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

CONTENTS

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:

>>

Title: "5 MW renewable energy project for a grid system" at Rohru Tehsil, Shimla District in Himachal Pradesh, India.

Version: 03

Date :29/03/2008

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

>>

- The purpose of the project is to produce clean electrical energy in a sustainable manner, optimising the utilization of renewable hydro resource in order to contribute to meet the local power demand in a system already overwhelmed by power production by thermal power plants utilizing fossil fuels.

  The project activity is a run of the river scheme across Andhra Khad, a tributary of Pabbar River near Gaskuwari village of Shimla District in Himachal Pradesh state. The project activity has an installed capacity of 5 MW and an annual gross energy production of 19.71 GWh. The project is constructed upstream of the existing 16.95 MW Andhra-I hydroelectric plant of Himachal Pradesh State Electricity Board (HPSEB).

  The energy produced will be sold to the state owned public entity HPSEB under a Power Purchasing Agreement (PPA). The supply of electricity to the Northern Grid of India leads to displacement of carbon-intensive electricity by electricity from a renewable energy source

- The project activity utilises potential energy available in flowing water for power generation.. The process involved is converting the kinetic energy available in the water flow into mechanical energy using hydro turbines and then to electrical energy using alternators. Therefore, no fossil fuels are involved for power generation. The project operation will contribute to sustainable development substituting fossil fuel generated power, reducing emissions of GHGs while responding to increasing energy demand, contributing to stabilize the price of power to consumers, reducing the dependence on fossil fuels.

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

Apart from the generation of electrical power, the project also supports to the following.

a) Sustainable development, through utilisation of renewable hydro resources available in the project region.
b) Rural development due to the location of the project being in rural area.
c) Capacity addition to the present installed capacity and increase in the energy availability.
d) Generation of additional employment.

- View of project participant about the project activity's contribution 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.

a) The project activity results in alleviation of poverty by generating direct and indirect employment during construction of the project as well as during operation. The project creates indirect employment opportunities for about 250 unskilled workers for a period of 30 months, which otherwise would not have happened in the absence of project. In addition, the project creates direct permanent employment for about 30 persons during operation of the project.

b) Project proponents will mobilise investment to the region to an extent of about Rs.258 millions which otherwise would not have happened in the absence of the project activity. This is a significant investment in a remote area often characterized by landslides due to heavy rains during the monsoon season.

c) This project activity results in extending the electric supply system to the remote villages. Generation from small/micro power station and feeding the power into local 66 kV system will greatly improve the much needed assured quality power in the far-flung and isolated areas thereby opening up the economy and giving a boost to food and tourism industry which will cater jobs for local people.

d) Hydro generation can not only meet the growing need of power for industry, agriculture and electrification, but also be the biggest source of income to the state by the way of sale of electricity to the neighbouring states.

e) More and more rural industries will be set up and new opportunities for development will be created as a consequence to the hydroelectric project in the area. This will result in infrastructure development, which ultimately lead to the rural development and prevent the migration of rural poor people to cities.

f) The project will result in reduction of local air pollutant emissions (NO_x, SO_2, particulates, etc.) as well as greenhouse gases, by displacing thermal power generation. In addition, it will respect regulations on residual water flow and thereby avoid negative impacts on the fauna and flora in the Andhra Khad river.

g) 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 rivulets and encourages setting up such new projects in future.

h) 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.

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

A.3. Project participants:

>>

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	**Private Entity :** Gowthami Hydro Electric Company (P) Limited	No

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

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

>>

A.4.1.1. Host Party(ies):

>>
India

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

>>
State: Himachal Pradesh

A.4.1.3. City/Town/Community etc:

