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 Debal Grid-connected Hydroelectric Project in Uttaranchal, India
Version: 04
Date : 16/01/2010

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

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The purpose of the proposed project activity is to generate clean electrical energy in a sustainable manner, optimising the utilization of renewable hydro resource and feed the generated power to the grid system, which is overwhelmed with thermal power plants utilizing fossil fuels.

It was originally intended to promote 2 hydro projects on Kailganga river in Chamoli district of Uttaranchal viz., 3 MW Debal Hydro project and 3 MW Kailganga hydro project by two groups of promoters. The implementation was intended to be joined by both promoters. During the process it was also decided by the project proponent of 3MW Debal project to increase the capacity to 5MW with the object of utilising the heavy monsoon water discharges to the optimum extent as the project activity generates more power during the monsoon season.

As there was no proper united action among the two groups of promoters it was decided to separate the projects as two independent activities to be implemented by each promoters group. Therefore, a de-merger was carried out with the approval of the government.

The project activity supplies 29.465 GWh of electricity to Uttarakhand Power Corporation Limited (UPCL). It will reduce the Green house gas emissions produced by thermal energy using fossil fuels and the annual emission reduction will be in the order of 238,800 tonnes of CO_2 over a period of 10 crediting years.

The hydroelectric project comprises a diversion structure, water conducting system, feeder channel, desilting tank, power channel, fore-bay tank, penstock, power house, and tail race channel.

Debal Small Hydro-Power project is proposed on the right bank of Kailganga River just before its confluence with Pinder River near Debal village in Narain Bagar taluk of district Chamoli, of Uttarakhand State.

The project is designed to generate electricity for grid system using available water sources. The technology for power generation process using hydro resources is converting the potential energy available in the water flow into mechanical energy using hydro turbines and then to electrical energy using alternators. The generated power will be transformed to match the nearest grid sub-station for proper interconnection and smooth evacuation of power.

Since, the project activity generates electricity through sustainable means, it will not cause any negative impact on the environment and there by it contributes to climate change mitigation efforts.

View of project participant on the project activity's contribution to Sustainable Development

Ministry of Environment and Forests (MoEF), Government of India, has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM project.

1. Social well-being
2. Economic-well being
3. Environmental well being and
4. Technological-well being

The project activity contributes to the above indicators in the following manner.

Social Well-Being

The small hydro project on Kailganga River is established in a rural area. Majority of population in this area depend on marginal cultivation in the terraced fields or work as labourers for their livelihood. The economic condition of the area is poor due to low agricultural yield and adverse climatic conditions. Setting up of the hydro project will open up employment opportunities in the local area during construction by employing local people and during operation by making available clean hydro power especially for power intensive industries and cater to its population for their socio-economic upliftment as well as improving their living conditions.

The project activity feeds the generated power to the nearest Debal substation at Nandakesari located at a distance of 5 km, thus energy availability and quality of power improves significantly under the service area of the substation.

Economic Well-Being

Project proponent will mobilise investment in the region to an extent of about Rs. 289.5 millions which otherwise would not have happened in the absence of the project activity. This is a significant investment in a hilly area.

The project proponent is developing basic infrastructures like road, communication facilities etc and the same could be utilised by the local population. The proponent is also developing a playground and a cremation ground with all modern facilities for the benefit of the villagers.

Environmental Well-Being

The proposed project activity utilises hydro potential available for power generation. The state of Uttarakhand is a part of the NEWNE regional grid system where power generation is dominated by fossil fuels. The project activity will not result in increase of GHG emissions and hence cause no negative impact on the environment both at local as well as at the global level. Further, 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 will result in utilisation of environmentally safe and sound technologies in small-scale hydroelectric power sector. Further, the project demonstrates harnessing hydro potential in small streams and encourages setting up of such new projects in future. The project generates real, measurable and long term emission reductions.

The above benefits due to the project activity will ensure that the project would contribute to the sustainable development of the region.

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:** Chamoli Hydro Power Private Limited	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):

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India

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

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Uttarakhand

A.4.1.3. City/Town/Community etc:

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Village : Debal
Taluk : Narain Bagar
District : Chamoli

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

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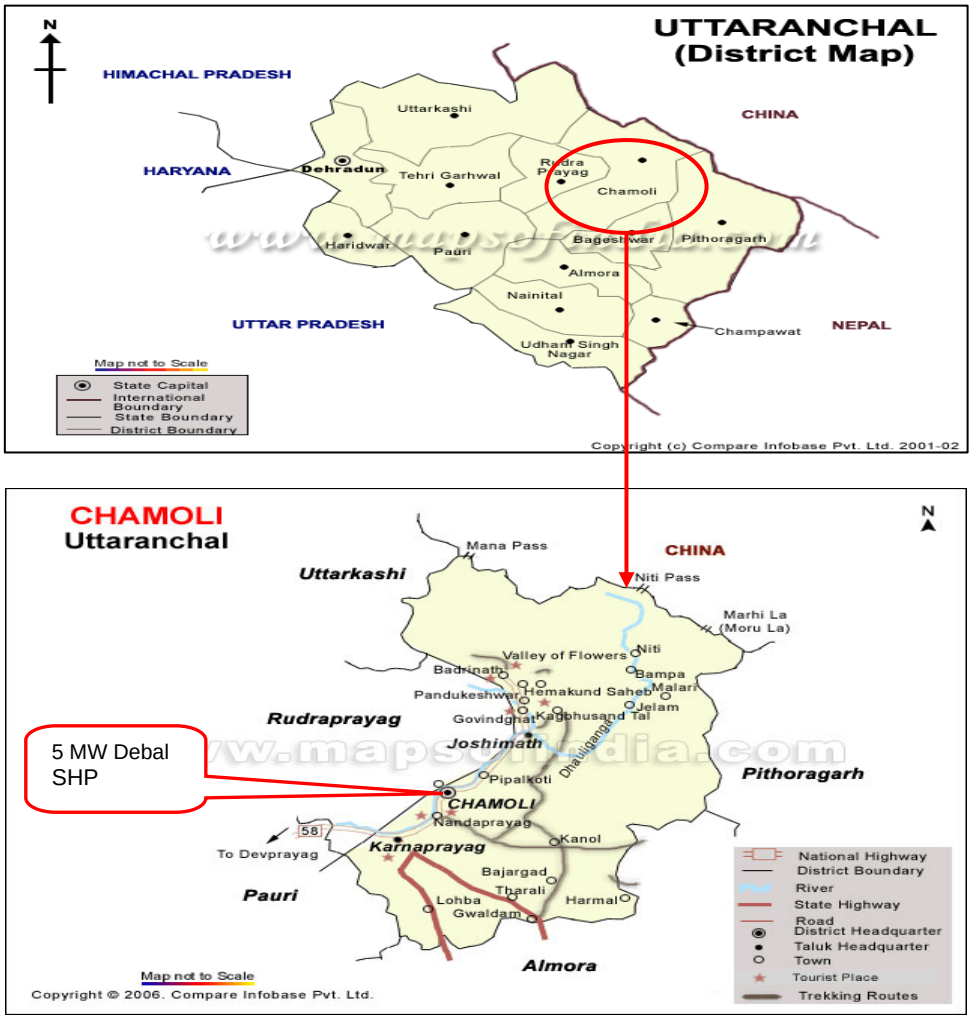
The Debal SHP is located in the village Debal of Narain Bagar taluk of Chamoli District. Debal village is located at a distance of 230 km from Rishikesh in Uttarakhand state, India. The nearest railway station is Rishikesh. The geographical co-ordinates of the location is 79°33’10”E (longitude) and 30°3”N (latitude).



