : 08/10/2007
17. Approached DNA for Host country approval : 26/11/2007
18. Commercial date of operation : 22/04/2008

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The project activity uses renewable energy source to generate electricity and exports the generated electricity to the grid system, which constitutes of both fossil fuel and non fossil fuel sources of electricity generation. Emission reductions due to the project activity are considered to be equivalent to the baseline emissions, since the present project activity would not lead to any project emission and leakage emissions. Emission reductions are related to the electricity exported by the project and the emission coefficient of the grid system.

Each step that is followed to determine the baseline emissions is explained as per the "**Tool to calculate the emission factor for an electricity system**".

Baseline

Step 1: **Identify the relevant electric power system**

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

Similarly, a **connected electricity system** e.g., national or international is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

When application of the criteria mentioned in the methodological tool doesn't result in a clear grid boundary, a regional grid definition should be used in case of large countries with layered dispatch systems (e.g provincial/regional/national). In other countries, the national (or other largest) grid definition should be used by default.

Since the host country has got a predefined regional grid definition, it is being used as per the methodological tool.

To overcome the uneven distribution of generation/energy resources, the concept of regional planning in power sector in India was introduced during the **third five year plan (1961-1966)[14].** Accordingly, for the purpose of power planning, the country was demarcated into five regions as Northern grid, Southern Grid, Eastern grid, Western grid and North eastern grid.

In the present case, **project electricity system** is the **project activity** and the **connected electricity system** is the **Northern regional grid** since the project activity comes under Northern regional grid.

Step 2: **Select an operating margin(OM) method**

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:
a) Simple OM or
b) Simple adjusted OM or
c) Dispatch data analysis OM or
d) Average OM

As per the above said methodological tool, any of the four methods can be used, however simple OM method can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in :
1) Average of the five most recent years
2) Based on long-term averages for hydroelectricity production

In India, due to lack of necessary data, option (b) and (c) cannot be applied. Since low-cost/must –run resources constitute less than 50% of the total grid generation and since fuel consumption data is available for each power plant/unit, option (a) is opted for calculation of Operating Margin.

Step 3: Calculate the operating margin emission factor according to the selected method

According to the "**Tool to calculate the emission factor for an electricity system**", the operating margin emission factor ($EFgrid_{,OM,Y}$) can be calculated based on any one of the following:
a) Simple OM or
b) Simple adjusted OM or
c) Dispatch data analysis OM or
d) Average OM

However, in India availability of accurate data on grid system despatch order for each power plant in the system and the amount of power despatched from all plants in the system during each hour is practically not possible. Also, still the merit order despatch system has not become applicable and is not likely to happen during the crediting period. In view of this, it is proposed to apply other alternatives as suggested in the "Tool to calculate the emission factor for an electricity system". Since the power supplied by low-cost-must-run power plants[15] to the Northern grid during 2005-06 is clearly below 50%, it was decided to apply the **Simple OM method.**

[14] http://planningcommission.nic.in/plans/planrel/fiveyr/3rd/3planch24.html

[15] Defined as Hydro, geothermal, wind, low cost biomass, nuclear and solar generation in" Tool to calculate the emissions factor for an electricity system". (ref foot note 3 page 4).

In the Simple OM method, the emission factor is calculated as generation weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. The data vintage option selected is the *ex-ante* approach, where a 3 year average OM is calculated. The most recent three year CEA data published on the emission factor of Northern region is considered. The CEA baseline is derived using the following formulae to calculate simple OM.

$$EF_{grid,OM,simple,y} = \frac{\sum_{i,m} FC_{i,m,y} * NCV_{i,y} * EFco_{2},_{i,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid.OM\ simple,\ y}$ = Simple operating margin CO_2 emission factor in year (tCO2/MWh)

$FC_{i,m,y}$.= amount of fossil fuel type I consumed by power plant/unit m year y(mass or unit volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y(GJ/mass or volume unit)

$EF_{co2,i,y}$ = CO2 emission factor of fossil fuel type i in the year y (tCO/GJ)

$EG_{m,y}$ = Net electricity generated and delivered to the grid by power plant/unit m in the year y (MWh)

m = All power plants / units serving the grid in year y excepts low-cost/ must-run power plants/ units

i = All fossil fuel types combusted in power plant/ unit m in year y

y = Either the three most recent years for which data is available at the time of submission of the CDM_-PDD to the DOE for validation (ex-ante option) or the applicable year during monitoring (ex-post option).