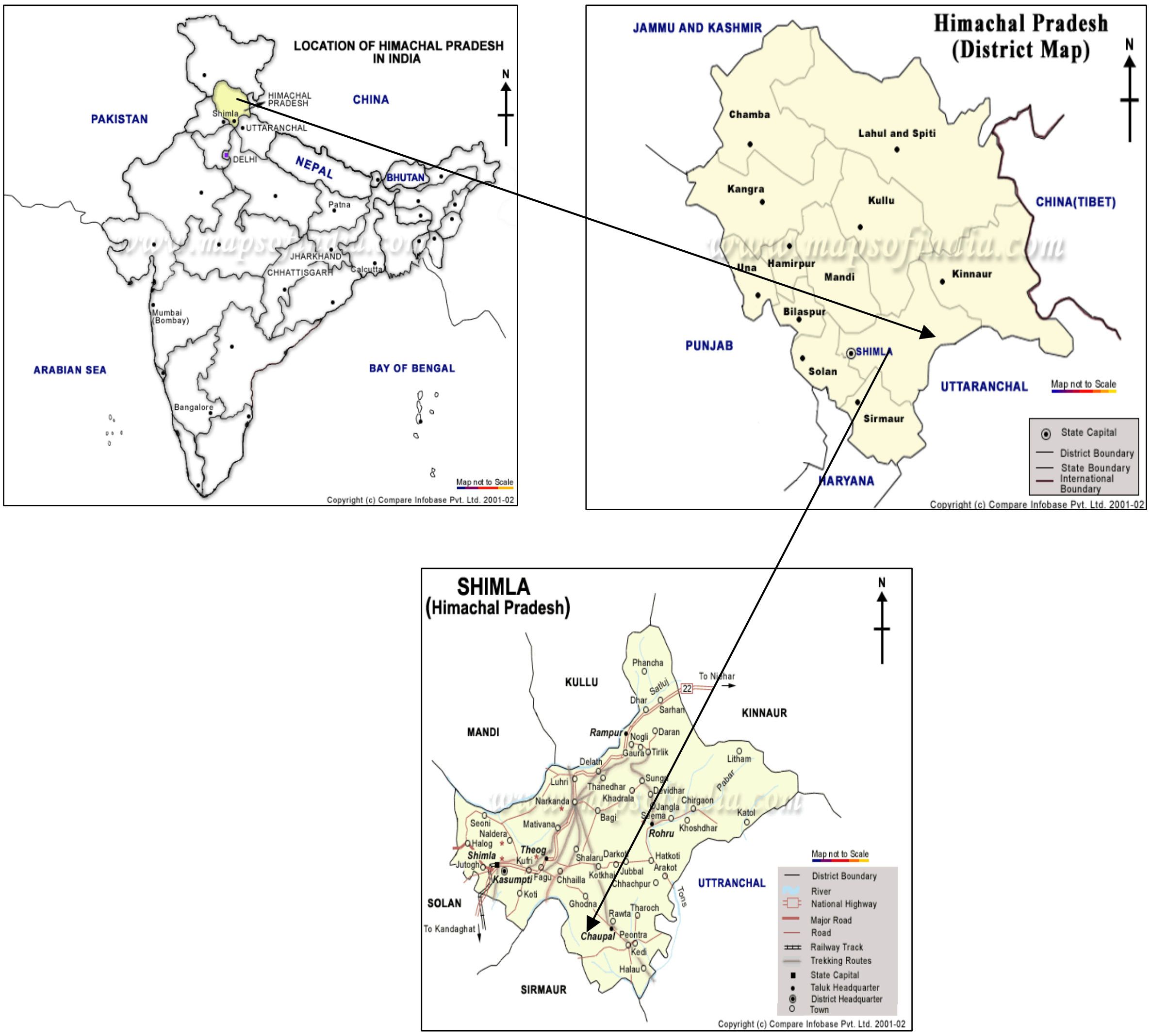
>>
District: Shimla
Tehsil : Rohru
Village : Gaskuwari

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

>>
The proposed project envisages exploitation of water flowing through the region in the river Andhra Khad, which is the tributary of the river Pabbar.

The project is located in Gaskuwari Village, Rohru Tehsil, Shimla District in the state of Himachal Pradesh. The diversion weir is to be located close to the village Hingori and power house is near village Chirgaon, accessible by motorable road, at a distance of 10 kms. The plant site is located at 148 kms by road from Shimla via Theog, Rohru and Chirgaon. The nearest railhead from the project site is Shimla on Narrow gauge and Kalka on Broad gauge. The geographical co-ordinates of the project is $77^{o}\ 0^{/}$ to $78^{o1}19\ ^{/}$ East (Longitude) and $30^{o}45^{/}$ to $31^{o}44^{/}$ North (latitude) .

Physical location of the project is marked in the maps below.



Map 1: Location of India, Himachal Pradesh state in India and Location of the project sites in Shimla District of HP

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

>>

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: Type I – Renewable Energy Projects
Category I.D: Grid connected renewable electricity generation

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 10, 22 December 2006, which includes hydro for electricity generation for a grid system.