Map: Location of Project Site in Chamoli District in Uttarakhand(former Uttaranchal) State, India

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

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Type & Category:

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 potential for power generation and exports the generated power to the regional grid system. Accordingly, the applicable methodology for the project activity shall be AMS I.D/ Version 13, Scope 1, EB 36 which includes hydro electric generation for a grid system.

Technical details of the project activity:

The technology employed for power generation in a hydroelectric plant is converting the potential energy available in the water flows into mechanical energy using hydro turbines and then electrical energy using alternators. The generated power will be transformed to match the nearest grid substation for proper interconnection and smooth evacuation of power.

The project employs the use of hydro energy for the purpose of electricity generation. Since, the technology employed by the project proponent does not result in GHG emissions, the project does not cause any negative effects on the environment. Hence, the technology used for the project activities do not pose any threat to the environment when compared to the fossil fuel-fired power plants.

The project activity will use two Synchronous generators with a rated capacity of 2500 kVA each coupled to two Horizontal Francis turbines with capacity 2500 kW each. Francis Turbines are appropriate for the head available for the project. The power generated from this project is proposed to be supplied to the UPCL grid through 33kV grid substation at Debal (near Nandakesari).

Technical details

Type of turbines	: Horizontal Francis Turbine
Type of generator	: Synchronous
No. of generating units	: 2 Nos.
Net (Max) Head	: 47.2 m
Net (Design) Head	: 45.0 m
Installed Capacity	: 2 x 2.5 MW
Annual Energy generation	: 31.18 GWh
Auxiliary Consumption	: 1.715 GWh
Annual Saleable energy	: 29.465 GWh

Technology Transfer

No technology transfer from other countries is involved in the project.

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

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The crediting period chosen for the proposed project activity is 10 years. Annual estimation of emission reductions by the project activity during the above crediting period are furnished below:

Year	Estimation of annual emission reductions in tonnes of CO_2e

2009	23880
2010	23880
2011	23880
2012	23880
2013	23880
2014	23880
2015	23880
2016	23880
2017	23880
2018	23880
Total estimated reductions (tonnes of CO_2e)	238800
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	23880

In the above table the year 2009 corresponds to 01.11.2009 to 31.10.2010. Similar interpretation shall apply for remaining years.

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

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No public funding from Annex I Party is involved in this project activity.

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

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In accordance with Appendix C[1] of the Simplified Modalities and Procedures for Small-Scale CDM project activities "Determining the Occurrence of Debundling", it can be confirmed that this project activity is not a debundled component of a larger CDM project.

No other CDM activity has been undertaken by the project participant within previous 2 years, which is in the same project category and technology/measure, whose boundary is within 1 km of the project boundary of this project activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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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 Projects

Reference : **AMS-I.D.** Grid connected renewable electricity generation

[1] http://cdm.unfccc.int/EB/Meetings/007/eb7ra07.pdf

Version : **Version 13**, AMS-I.D, Scope : 01, EB 36

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

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The proposed project activity is a 5 MW, hydro electric power project. The project activity is eligible to use the methodology since project activity generates and exports the renewable electricity to a grid system i.e. dominated by thermal energy sources. The capacity of the project activity is well below the qualifying limit for project activities under the small scale methodology i.e. 15 MW limit[2]. Hence, AMS.I.D, Version 13, EB 36 'Grid connected renewable electricity generation' is applied for the proposed small scale project activity.

The water and power studies carried out for this project keeping its main parameters in view such as head and discharge available in the canal, the project participants declare that the project will be within the limits of the small scale project activity throughout the crediting period. In addition, the design parameters of turbine and generator indicate that the project will be within the small scale limit throughout the crediting period.

B.3. Description of the project boundary:

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In accordance with AMS I.D version 13, the project boundary encompasses the physical, geographical site of the renewable generation source.

The project boundary is therefore the physical boundary around the diversion structure, desilting tank, headrace tunnel, fore bay, powerhouse, tailrace and the transmission system till the evacuation point. The power generated from this project is metered and accurately quantifiable.

In addition, the project boundary also includes the connected electricity system, i.e. the Northern grid of India, for the purpose of determining the baseline emission factor for displaced grid electricity.

B.4. Description of baseline and its development:

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Baseline Methodology Procedure:

According to the Methodological tool, "**Tool to calculate the emission factor for an electricity system**", the project participants shall apply the following steps in order to determine the baseline methodology:

Step 1: Identify the relevant electric power system
Step 2: Select an operating margin (OM) method.
Step 3: Calculate the operating margin emission factor according to the selected method
Step 4: Identify the cohort of power units to be included in the build margin (BM)
Step 5: Calculate the build margin emission factor

[2] In accordance with the simplified modalities and procedures for small-scale CDM project activities (annex II to decision 21/CP.8 contained in document FCCC/CP/2002/7/Add.3): http://cdm.unfccc.int/Reference/Documents/AnnexII/English/annexII.pdf

Step 6: Calculate the combined margin (CM) emission factor.

Each step is explained in detail in section B.6.1.