The CEA data published on Baseline emission factor for different regions in Indian electricity system are provided in Annex 3.

Table B.5 : Operating Margin[16]

Most recent three years	2003/04	2004/05	2005/06
Operating Margin* (OM) in t CO_2 / GWh	987	976	995

[16] CEA published CO2 data base, http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Average of 3 years	986

* including imports

Source: CDM Carbon Dioxide Baseline Data base, Version 2, June 2007(www.cea.nic.in)

Step 4: **Identify the cohort of power units to be included in the build margin**

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

a) The set of five power units that have been built most recently or

b) The set of power capacity additions in the electricity system that comprises 20% of the system generation (in MWh) and that have been built most recently.
Project participants should use the set of power units that comprises the larger annual generation.

As per the most recent version of CO_2 database published by CEA, the build margin is calculated as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation. Depending on the region, the build margin covers units commissioned in the last five to ten years. Further, if a unit is part of a registered CDM activity, it is excluded from the build margin.

Step 5: **Calculate the build margin emission factor**

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

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

Where :

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year in year *y* (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available.

Build Margin emission factor is determined as below:

Build Margin (BM)	**601**	tCO_2 / GWh

Step 6: **Calculate the combined margin emissions factor**

The combined margin emission factor is calculated as follows:

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

Where

$EF_{grid,CM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of operating margin emission factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The default values that are to be chosen for w_{OM} and w_{BM} are

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ for the first crediting period and for subsequent crediting periods
- All other projects: $w_{OM} = 0.5$ and $w_{OM} = 0.5$ for the first crediting period and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period.

The baseline emission factor in year y is calculated as the simple average of the OM and BM emission factors, i.e. OM and BM are each assigned a weightage of 50%. As noted above, the resulting Combined Margin is fixed ex ante for the duration of the crediting period:

Combined Margin (CM) Simple average of OM and BM	**793**	tCO_2 / GWh

The baseline emissions are calculated based on the net energy provided to the grid (in GWh/year), and an emission factor for the displaced grid electricity (in tCO_2 /GWh). The baseline scenario is electricity delivered to the grid by the project that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources.

$$BE_y = EG_{m,y} \times EF_{grid,CM,y}$$

Where,

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year in year y (MWh)

$EF_{grid,CM,y}$ = Combined margin emission factor of the grid to which the project exports electricity in (tCO_2/MWh)

Central Electricity Authority (CEA) (which is an official source of Ministry of Power, Government of India) have worked out baseline emission factor for various grids in India and made them publicly available i.e., "**CO_2 Baseline Database**" at

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

The emission factor of the grid for the ex-ante approach is calculated in the following way:

Northern regional grid consists of independent state level electricity systems, including public sector undertakings that exchange significant power within the region depending on the demand. Other regions viz. North Eastern, Western, Eastern and Southern grids are connected with the Northern grid. The power inflows from and outflows to these regions would constitute imports and exports. The Northern region has considerable amount of imports from the grid. The baseline Emission factor (including Imports) of Northern region published by CEA is considered for calculation of Emission reductions due to displacement of electricity in accordance with the Baseline of AMS I.D, version 13.

Project emissions

No project emissions are applicable to the proposed small scale hydro electric power project, since the electricity generation is based on hydro resources, which does not involve combustion of fossil fuels or generation of emissions from fossil fuels. Hence, the baseline emissions will be equivalent to the emission reductions in the project activity.

$$PE_y = F_{i,y} \times COEF_i$$

Where

PE_y Project emissions from combustion of fossil fuel (diesel for DG set) in the project activity during the year *y*

$F_{i,y}$ Quantity of fossil fuel type *i* combusted (DG set) during the year *y*

$COEF_i$ Carbon dioxide emission coefficient of the fuel type
Where

$$COEF_i = NCV_i \times EFCO_{2,i} \times OXID_i$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*(43 TJ/Gg as per IPCC2006 default values)

$OXID_i$ is the oxidation factor of the fuel (1 as per IPCC 2006 default Values)

$EFCO_{2,i}$ · is the CO2 emission factor per unit of energy of the fuel *i*(74.1 tCO_2/TJ as per IPCC 2006 default values)
Where available, local values of NCV_i and $EFCO_{2,}i$ should be used. If no such values are available, Country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

Leakage:

No leakage emissions are considered for the proposed project activity since no energy generating equipment is transferred from another activity and/or the existing equipment is transferred to another activity.