Application of environmentally sound and safe technology

The technology of power generation process using hydro resources is converting the kinetic 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 voltage of nearest grid sub-station for proper interconnection and smooth evacuation of power. In this process there are no greenhouse gas emissions or burning of any fossil

fuels. Thus electricity is generated through sustainable means without causing any negative effect on the environment. Therefore the technology is environmentally safe and sound.

Technical details of the project activity
No technology transfer is envisaged for the proposed CDM project activity.

The proposed project shall use the potential energy in a flowing river by diversion weir for running Horizontal Francis turbines to generate power. The components involved in the hydro electric scheme consists of construction of a trench type diversion weir, intake chamber, de-silting 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. Power 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.

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

Parameter	Specifications
Hydrology	
Gross Head	156.7 m
Design Head	154 m
Turbine	
Type of hydro turbine	Horizontal Francis
No. of generating units	2
Capacity of each generating units	2.5 MW
Generator	
Type	Synchronous Brushless
Rated speed	750 rpm
Generation voltage	11 kV
Power Factor	0.9 (lag)
Frequency	50 Htz
Power Evacuation	
Transmission Voltage	66 kV
HPSEB Substation/Switchyard	16.95 MW Andhra HEP Switchyard
Switchyard distance from site	8 kms
Energy (Optimum year)	
Gross Energy	19.71 GWh
Auxiliary Consumption, outage, transmission losses etc., @ 8%	1.58 GWh
Net Energy Export to HPSEB grid	18.13 GWh

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

>>

The expected emission reductions are calculated based on the net electricity sales and combined margin emission factor of 793 tCO_2/GWh for the Northern Grid. Annual estimates of emission reductions as well as total emission reductions for the chosen 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
2007-08	14380
2008-09	14380
2009-10	14380
2010-11	14380
2011-12	14380
2012-13	14380
2013-14	14380
2014-15	14380
2015-16	14380
2016-17	14380
Total estimated reductions (tCO_2 e)	**143,800**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	**14,380**

In the above table the year 2007-08 corresponds to 01.12.2007 to 30.11.2008. Similar interpretation shall apply for remaining years.

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

>>

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:

The 5MW small hydro project is not a debundled component of a larger project activity as explained below.

As per debundling rules specified in Appendix C of the Simplified Modalities and Procedures for Small Scale CDM project activities, a proposed small scale project activity shall be deemed to be a debundle 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;

- With the same project participants;
- in the same project category and technology / measure; and
- 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

No other CDM activity has been undertaken by the project participant, which is in the same project category and 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

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

>>
Title: Type I, Renewable Energy Project.
Reference: I.D. Renewable Electricity Generation for Grid
Version: 10, Scope : 01, 22 December 2006

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

>>
The project involves installation of a grid-connected hydropower plant of 5 MW capacity. Hence it qualifies for methodology AMS I.D.

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 through out the crediting period. To determine the capacity of the power plant two important inputs are required namely the head available and discharge of water in the stream. The hydrology studies carried out have established the envisaged capacity of the plant. The design head available has been estimated as 154 m. Based on the head available and discharge, the optimum capacity of the power plant has been envisaged at 5 MW.

By keeping the above considerations, and also the maximum electricity generating capacity is 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:

>>
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 around the diversion weirs, 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 this project is metered and accurately quantifiable.

B.4. Description of baseline and its development:

>>
As per the Para 9 of approved methodology I.D. Version 10, 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 approved methodology ACM 0002.

OR

b) The weighted average emissions (in kg CO_2equ/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 through out 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 Combined Margin emission factor for the Northern Grid is derived from the CO_2 Baseline Database of Central Electricity Authority, Ministry of Power, Government of India (Version 2.0, June 2007, available at www.cea.nic.in). The CEA database was prepared specifically for application by grid-connected CDM projects, and is updated annually.

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:

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 any way. Project participants identified the following barriers for the project activity.

A. Investment Barriers

Financial barrier:

The project proponent has worked out investment analysis for a period of 20 years based on the following assumptions.

Table B.2: Assumptions for Financial Analysis

Project Cost	Rs.258 millions
Means of Finance: - Share Capital - Term Loan	 Rs. 64.50 millions Rs. 193.50 millions
Annual net energy export	18.13 GWh
Electricity tariff /kwh	Rs.2.50 without any yearly increase
Interest on Term Loans	10 %
Operation & Maintenance	1.5% on Capital cost with yearly escalation of 5 %
Depreciation	3.4%
Loan Period	8.0 years
Tax holiday U/s.80IA	10 years
Minimum Alternate Tax (MAT)	7.841 %
Annual emission reductions	14,380 tCO_2
CER Price	Euro 8
Exchange Rate INR = Euro	56

The IRR is the most common financial indicator used by bankers as well as investors to ascertain the financial viability of the project. The IRR for the project activity is worked out to 12.25%. The IRR is low compared to the Weighted Average Cost of Capital (WACC) worked out at 15.92%.