As per the Para 9 of methodology AMS I.D. Version 13, EB 36, the baseline is the MWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/MWh) The methodology says that emission coefficient should be calculated in a transparent and conservative manner as explained in the later sections of this document.

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 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 are calculated according to the guidelines of CDM UNFCCC website. The key parameters and data sources are furnished below:

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

The Emission factor for Northern grid is taken from CEA published Grid Emission Factors for Indian grid systems, which are made publicly available on CEA website (CO_2 Baseline Database Version 3). The Emission factors have been calculated according to the guidelines of CDM UNFCCC website. The emission factor published by CEA for the latest year 2006-07 is 810.46 tCO_2/GWh, based on combined margin approach.

Actual emission reductions will be calculated ex post based on the actual monitored data during each year of the crediting period and fixed CEA baseline grid emission factor.

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:

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UNFCCC simplified modalities seek to establish additionality of the project activity as per Attachment A to Appendix B, which listed various barriers, out of which, at least one barrier shall be identified due to which the project would not have occurred. The barriers listed as per Attachment A to Appendix B are as follows:

1. Investment Barriers: A financially more viable alternative to the project activity would have led to higher emissions.

2. Technological barriers: 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

3. Barriers due to prevailing practice: Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

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

The following barriers were identified for the project by the project participants.

Investment Barrier:

Low return on investment:

Investment analysis has been carried out by the PP to demonstrate additionality of the project. For this purpose, project IRR has been chosen as the financial indicator, which has to be compared with a benchmark to demonstrate the additionality.

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 Average Prime lending rate (PLR) of Reserve Bank of India (RBI) i.e. 10.50% at the time of investment decision. The PLR as per RBI was in the range of 10.25% % to 10.75% at the time of investment decision[3]

Computation of financial indicator:

IRR analysis is based on the assumptions made in the detailed project report. UERC order is the basis for tariff. Depreciation and tax rates prevailing at the time of decision making were taken into consideration. Project IRR has been prepared for a period of 30 years. Detailed computation of project IRR forms part of worksheet submitted to DOE for validation.

The key assumptions for determining the IRR of the project activity are provided below:

Details	Value	Data Source
Project Cost	Rs. 289.50 millions	Detailed Project Report

[3] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/67614.pdf

Means of Finance - Share Capital - Term Loan	 Rs. 97.00 millions Rs. 192.50 millions	Detailed Project Report
Annual Net Energy Export	29.465 GWh	Estimated
Electricity Tariff (up to 45% PLF)	Rs. 2.27 /kWh	UERC Order dated 10/11/2005
Electricity tariff (beyond 45% PLF) as an incentive	Rs. 0.25 /kWh	UERC Order dated 10/11/2005
Interest on Term Loan	9.75 % per annum	Detailed Project Report
Operation & Maintenance	3.0 % of project cost with 5 % escalation per annum	Detailed Project Report
Depreciation (SLM)	3 % per annum	Indian Companies Act
Loan Repayment Period	7 years	Detailed Project Report
Moratorium (from COD)	1 Year	Detailed Project Report
Tax Holiday	10 years	Indian Income Tax Act
Capital Subsidy	Rs.47.73 Millions	Detailed Project Report
Income Tax Tax (MAT)	8.415 %	Indian Income Tax Act
Income Tax (Regular)	33.66 %	Indian Income Tax Act

The suitability of PLF and Tariff used in the financial analysis is explained below.

Suitability of PLF:

The detailed hydrological and topographical Investigations have been carried out by an independent expert agency and submitted the Detailed Project Report for the project in June, 2005. The investigations carried out are briefly mentioned below:

(i) Direct discharge measurements (site specific discharge data) and other hydrological data at the project location

(ii) Topographical surveys to determine head available for the project

(iii) Power Energy studies and determination of Plant Load Factor (PLF) for the project using site Specific discharge data and head.

Based on the site specific technical parameters, Gross Energy generation and PLF were calculated as follows:

Project	Gross Energy Generation	Plant Load Factor
Debal	31.18 GWh	71 %

Details of investigation results and calculation of Gross Energy and PLF for the project is available in the Detailed Project Report of the project activity. The discharge data and calculation of PLF available in the DPR is already furnished to the DOE for verification.

Factor	Variation		
	-10%	0%	+10%
Generation	6.86%	7.18%	7.50%
Tariff	4.99%	7.18%	9.18%
Project Cost	9.30%	7.18%	5.31%
O& M Cost	7.81%	7.18%	6.50%
Salvage Value	7.16%	7.18%	7.20%

The PLF of 71% considered by the PP is higher and thus more conservative than the PLF recommended by the Uttaranchal Electricity Regulatory Commission (UERC), which is only 45%.

The project activity is commissioned on 31st September, 2007 and year wise generation details are given below:

Year	Gross Energy Generation	Plant Load Factor
Sep, 2007-Aug, 08	19.52 GWh	44.56 %
Sep, 2008-Aug, 09	18.43 GWh	42.00%

The above generation figures indicate an average PLF of only 43.28% against the estimated PLF of 71% as per the DPR.. The PP suffered losses due to the low generation achieved by the project activity.

As could be seen from the above, the PLF estimated in the DPR is more conservative.

Suitability of Tariff:

At the time of investment decision i.e., on 20.11.2005 the tariff applicable for the project as per Uttaranchal Electricity Regulatory Commission (UERC) order dated 10.11.2005 is Rs.2.27 per kWh up to 45% PLF, thereafter the PP will get Rs.0.25 per kWh as an incentive. The same is considered for investment analysis. Copy of the UERC order has already been submitted to DOE.

Based on the above assumptions, the project IRR works out to 7.18% without CDM benefits in contrast to the benchmark of 10.50 %. As evident the project is not financially attractive.

Sensitivity Analysis:

Sensitivity analysis has been conducted by varying critical assumptions by 10% on either side. The outcome of the sensitivity analysis is given below:

The sensitivity analysis proves that the project is unlikely to be financially attractive even under the most optimistic conditions. Having said that, it needs to be stated that project cost coming down is unrealistic as the project is already facing cost overruns. The generation has been considered at the maximum and hence it is highly unlikely that the project would be able to achieve a generation more than 72%, is well high impossible. Moreover there is a drastic reduction in the energy projected by the project proponent. Against an envisaged generation of 29 MU the project activity has generated little over 20 MU which indicates the prevalence of hydrology barrier evidencing uncertainty of generation. Tariff is considered as per UERC order and O&M cost is only subject to increase, not decrease. Even considering the total project cost as salvage in the terminal year the IRR is below the bench Mark. Therefore, the occurrence of any of the events considered in the sensitivity analysis is remote.