Emission Reductions:

Since the project emissions as well as the leakage are zero, the emission reductions are equal to the baseline emissions. These are calculated based on the monitored net amount of electricity supplied to the grid, and the baseline emission factor.

$ER_y = BE_y - PE_y - L_y$

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

Data / Parameter:	**EF_y**
Data unit:	t CO_2/GWh
Description:	Combined margin emission factor of Northern Grid
Source of data used:	Central Electricity Authority (CEA), Gov. of India: "CO_2 Baseline Database", Version 2.0, June 2007. Available at www.cea.nic.in.
Value applied:	793
Justification of the choice of data or description of measurement methods and procedures actually applied :	The emission factors in the CO_2 database of CEA are compiled specifically for application by grid-connected CDM projects. The emission factors are consistent with ACM0002 (Version 6) and AMS I.D (Version 13).
Any comment:	….

Data / Parameter:	$COEF_i$
Data unit:	*kg CO_2/TJ*
Description:	CO_2 emission coefficient of fuel type i
Source of data used:	IPCC 2006 default values
Value applied:	74000
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC values have been used for diesel since no country specific data is available.
Any comment:	The project activity may combust only one type of fossil fuel i.e., diesel during the project operation DG set is used only for lighting for emergency purposes and hence consumption of diesel will be negligible.

B.6.3 Ex-ante calculation of emission reductions:

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Baseline emissions

As per AMS I.D, the baseline emissions are calculated as the net electricity generated by the project activity, multiplied with the baseline emission factor for the project grid.

Baseline emissions calculated as explained in section B.6.1 above are summarised as below.

BE_y = 20.75 GWh X 793 tCO_2/GWh

BE_y = 16,457 tCO_2

Project emissions

No project emissions are applicable.

Leakage

No leakage emissions are applicable.

Emission reductions

ER_y = BE_y - PE_y - L_y

ER_y = 16,457 - 0 - 0

ER_y = 16,457 tCO_2 ($ER_y = BE_y$)

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

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Summary of the ex ante estimation of emission reductions are furnished below.

Year	Estimation of project activity emissions (t CO_2 e)	Estimation of baseline emissions (t CO_2 e)	Estimation of leakage (t CO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2009	0	16,457	0	16,457
2010	0	16,457	0	16,457
2011	0	16,457	0	16,457
2012	0	16,457	0	16,457
2013	0	16,457	0	16,457
2014	0	16,457	0	16,457
2015	0	16,457	0	16,457
2016	0	16,457	0	16,457
2017	0	16,457	0	16,457
2018	0	16,457	0	16,457
Total (tonnes of CO_2 e)	**0**	164,570	**0**	164,570

In the above table the year 2009 corresponds to 01.06.2009 to 31.05.2010. Similar interpretation shall apply for remaining years.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{gross,y}$
Data unit:	GWh
Description:	Total electricity generated by the project during the year *y*
Source of data to be used:	On-site measurements
Value of data	22.56
Description of measurement methods and procedures to be applied:	Measurement methods and procedures: continuous measurement of the generated electricity by generation meters at generation points Accepted industry standard : National standard Measurement equipment : Energy meters Calibration procedure : National standard Calibration frequency : At least once in three years period. Accuracy of the meters : 0.5s Responsible person : Project site in-charge Measurement interval : Continuous measurement, daily recording, compiled monthly and aggregated annually
QA/QC procedures to be applied (if any):	Measurement will be carried out by calibrated meters.
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later