The project IRR reaches benchmark only if the cost of project is reduced by 15.02%, tariff increases by 16.95% and O&M cost decreases by 58.9% Even if the Generation and Realisable value (Salvage value) increases by 100% the IRR does not reaches the benchmark.

It was against this background that the PP, while taking a decision to invest in the project activity, considered the CDM benefits. The minutes of the meeting of the Board of Directors, where the imperativeness of the CDM benefits was discussed, is furnished to the DOE for verification. 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 14.50% in contrast to the benchmark return of 10.50 %. Hence, the project requires CDM benefits to become financially attractive.

Other Barriers:

Geological Risks:

The small and mini hydro power plants in the Himalayan regions (including those in Uttarakhand[4]) suffer from various natural calamities including landslides. During the monsoon period, frequent land slides occur especially from the hill slopes overlooking the power channel. Consequently, the power channels may get washed away over some length, which may cause under cutting of the land below the power channel and may require realignment. Thus, the power generation may stop due to the landslides, which may need further reconstruction. This phenomenon is very common and almost renders these small power stations inoperative for almost the entire monsoon season and later a few more months are required for construction of the power channel along a new alignment.

The state of Uttarakhand has been witnessing a number of natural disasters which include earthquakes, landslides and flash floods[5].Uttarakhand represents one of the Himalayan states of India and is traversed by a number of regional tectonic discontinuities. The geotectonic setup, meteorological regime and high relief make this region highly prone to earthquakes, landslides, and

[4] Section 3.2, Table 2 ENVIS Bulletin on Himalayan Ecology Vol 14(I)- GPBIHED, Almora http://gbpihed.gov.in/envis/HTML/vol14_1/vpsati.htm

[5] current science, vol. 87, no. 2, 25 july 2004, http://www.iisc.ernet.in/currsci/jul252004/134a.pdf

flash floods. In the recent past the state was devastated by two major earthquakes (Uttarkashi 1991 and Chamoli 1999) and a number of landslides[6]. Out of the total area of about 51000 sq.km of Uttarakhand, 21000 sq.km lies in the severest zone `V'[7] and the rest in zone `IV'. Apart from this, Chamoli itself falls under zone v , seismically the most active zone.

The natural weakness of the rocks coupled with high relative relief and concentrated atmospheric precipitation makes the region prone to mass wastage processes, particularly in the vicinity of major tectonic discontinuities and shear zones. Landslides and flash floods are therefore a common feature in the region, particularly during the monsoon season thus leading to high investment towards strengthening of adjacent slopes, additional safety margins in structural designs etc. Landslide, though seemingly small and of stray incidence, causes considerable concern in the region as it claims a heavy cumulative toll of human lives and infrastructure especially during the monsoon season (rainy season in the Indian subcontinent spanning mid-June to mid-September) when prolonged rainfall provides favorable conditions for down slope movement. In the past the state of Uttarakhand has been affected by a number of landslides. A large number of landslides go unnoticed and do not gain media attention as the losses are small, but the cumulative toll of these events is significant and comparable to any major natural disaster[8].

Uncertainty of geology:

The Himalayas are among the youngest mountains. Hence the geological conditions are very uncertain. Loose riverbed material, unstable slopes, land/ avalanche slides are encountered frequently.

Unpredictable geographical conditions, cloud bursting and slope failures demands high expenditure on protection works.

Road blockage due to natural calamities and severe climatic conditions also cause difficulty in construction, operation, and maintenance thereby leading to time and cost over runs.

Barriers due to prevailing practice:

Establishment of small hydro projects is not a common practice in the State of Uttaranchal due to prevalence of several barriers as explained earlier. This statement is supported by the following statistics published by various sources:

Uttaranchal is estimated to have a potential for small hydro projects to an extent of 1478.235 MW[9] out of which the installations of small hydro projects of capacity less than 25 MW is 72.45 MW[10] constituting

[6] http://info.worldbank.org/etools/docs/library/114813/bestcourse/docs/Course%20Projects/Best%20End%20of%20Course%20Projects/SVETLANA/Rautela-final%20project.pdf

[7] Un/Desa Project-Int/98/X70 (Uncrd), Consultant Report On Field Survey Of Natural Disasters by Dr. ANAND S. ARYA, F.N.A., F.N.A.E.,Professor Emeritus, Dept. of E.Q. Engg., IIT Roorkee http://www.humanitarianinfo.org/sumatra/reliefrecovery/cross/docs/EmergencyDisasterMitigation/UNCRD_ConsultantReportOnFieldSurveyOfNaturalDisasters_August2002.pdf

[8] Traditional inputs in disaster management: the case of Amparav, North India, *International Journal of Environmental Studies*,Vol. 62, No. 5, October 2005, 505- 515http://gov.ua.nic.in/dmmc/newsletter/IJES%20Amparav1.pdf

[9] http://mnes.nic.in/annualreport/2004-2005_English/ch8_pg1.htm

[10] http://mnes.nic.in/annualreport/2004-2005_English/ch8_pg2.htm

4.9% of total installed capacity. This capacity is achieved by implementation of over 75 projects. A close look at the annual report for the year 2006, provided by Central Electricity Authority (CEA) as well as study by Asian Development Bank(ADB)[11] with respect to hydro power development in Uttaranchal indicated that there is no participation of private sector in small hydro power development. In Appendix F of the report "Hydropower Development in India: A Sector Assessment", based on the study made by ADB they have also clearly observed that the entire installed capacity is run by state owned Uttaranchal Jal Vidyut Nigam Limited (UJVNL). Copy of the relevant report will be furnished to the DOE for verification. This makes it very clear that there is no private sector participation in small hydro development in the state and all the projects implemented so far are owned by UJVNL. The objective of the government institution to set up hydro power projects need not necessarily be for economical reasons but also as social aspects for taking up of these projects.

ADB has also pointed out in another Chapter IV of their report under Private Sector Participation "Development of hydro power projects had been impeded in the past due to a variety of reasons like (a) long gestation period; (b) capital intensive nature of projects; (c) requirement of statutory clearances; (d) geological surprises often encountered; (e) land acquisition problems; (f) law and order problems in some cases; (g) R & R problems etc., as detailed in Section IV. In over all terms, this presented a higher level of risk which the private sector is generally averse in taking. This often meant time and cost overruns of projects. Non availability of long term debt financing, credit worthiness of the utilities to whom they have to sell the power, provision of free power and front ended tariffs were also factors adversely impacting the foray of the private sector into hydro power development".