Data / Parameter:	$EG_{Auxiliary, y}$
Data unit:	GWh
Description:	Auxiliary electricity consumption of the project during the year y
Source of data to be used:	On-site measurements
Value of data	0.113 (=0.5% of gross electricity generation)
Description of measurement methods and procedures to be applied:	Measurement methods and procedures: continuous measurement of the auxiliary electricity consumption (of the project site) by auxiliary meter. Accepted industry standard : National standard Measurement equipment : Energy meter Calibration procedure : National standard Calibration frequency : At least once in three years period. Accuracy of the meters : 0.5s Responsible person : Project site in-charge Measurement interval : Continuous measurement, daily recording, compiled monthly and aggregated annually

QA/QC procedures to be applied (if any):	Measurement will be carried out by calibrated meters.
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later

Data / Parameter:	$EG_{export,,y}$
Data unit:	GWh
Description:	Quantity of electricity exported to grid by the project during the year y
Source of data to be used:	Measurement at grid sub-station
Value of data	20.75
Description of measurement methods and procedures to be applied:	Measurement methods and procedure: Continuous measurement of the exported electricity (to grid) by one set of main and check meters at grid sub-station. Monthly joint meter readings of the main meter and check meter will be recorded jointly by the designated officials of the company and HPSEB and incorporated on monthly basis in Joint Meter Reports (JMRs) for commercial purpose. Accepted industry standard : National standard Measurement equipment : Energy meters (main meter and check meter) of bi-directional Trivector type. The meters (both main and check) shall reflect the electricity exported to the grid as well as the electricity imported from the grid. Calibration procedure : National standard Calibration frequency : Once in twelve months. Accuracy of the meters : 0.2s Responsible person : These meters are sealed and under the custody of HPSEB. Project site in-charge would be responsible for ensuring regular maintenance and calibration of the meters from HPSEB authorities. Measurement interval : Continuous measurement, monthly recording and aggregated annually.
QA/QC procedures to be applied (if any):	Measurement will be carried out by calibrated meters. To be cross-checked with monthly joint meter reading statements, invoices or receipts of payments. In case of any abnormality in the main meter, the reading of check meter would serve as a basis for the export electricity figure.
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EG_{import,y}$
Data unit:	GWh
Description:	Quantity of electricity imported (from grid) by the project plant during

	the year y
Source of data to be used:	Measurement at grid sub-station
Value of data	0
Description of measurement methods and procedures to be applied:	Measurement methods and procedure: continuous measurement of the imported electricity (from grid) by one set of main and check meters at grid sub-station. Monthly joint meter readings of the main meter and check meter will be recorded jointly by the designated officials of the company and HPSEB and incorporated on monthly basis in Joint Meter Reports (JMRs) for commercial purpose. Accepted industry standard : National standard Measurement equipment : Energy meters (main meter and check meter) of bi-directional type. The meters (both main and check) shall reflect the electricity exported to the grid as well as the electricity imported from the grid. Calibration procedure : National standard Calibration frequency : Once in twelve months. Accuracy of the meters : 0.2s Responsible person : These meters are sealed and under the custody of HPSEB. Project site in-charge would be responsible for ensuring regular maintenance and calibration of the meters from HPSEB authorities. Measurement interval : Continuous measurement, monthly recording and aggregated annually..
QA/QC procedures to be applied (if any):	Measurement will be carried out by calibrated meters. To be cross-checked with monthly joint meter reading statements, invoices or receipts of payments. In case of any abnormality in the main meter, the reading of check meter would serve as a basis for the import electricity figure.
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EG_{m,y}$
Data unit:	GWh
Description:	Net quantity of electricity exported to grid by the project plant during the year *y*
Source of data to be used:	Calculated (as the difference of "$EG_{export,y}$" and "$EG_{import,y}$"
Value of data	20.75
Description of measurement methods and procedures to be applied:	Not applicable as it is calculated from the measured values of "$EG_{export,y}$" and "$EG_{import,y}$"
QA/QC procedures to be applied (if any):	To be cross-checked with monthly joint meter reading statements, invoices or receipts of payments.

Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$F_{diesel, y}$
Data unit:	*Liters*
Description:	Quantity of Diesel consumed in running DG set during year *y*
Source of data to be used:	Plant records
Value of data	0 (assumed value for ex-ante calculation of emission reductions)
Description of measurement methods and procedures to be applied:	The total number of operating hours of DG set and the corresponding quantity of diesel consumed for the purpose will be measured by using pre calibrated level gauge and recorded in the log book maintained at the DG set room. The operating hours and the quantity of diesel consumption will be recorded.
QA/QC procedures to be applied:	The data recorded can be cross checked against the fuel purchase receipts.
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	P_{diesel}
Data unit:	kg/Lit
Description:	Density of Diesel
Source of data to be used:	Society of Indian automobile manufacturers (SIAM) http://www.siamindia.com/scripts/Diesel.aspx
Value of data	0.82
Description of measurement methods and procedures to be applied:	The SIAM value is considered as it is publicly available and can be referred as authentic source.
QA/QC procedures to be applied (if any):	Project participant has no control on the parameter. Hence, no QA/QC procedures are applicable
Any comment:	Data will be archived electronically and on paper. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

B.7.2 Description of the monitoring plan:

>>

The monitoring plan is developed in accordance with the modalities and procedures for small-scale CDM project activities and is proposed for grid-connected small hydroelectric project being implemented in Himachal Pradesh in India. The monitoring plan, which will be implemented by the project proponent describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

Project Management

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the Board of Directors. The Board may delegate the same to a competent person identified for the purpose. The identified person will be the in charge of GHG monitoring activities and necessary reports will be submitted to the management or it's Committee for review.

Monitoring Requirements

The monitoring plan includes monitoring of energy parameters such as Gross energy, Auxiliary consumption, energy export to the HPSEB grid system and energy import to the project activity from grid, diesel consumption and density of diesel. Baseline emissions resulted from the project activity will be calculated based on the net energy export to the grid system and project emissions due to usage of diesel consumption will be calculated in accordance with the calculations illustrated in Section B.6.3 of the PDD. Emission reductions generated by the project shall be monitored at regular intervals. The crediting period chosen for the project activity is 10 years.

Monitoring equipment comprises of energy meters, which will monitor the gross energy generation, auxiliary consumption, energy exported by the plant to HPSEB grid system and energy imported by the proposed project. One set of two energy meters (main meter and check meter) will be installed at grid interconnecting point. Project proponent will ensure to calibrate both the meters by HPSEB. Project proponent will appoint a Designated Operational Entity (DOE) for verification of emission reductions and leakages resulted by the project activity at regular intervals.

Methodology adopted for determining baseline emission factor is the Combined Margin (Including Imports) of the generating mix in the Northern grid system, which will represent the intensity of carbon emissions of the grid system. The baseline emission factor is fixed ex-ante for all the years of the crediting period using the official data published by the Central Electricity Authority for the Northern grid for the year 2005-06 and therefore is not included in the monitoring procedures.

QA & QC Procedures

The project shall employ monitoring equipments conforming to national standard. Necessary check meter as required would be installed, to operate in parallel to main meter. In case of any abnormality in the main meter, the reading of check meter would serve as a basis for net electricity figure. All meters will be calibrated and sealed as per industry practices at regular intervals. Records of calibration certificates will be maintained for verification. Hence, high quality is ensured with the above parameters. Sales records will be used and kept for checking the consistency of the recorded data.

Leakage Monitoring

No leakage is involved in the proposed project activity.

Data Recording and Storage

For measuring the delivery/import of energy by the project at the interconnection point, one set of Main meter and Check Meter shall be provided by the Project proponent and the HPSEB respectively at the interconnection point. Representatives of both the project proponent and HPSEB will sign the JMR which will contain all details such as the equipment data, previous reading, current reading, export, import, net billable units, date of recording etc. This JMR will be used as a basic document for monitoring and

verification of the net energy exported to the grid. HPSEB will pay to project proponents based on this JMR.

The JMR will be kept at safe storage for verification of emission reductions generated from the project activity. Supporting documents such as receipts of payments released by HPSEB will also be kept in safe storage for later verification by an independent third party. The period of storage will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

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

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Date of completion of the baseline 22/09/2008

Name of the person / entity determining the baseline: Him Kailash Hydro Power Private Limited

The project proponent has determined the baseline and monitoring methodology with guidance from their consultants.