Even the Electricity regulatory commission of Uttaranchal, UERC has observed the barriers for implementation of small hydro projects in the state of Uttaranchal which they have indicated in their tariff order dated 10th November 2005.In Para 5 of the order the commission mentioned "the reasons for higher capital cost have been stated to be higher cost of civil works, transportation of men and material, cost of construction of roads/bridges and longer transmission lines etc in the hilly regions. It was even suggested that due to peculiar, unique and widely varying characteristics of each small hydro power project, putting any ceiling on the capital cost is not correct and may lead to either under-recovery of cost incurred or may lead to reduction in capital cost by compromising on the safety, reliability and optimal design of the plant particularly on account of geological surprises".
In para 10 of the order, the UERC says that the reasons for high O & M costs are "the requirement of minimum staff irrespective of capacity, higher staffing and adminstartion expenditure due to remote and hilly locations and higher R & M expenditure due to frequent repairs and outages of civil/electromechanical parts on account of high silt and adverse weather conditions".

The above could be the reasons for the private sector not coming forward to set up small hydro projects in a big way in Uttaranchal which forms part of Northern regional grid.

Based on enquiries made with various agencies in the state it has been found out that some projects are under implementation in the state of Uttaranchal and all these projects are proposing to establish projects considering CDM revenues. Their details are furnished below:

Registered Projects:

1) 22.5 MW Bhilangana hydro power project

[11] http://www.adb.org/Documents/Reports/Hydropower-Devt-India/

2) 4.8 MW Birahiganga hydro power project

Due to the barriers with respect to hydrology, geology, Low PLF, other extreme climate private sector is not coming forward in a big way to implement the projects.

It is therefore demonstrated by the PP that due to prevailing practice barriers, the absence of the project activity would have led to higher emissions in the Northern grid as it is dominated by thermal power projects.

Hence, the proposed project is additional and not the same as the baseline scenario and would not have occurred without the CDM benefits. CDM revenues are expected to leverage the project economics in case of any unforeseen outages, which may be resulted due to the above uncertainties, and also CDM revenues will help the project proponents to overcome some of these barriers.

Early Consideration of CDM:

Annex 46 of EB 41 requires project activities for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, to demonstrate that serious consideration of CDM in the decision to implement the project activity. Such demonstration, as per the Annex requires the following elements to be satisfied with documentary evidence, viz.,

a) awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project; and
b) that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

PP was aware of the CDM benefits (gathered from newspaper reports, information from other developers who have got their projects registered with CDM EB from India) and the CDM benefits were the reason as to why PP ventured into this project activity. The following paragraphs explain how the two elements stipulated by Annex 46 of EB 41 are fulfilled.

The first requirement stipulated by the Annex is satisfied by the resolution passed by the Board of Directors of the project activity on November 20, 2005, a copy of which is submitted to the DOE for validation. The resolution was passed by the Board of Directors prior to the commencement of project activity start date. The resolution reveals that CDM benefit was a decisive factor in the decision to proceed with the project. As the minutes of the decision of the Board of Directors (which is generally referred to as “Board Resolution”) is the document stipulated by EB and the resolution reveals that CDM benefit was a decisive factor in the decision to proceed with the project, the first requirement of serious consideration of CDM by the PP as required by Annex 46 of EB 41 is fulfilled.

The second requirement relates to the demonstration, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. Evidence to support this, as per Annex 46 of EB 41 includes contracts with consultants for CDM services, appointment of DOE, among others. The following chronology of events would demonstrate the parallel action taken by the PP to get the project registered as CDM activity and implement the project.

Appointment of CDM consultant : 15-04.2005
Date of preparation of DPR : June 2005
Board resolution considering CDM revenues : 20.11.2005

Implementation agreement	: 09.03.2006
Order for Electro Mechanical Equipment	: 31.05.2006*
Order for Civil Works	: 16.10.2006
Appointment of DOE	: 20.12.2006
Indian DNA approval	: 16.04.2007
Commencement of generation	: 01.09.2007
Pollution Control Board permission	: 12.03.2008

*31/05/2006 has been considered as the start date of the project activity as it was on that date that PP has entered into an agreement for supply of E & M equipment for the project activity. This was the day on which the real action of the project activity began and the project participant committed expenditure related to the construction of the project activity.

It may be added in this context, the contract with the CDM consultant is not only for the CDM services, but also includes ERPA. Thus, it could be seen that both the conditions stipulated vide Annex 46 of EB 41 has been fulfilled by the project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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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 hydro electricity project would not lead to any project emission and leakage emissions. Emission reductions are related to the electricity exported by the project and the emission co-efficient 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)**[12]**.** 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

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

happen during the crediting period. In view of this, it is proposed to apply other alternatives mentioned in the "Tool to calculate the emission factor for an electricity system". Since the power supplied by low-cost-must-run power plants[13] to the **Northern regional** grid during 2006-07 (27.1%)[14] is clearly below 50%, it was decided to apply the **Simple OM method.**

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 CO2 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)

$EF_{co2,i,y}$ = CO_2 emission factor of fossil fuel type i in the year y (tCO_2/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.

[13] Defined as Hydro, geothermal, wind, low cost biomass, nuclear and solar generation plants in the ACM 0002. (ref foot note 3 page 4).

[14] Baseline Carbon Dioxide Emission Database Version 3.0
http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Table B.5 : Operating Margin[15]

Most recent three years	2004/05	2005/06	2006/07
Operating Margin* (OM) in t CO_2 / GWh	980.10	999.20	998.46
Average of 3 years	**992.58**		

* including imports

Source: CDM Carbon Dioxide Baseline Data base, Version 3, 15th December 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)

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

$EF_{EL,m,y}$ = 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)	**628.34**	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	**810.46**	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 – Version 3**" at

http://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:

The baseline Emission factor (including Imports) of **Northern regional** grid 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 any combustion or generation of emissions from fossil fuels. However, as the project is equipped with diesel generator of suitable capacity to meet the emergency requirements of power house etc., emissions out of usage of fossil fuel (diesel) will be accounted for as project emissions based on the following equation.