Contact information of the above entity furnished below:

Organization:	Him Kailash Hydro Power Private Limited
Street/P.O.Box:	Durga Nagar colony, Punjagutta
Building:	6-3-668/10/49, plot-56
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	730082
Country:	India
Telephone:	+91- 40- 6452 1424
FAX:	+91- 40- 2354 2128
E-Mail:	naresh.hydro@gmail.com
URL:	
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	V.Narasimha Raju
Middle Name:	
First Name:	Ch.
Department:	
Mobile:	
Direct FAX:	+91- 40- 6648 1144
Direct tel:	+91- 40- 64521424
Personal E-Mail:	naresh.hydro@gmail.com

SECTION C. Duration of the project activity/crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
08/07/2005 (Civil works construction agreement)

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

>>
30 years

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

10 years fixed crediting period

C.2.1. Renewable crediting period

Not chosen

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

>>
Not applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/06/2009 or from the date of registration of the project activity whichever occurs later

C.2.2.2. Length:

>>
10 y – 0 m

SECTION D. Environmental impacts

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D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

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As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India and also the concerned ministry for environmental issues in India, Environmental Impact Assessment (EIA) studies need not to be conducted for the projects less than Rs. 1000 millions[17, 18] Since the total cost of the project is only Rs.258 millions, the project activity doesn't call for EIA study.

However the project activity is required to obtain permission from Himachal Pradesh State Environment Protection & Pollution Control Board (HPPCB) for setting up of the project. The project proponents have obtained necessary clearance in this regard.

The scheme is run-off-river based and does not involve submergence of land or rehabilitation activity. The project shall not affect the aquatic life available in this stream, which at present is insignificant. It will respect the Government requirement that all hydro projects must release at least 15% of minimum discharge at the diversion of water in order to maintain flora and fauna.

Hence the project is not likely to have any significant adverse environmental effects during execution or after commissioning or during the operational lifetime of the project.

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

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No significant environmental impacts considered due to implementation of project activity by the host party, hence, no references or procedures are specified here

SECTION E. Stakeholders' comments

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

No specific public consultation / participation requirements are specified in Indian statutes for setting up of small-scale industries. However, there are certain procedural requirements, which every project investor needs to follow before implementing any project.

Before implementing any project, project investors / developers need to identify the stakeholders, prepare necessary documents, approach the identified stakeholders directly and obtain required clearances / approvals. The stakeholders after review of documents and investment profile, will accord approvals / licences or send comments in writing to project investors for further clarifications / corrections. In case they are not satisfied with the project design or they feel that the project impacts any of the local environment / social / economical environments, they will not issue clearances / approvals and stop the implementation of the project.

[17] Sub Para (b) of Para 3, S.O. 60 (E), Environment Impact Assessment Notification, Ministry of Environment and Forests, Govt. of India dated 27th January 1994.

[18] Amendment made on 13th June 2002 vide S.O. 632 (E), Ministry of Environment and Forests, Govt. of India.

Government of Himachal Pradesh had made it mandatory for all the projects to go for public consultation before start of the project. It should be publicized in national and vernacular dailies and invites objections / comments from the public during a period of 60 days before issuing license. Based on the feedback the Government of Himachal Pradesh will decide whether the project to be sanctioned or withheld.

Stakeholder Name	**Function of Stakeholder**	**Description of Involvement**
Himachal Pradesh Government Energy Development Agency (HIMURJA)	A state nodal agency and policy implementation body in respect of renewable energy projects in Himachal Pradesh. HIMURJA reviews the project documentation and accords clearance for utilizing renewable energy sources in the state.	Issues clearance for setting up the project in Himachal Pradesh utilizing hydro potential available at the proposed site.
Himachal Pradesh State Electricity Board (HPSEB)	The state owned electricity utility company that manages the electricity generation and distribution in Himachal Pradesh state. Any electricity generation project proposed in Himachal Pradesh shall approach HPSEB for power evacuation arrangements. Both HPSEB and the project proponent shall sign a Power Purchase Agreement, before implementing the project.	Accords techno-economic clearance to the project, purchases power from the project by executing Power Purchase Agreement to determine the tariff and other terms.
Electricity Regulatory Commission of Himachal Pradesh (ERCHP)	The state owned electricity regulatory body responsible for tariff fixation, grievance redressing etc. throughout the state of Himachal Pradesh.	Electricity Regulatory Commission of Himachal Pradesh (ERCHP) makes a public announcement in local dailies for public comments on the project before according clearance for the tariff and export of power into HPSEB grid. Announcement will kept open for 60 days. It considers public comments in its approval process before giving approval.
Himachal Pradesh State Environment Protection & Pollution Control Board (HPPCB)	A statutory local body that oversees the pollution control aspects in the state. Any project activity shall obtain clearance from the EPPCB before implementation.	Issues 'Consent for Establishment' before starting the construction of the project and issues 'Consent for Operation' before commissioning of the project.
Department of Irrigation, Govt. of Himachal Pradesh	Part of Himachal Pradesh Government and oversees utilization of water	Accords clearance for utilizing water resources in Himachal Pradesh state.
Ministry of Environment &	Part of Government of India responsible for overseeing utilization of forest land.	Provides permission for utilizing forestland for construction of the