$PE_{diesel,y} = F_{d,y} * Density * NCV * EF_{CO2} * OXID / 10^6$

Where $F_{d,y}$ is the quantity of diesel used during the year (Ltrs)

Density of diesel (0.82 kg/Ltr. as per Society of Indian Automobile Mfgs. http://www.siamindia.com/scripts/Diesel.aspx)

NCV is the calorific value of diesel (43 TJ/Gg as per IPCC 2006 default value)

EF_{CO2} is the CO_2 emission factor of Diesel (74.1 t CO_2/TJ as per IPCC 2006)

OXID is the oxidation factor of the coal (1 as per IPCC 2006 default value)

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.

ERy = BEy - PEy - Ly

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

Data / Parameter:	EF_y
Data unit:	t CO_2/GWh
Description:	CO_2 emission factor for the regional grid system
Source of data used:	CEA published grid emission factors
Value applied:	810.46
Justification of the choice of data or description of measurement methods and procedures actually applied :	Central Electricity Authority (CEA) values (CO2 baseline database Version 3) have been used for authenticity of the data, available publicly by Govt of India with a view to obtain uniformity of approach in the country towards a common objective.
Any comment:	--

Data / Parameter:	EFco2, i
Data unit:	t CO2/TJ
Description:	CO_2 emission coefficient of fuel type i
Source of data used:	IPCC 2006 default values
Value applied:	74.1
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 to meet the emergency power requirement of the project. Hence only emission factor of diesel is provided in the parameter

Data / Parameter:	OXID
Data unit:	Not applicable (constant)
Description:	Oxidation Factor of Diesel
Source of data used:	IPCC 2006 default values
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC value have been used for the fuel type since no country specific oxidation factor is available
Any comment:	--

Data / Parameter:	NCV_{Diesel}
Data unit:	*TJ/Gg*
Description:	Net calorific value of diesel
Source of data used:	IPCC Default value (*"2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Tables 1.4 and 2.2 "*)

Value applied:	43
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC value have been used for the fuel type since no country specific oxidation factor is available
Any comment:	--

Data / Parameter:	$Density_i$
Data unit:	kg/Lit
Description:	Density of the fossil fuel used for the project site (Diesel)
Source of data used:	Society of Indian Automobile Manufacturers (SIAM) *http://www.siamindia.com/scripts/Diesel.aspx*
Value applied:	0.82
Justification of the choice of data or description of measurement methods and procedures actually applied :	The SIAM value is considered as it is publicly available and can be referred as authentic source.
Any comment:	--

B.6.3 Ex-ante calculation of emission reductions:

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Baseline emissions

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

BE_y = 29.465 GWh ×810.46 tCO_2e/GWh

BE_y = 23,880 tCO_2

Project emissions

The project emissions due to the combustion of diesel are considered as zero for estimation of ex-ante calculations of emission reductions. The corresponding emissions from the combustion of diesel for operation of DG set during emergency situation are considered negligible. However the quantity of diesel combusted in the project activity will be monitored during each year of crediting period (B.7.1) and deducted from baseline emissions, provision has been made in Section B.6.1 by providing formula to calculate project emissions. Since estimation of quantity of diesel consumption is unpredictable before actual operation of the project and also to simplify the ex-ante calculations of emission reductions, excluding project emissions is considered reasonable.

PE_y = 0 tonnes * 74000 tCO_2/TJ

PE_y = 0 tCO_2

Leakage

No leakage is applicable

Emission reductions

ER_y = BE_y - PE_y - L_y

ER_y = 23,880 - 0 - 0

ER_y = 23,880 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 (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2009	0	23880	0	23880
2010	0	23880	0	23880
2011	0	23880	0	23880
2012	0	23880	0	23880
2013	0	23880	0	23880
2014	0	23880	0	23880
2015	0	23880	0	23880
2016	0	23880	0	23880
2017	0	23880	0	23880
2018	0	23880	0	23880
Total (tonnes of CO_2e)	**0**	238800	**0**	238800

In the above table the year 2009 corresponds to 01.11.2009 to 31.10.2010. 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_{grossy}
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	31.18 GWh
Description of measurement methods and procedures to be applied:	For measuring the delivery/import of energy by the project activity at the interconnection point, one set of main meter(part of interconnection facilities and check meter)shall be provided by the company and the corporation respectively at the interconnection point.
QA/QC procedures to be applied:	Meters will be calibrated as per industry standards. Accuracy class for active energy measurement shall be 0.5 as defined in applicable IEC/Indian Standards. The main meter and the check meter shall be test checked for accuracy class at least fifteen days before synchronisation of the first unitand every six months thereafter
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
Source of data to be used:	On-site measurements
Value of data	1.715 GWh
Description of measurement methods and procedures to be applied:	The difference between the gross energy generation and the net electricity export to the grid system can be arrived as auxiliary consumption of the project activity
QA/QC procedures to be applied:	If the data is calculated as the difference between gross and net power export, no QA/ QC procedures are applicable, as the both parameters have already undergone the QA/QC procedures.
Any comment:	

Data / Parameter:	EG_y
Data unit:	GWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	On-site measurements
Value of data	29.465 GWh
Description of measurement methods and procedures to be applied:	For measuring the delivery/import of energy by the project activity at the interconnection point, one set of main meter (part of interconnection facilities and check meter) shall be provided by the company and the corporation respectively at the interconnection point.
QA/QC procedures to be applied:	Meters will be calibrated as per industry standards. Sales records to the grid and other records are used to ensure consistency. Accuracy class for active energy measurement shall be 0.5 as defined in applicable IEC/Indian Standards. The main meter and the check meter shall be test checked for accuracy class at least fifteen days before synchronisation of the first unitand every six months thereafter
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:	Grid electricity import to the project activity during the year y
Source of data to be used:	On-site measurements
Value of data	0 GWh
Description of measurement methods and procedures to be applied:	For measuring the delivery/import of energy by the project activity at the interconnection point, one set of main meter(part of interconnection facilities and check meter)shall be provided by the company and the corporation respectively at the interconnection point.
QA/QC procedures to be applied:	Meters will be calibrated as per the industry standards. Project proponent will pay to the UPCL based on the meter reading recorded in the import meter. The maintenance and/or other quality control measures are taken by UPCL, since any false reading in the meter is a financial loss to UPCL. Hence, UPCL give high priority in quality control of the import meter. Since, the data item is not under the control of project proponents, no QA/QC procedures are provided here.
Any comment:	

Data / Parameter:	$F_{i,y}$
Data unit:	*Tonnes/ kilo litres*
Description:	Quantity of fossil fuel type *i* combusted in the project plant during year *y*
Source of data to be used:	On-site measurements
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 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 weigh bridge meter will under go calibration/maintenance subject to appropriate industrial standards. The data recorded can be cross checked against the fuel purchase receipts.
Any comment:	

B.7.2 Description of the monitoring plan:

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This 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 Uttarakhand state in India. The monitoring plan, which will be implemented by the project proponent, describes about the monitoring organisation, parameters to be monitored, monitoring practices, QA and QC procedures, data storage and archiving.

Procedures for training of monitoring personnel

The project would employ qualified and experienced persons for plant operation. Basic personnel to deal with monitoring of parameters are plant operators. The project would maintain standard log sheets and formats to record the monitoring parameters. The persons would be given proper training to maintain the plant records. The plant manager would be the designated person to verify, compile and archive all the

monitored data. The parameters to be monitored during the crediting period would be provided in a table format to the designated person. The person would be provided necessary training with respect to maintenance the relevant monitoring records to enable him/her to deal the monitoring independently. The training would be provided to the monitoring personnel for the monitoring of the following parameters:

- Energy Export
- Energy Import
- Gross energy generated
- Auxiliary consumption
- Periodical Calibration of monitoring equipment.

Further, any uncertainties in monitoring procedure would be handled by external GHG experts.

Procedures for documentation and storage:

The Plant operators would record the parameters every day during the operation of the plant. Since the project is a hydel power project only the following energy related data, needs to be monitored:

Gross Energy generation, Auxiliary consumption, Energy Export and import and diesel consumption for the DG set. The Energy meter readings would be taken during a particular time of every day to ensure constant recording frequency of parameter. The recorded parameters would be documented every day in the standard log books maintained at the plant.

The day to day records would be verified by plant manager, compiled and documented for preparation of internal audit reports.

The company might introduce an internal audit system for documentation and safe storage of data. Internal auditing would be carried out as per the monitoring plan and whenever necessary. An internal audit report would be prepared for review by the higher authorities not less than the rank of Chief Engineer specified by UPCL. The internal auditor could be an outside entity or one of the senior managers of the plant. The internal auditor would be required to verify the records independently with reference to the power exported and imported. The reports would be submitted periodically to the Chief Engineer designated. Internal audit reports are the basic documents for the monitoring and storage of plant operational data.

Procedures for Corrective actions

The parameters to be monitored during a crediting period would be compiled as internal audit report for every quarter of each crediting year and submitted to the Board of Directors for review. The parameters include the Gross generation, Auxiliary consumption, Energy export, import and diesel consumption for the DG set. Based on the audit report submitted by plant manager, the Chief Engineer would assess the performance of plant. The Chief Engineer would discuss and recommend necessary mechanism to improve the operational efficiency of the plant and directs the respective person to rectify the problem.
The report would also cover comments on variations in the records with reference to the above parameters compared to the bills submitted to the utility or records maintained. The Board would consider these variations in their review meeting and instruct the concerned personnel of the plant to rectify the variations and report the action taken in the next review meeting.

Monitoring Organisation

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the Board of Directors. The Boards may delegate the same to a competent person identified for the purpose. The identified person, in the rank of General Manager, will be the in charge of GHG monitoring activities for the project activity. A team of experienced personnel in various disciplines will assist the General Manager (mechanical and electrical) with experience in plant operation, measurements and management. The primary responsibilities of the team is to measure, monitor, record and report the information on various data items to the General Manager, in accordance with the applicable standards. Periodic calibration of various instruments used in the monitoring of GHG related data and record keeping of the same also will be the responsibility of the team.

The responsibility of review, storage and archiving of information in good condition lies with the General Manager. General Manager will undertake periodic verifications and onsite inspections to ensure the quality of the data collected by the team and initiate steps in case of any abnormal conditions. The General Manager will review the data collected by the team and suggest corrective actions wherever required. An internal audit report will be prepared for review by the Board of Directors which will be later submitted for verification to an independent entity (DOE). Board of directors will examine the internal audit reports and will in particular take note of any deviations in data over the norms and monitor that the corrective actions have resulted in adherence to the standards.

The team including the General Manager will be appointed by the Boards of Directors of the company, in advance before the start of project operations. The General Manager will report to the board of directors and seek guidance in case of conflicts or difficulties in order to maintain the monitoring organisation in good spirit.

The implementation of the project was completed in July 2007. The General Manager has been entrusted with the authority and responsibility of measurement, monitoring, reporting, calibrating and maintenance. The General Manager is also responsible for evolving and following management systems, procedures related to documentation/record keeping, corrective actions, internal audits and performance reviews. Management systems and procedures for maintaining necessary records including audit thereof is a part of company's operational system.

Parameters Requiring Monitoring

This monitoring plan requires monitoring of all parameters indicated in section B.7.1. Necessary documents required for verification of the data will be maintained for later archiving. Using the power exported to the grid, emission reductions will be estimated. Emission reductions generated by the project will be monitored at regular intervals and will be reported to the board of directors.

QA & QC Procedures

The project employs latest state of art microprocessor based high accuracy monitoring and control equipment that will measure, record, report, monitor and control of various key parameters of the plant. These monitoring and controls will be the part of the Control Systems of hydroelectric plant. Necessary standby meters or check meters as required would be installed, to operate in standby mode or when the main meters are not working. 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.

Data Storage & Archiving

All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Methodology adopted for determining base line emission factor is the Combined Margin (CM) emission factor of the generating mix in the Northern regional grid system, which will represent the intensity of carbon emissions of the grid system. The baseline emission factor is adopted from the "CO_2 Baseline Database" published by CEA for the latest available year for the Northern grid and the same is used for the future projection and will be reviewed each year based on data published by CEA. The monitored data will be presented to an independent verification agency or DOE to whom verification of emission reductions is assigned.