Forests, Govt. of India		project.
Local Village Panchayat	Elected statutory body of the local populace	Accords permission for setting up of the project under the jurisdiction of the village

STAKEHOLDERS INVOLVEMENTS

Govt. of Himachal Pradesh

- The company has entered into Memorandum of Understanding (MoU) with Govt. of Himachal Pradesh on 17th May 2001.

- The company has signed an Implementation Agreement (IA) with Govt. of Himachal Pradesh on 3rd September 2003.

HPSEB

The project has obtained 'Techno-economic Clearance (TEC) from Himachal Pradesh State Electricity Board (HPSEB) vide **HPSEB/CE(P)/CC-Sahu/2003-501-09** dated 2nd July 2003.

Pollution Control Board

The project has obtained 'Consent for Establishment' from Himachal Pradesh State Environment Protection & Pollution Control Board (EPPCB) vide **EPPCB/Sahu SHEP- Sahu-Chamba/2004-15561-66,** dated 15th December 2004.

Power Purchase Agreement

The project has entered into a Power Purchase Agreement (PPA) with Himachal Pradesh State Electricity Board (HPSEB) on 28th April 2004.

Irrigation & Public Health

The project got 'No Objection Certificate' from Department of Irrigation & Public Health, Govt. of Himachal Pradesh vide **No.IPH-CBA_WA_NOC** dated 26th October 2004.

Forests Clearance

The project got clearance from Ministry of Environment & Forests, Govt. of India for diversion of forests of land vide **No: 9HPD-2471/2004-CHA/3549** dated 24th January 2005.

Village Panchayat

The project has obtained 'No Objection Certificate' from local Gram Panchayat on 20th September 2004.

Detailed Project Report

Govt. of Himachal Pradesh and the Company have signed a Memorandum of Understanding (MoU) for preparation of Detailed Project Report (DPR) for the project activity on 17th May 2001.

Electro-mechanical Contract

The project has entered into an agreement with M/s Shanghai Leichun(I) Trading Company pvt ltd, on 3rd December 2005 for Design, Manufacture, Supply of Electro-mechanical equipment.

CDM – Executive Board

STAKEHOLDERS' COMMENTS

All stakeholders have issued their approvals/consents/licenses for setting up the project and no comments were received on the project.

E.2. Summary of the comments received:

>>
No comments are received on the project

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

>>
No comments received and hence no action report is applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Him Kailash Hydro Power Private Limited
Street/P.O.Box:	Durga Nagar colony, Punjagutta
Building:	6-3-668/10/49, plot-56
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	730082
Country:	India
Telephone:	+91- 40- 64521424
FAX:	+91- 40- 2354 2128
E-Mail:	naresh.hydro@gmail.com
URL:	
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	V.Narasimha Raju
Middle Name:	
First Name:	Ch.
Department:	
Mobile:	
Direct FAX:	+91- 40- 6648 1144
Direct tel:	+91- 40- 64521424
Personal E-Mail:	naresh.hydro@gmail.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from the parties included in Annex - I is involved in the project activity

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Annex 3

Baseline information

This project uses grid emission factor calculations officially published by the Central Electricity Authority (CEA) of India, following the approaches and rules defined in ACM0002. For details and further information on data please see CEA CO_2 data base from the following web link:

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

"CDM Carbon Dioxide Baseline Database, Version 2, June 2007 "

Annex 4

MONITORING INFORMATION

Monitoring information is already provided in section B.7.2

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