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: 01/03/2008

Name of the person / entity determining the baseline: Zenith Energy Services (P) Ltd., Hyderabad, India,

Contact information of the above entity furnished below:

Organization:	Zenith Energy Services (P) Limited
Street/P.O. Box, Building:	10-5-6/B, My Home Plaza, Masab Tank,
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500028
Country:	India
Telephone:	+91- 40- 2337 6630, 2337 6631
FAX:	+91- 40- 2332 2517
E-Mail:	zenith@zenithenergy.com
URL:	www.zenithenergy.com
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Reddy
Middle Name:	Mohan
First Name:	Attipalli
Mobile	+91- 9849408485
Direct Fax	+91- 40- 2332 2517
Direct Telephone	+91- 40- 2337 6630, 2337 6631
Personal E-mail	mohan@zenithenergy.com

The above entity is not a project participant.

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:

>>
31/05/2006 (Agreement executed with the supplier of Electro Mechanical Equipment)

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

>>
30 years

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

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:

>>
01/11/2009 or from the date of registration whichever occurs later.

C.2.2.2. Length:

>>
10 y – 0 months

SECTION D. Environmental impacts

>>

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

>>
The total project cost (US$ 7.36 million) is less than the prescribed cost limit for small-scale projects i.e. US$1000 million; hence in accordance with the Ministry of Environment and Forests (Environment

Impact Assessment Notification S.O. 60 (E), dated 27/01/1994), Government of India, Environmental Impact Assessment is not required for the proposed project.[16]

The establishment of Debal hydro project is not likely to have any significant adverse affect on the environment during execution or after commissioning. As the size of the project is small, no impact is expected on the surrounding areas.

The scheme does not involve any impounding of water and hence no submergence or rehabilitation activity is needed. The construction of this project neither alters nor contributes to rising of water level in the stream; thereby do not inhibit migration of local fauna, if any. This project shall not also affect the aquatic life available in this stream, which in any case, at present is insignificant.

The schemes will not have any risk by drainage discharge from the escape channel, as the amount of discharge will be quite low. The penstock and power channel will be provided with proper crossings at the places of usual migration routes. There is no risk of health to the people as there is no storage of water or the formation of reservoir and as such the air and water environment is not affected. There is no risk of soil erosion due to the project. There will be positive impact from the commissioning of the project as it may bring a change in life and economy of the local people with the availability of power. The project will open up opportunities of self-employment and boost their income.

To mitigate the noise, greenery in the form of native local trees with a good crown cover as a buffer is planned in surrounding areas. Construction equipment generating minimum noise and vibration will be employed.

The entire catchment area of the proposed project area is sparsely populated because of steeply sloping mountain ranges, remote location, inaccessibility and lack of economically exploitable resources.

There will not be any change in the landscape since the project to be constructed is run of river schemes causing no hindrance to the normal flow of water.

There will be no adverse impact on forest, wild life or fish life by this project. The project will not affect the biotic and other components of the forest system, the river bed and the area in general. No ecological disturbances, backlashes or boomerangs are anticipated in the project area upsetting the ecological balance.

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:

>>

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

SECTION E. Stakeholders' comments

>>

[16] Environment Impact Assessment Notification S.O. 60 (E), dated 27/01/1994

http://envfor.nic.in/legis/eia/so-60(e).pdf

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

>>

The following stakeholders have been identified for the proposed project activity

Name of the Stakeholder	Brief Description and Responsibility
Uttarakhand Jal Vidyut Nigam Limied(UJVNL)	A Govt.of Uttarakhand nodal agency for short listing of private bidders and selection of credible developers and allotment of projects
Uttarakhand Power Corporation Limited (UPCL)	Purchases power from the project. Power purchase agreement is to be executed to determine the tariff and other terms of purchase.
Irrigation department	Accords clearance for utilizing water resources in Uttarakhand state.
Revenue Department	Gives consent to establish the project and registers the project in revenue records of the Uttarakhand state.
Local village Panchayat	Accords permission for setting up of the project under the jurisdiction of the village.
Forest Department	Provides permission for utilizing forestland for construction of the project.
Uttarakhand Electricity Regulatory Commission (UERC)	A nodal agency which determines the power purchase policy in the State of Uttarakhand.

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

Stakeholders Involvement:

Uttarakhand Power Corporation Limited (UPCL): The company has signed an Implementation Agreement (IA) with Govt. of Uttaranchal state on 9th March, 2006.

Irrigation Department: The project has obtained "No Objection Certificate" from the Irrigation department vide letter no. 3434/Irrig./P-3G dated 22nd December, 2005.

Revenue Department: The project has obtained "No Objection Certificate" from the Revenue department vide letter no. 1267/26(2004-05) dated 20th December, 2005.

Power Purchase Agreement: The Project has entered in to Power Purchase Agreement (PPA) for 5 MW with Uttaranchal Power Corporation Limited (UPCL) on 10th November, 2006.

Local Village Panchayat: The project has obtained 'No Objection Certificate' from local Gram Panchayat on 18th April, 2006.

Uttarakhand Electricity Regulation Commission (UERC): The tariff order for hydro-electric power-stations with capacities above 1 MW and up to 25 MW under Section 62 (1) (a) of Electricity

Act, 2003 dated November 2005 is applicable and has been issued by Uttaranchal Electricity Regulation Commission (UERC).

As per the EIA Notification S.O.60(E) dated 27/01/1994, clause no.3(b), 2[I(a)] & Schedule-I para 2; a small scale hydro project is not required to conduct any Public Hearing. In the absence of any such requirement, the project proponent approached all the concerned stakeholders for their consent/license for setting up of the project and had obtained their approvals/clearances for the same. The local populace had also issued their consent to the project in the form of an NOC from the Village Gram Panchayat which representsn the poulation in the village.There is no such requirement to involve NGO's in the stake holder consultation and all the Government agencies and the local village panchayat are only involved for the process.

E.2. Summary of the comments received:

>>

No comments have been received.

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

>>

As no comments have been received, hence no report is applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Chamoli Hydro Power Pvt. Ltd
Street/P.O.Box:	Road No: 41, Jubilee Hills
Building:	Plot No. 813
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 033
Country:	India
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FAX:	+91-040-23546759
E-Mail:	chamolihydro@yahoo.com
URL:	----------
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Reddy
Middle Name:	Sadasiva
First Name:	B
Department:	
Mobile:	
Direct FAX:	+91-040-23546759
Direct tel:	+91-040-23541474
Personal E-Mail:	chamolihydro@yahoo.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 METHODOLOGICAL TOOL. 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 3 (15th December 2007)"

Annex 4

MONITORING INFORMATION

Monitoring information is already provided in section B.7.2