WACC represents the weighted average cost of debt and equity funds invested in the project and therefore the minimum rate of return which the project should earn to merit consideration of investment in the project..

In respect of cost of equity the same is estimated based on CERC guidelines. CERC has fixed a post tax return of 14% on equity[1]. A detailed working has been done to ascertain the required rate of return to declare 14% post-tax return on equity. The approach along with the workings made for estimating the WACC will be part of the PDD. While working out the IRR subsidy available from Ministry of Non-conventional Energy Sources (MNES) to an extent of Rs.41.25 millions has also been taken into account.
Appropriateness of WACC as benchmark:

The investment in the hydro power sector is the first investment for the project proponent and therefore, there was no opportunity for the company for evaluating other investment projects of similar risks in the past. The company Gowthami Hydro Electric Company Private Limited was incorporated in the year January 2003 with the main object of implementing the present project activity in the State of Himachal Pradesh. The company does not have any internal bench mark and therefore considered WACC as the suitable bench mark for evaluating the attractiveness of the investment in a small hydro project.

The above contention derives its strength from various publications on corporate finance "Ezra Solomon", the much celebrated author in financial management, had demonstrated long back that the minimum acceptance level of return for an incremental investment is equal to is the rate of discount which equates the flow of future payments to owners and creditors with the current value of the firm. Within the framework of Solomon's restrictive assumption, this true cost of capital is identical to weighted average cost of capital. Thus, incremental investments yielding at least the weighted average cost of capital provide a net return on the equity capital, which is at least equal to the rate of return required by the owners of the

[1] http://cercind.gov.in/28122004/CERC%20new%20terms%20&%20conditions%20of%20tariff%20_2004-09_.pdf

firm" (*Raymond R. Reilly and William E. Wecker, On the Weighted Average Cost of Capital, Journal of Financial and Quantitative Analysis, January 1973 pp123-126*).

Further the appropriateness of WACC as the benchmark has been upheld James C. Vanhorne the much celebrated author on corporate finance. The accepted principle in financial management is that a project would be accepted if the IRR>WACC and would be rejected if IRR<WACC. In the above background, it could be appreciated that WACC is an appropriate indicator against which the financial viability of the project activity could be assessed.

Salvage Value:

For the purpose of investment analysis, the salvage value is considered at 100% of the cost of land and 5% of the cost of plant and machinery, which is very conservative having regard to the fact that the assets in hydro power projects are built for the specific project site and the plant and machinery is subject to high wear and tear caused by various geographical factors. It should be noted that even with such optimistic assumptions, i.e., recovering 5% of the cost of project specific plant and machinery after 20 years of operation, the project IRR (12.25%) works out to less than the benchmark return (15.92%).

Soft copy of detailed financial calculations are furnished separately.

IRR for the project activity without CDM revenue works out to 12.25 % and improves to 14.42 % considering revenue from CDM.

Therefore it is evident that the project is not attractive without CDM revenue and the CDM Revenue will enable the project proponent to reach the bench mark return on investment.

Sensitivity Analysis

A sensitivity analysis has also been conducted for the project activity considering a decrease / increase in PLF by 10 %.

Table B.3: <u>Sensitivity Analysis</u>

Post Tax IRR	**IRR without CDM Revenue (%)**	**IRR with CDM Revenue (%)**
Base Case	12.25%	14.42%
10% Increase in Generation	14.06%	
10% Decrease in Generation	10.41%	

As could be seen from the above, even under the most optimistic condition of a 10% increase in PLF, the project IRR will not equal the WACC (required return). The condition of the project will be worse, if the PLF goes down by 10%. Thus, the IRR is quite sensitive to any variation in the PLF. This sensitivity is sought to be overcome by CDM revenue. Hydro power generation, particularly in Himachal Pradesh is subjected to several barriers, some of which are discussed subsequently.

In view of the above it is concluded that CDM project activity is unlikely to be the most financially attractive proposition.

B. Other barriers

Lack of Infrastructure

The project location is underdeveloped hence infrastructure such as roads, electricity, communication, transportation and proper civic amenities are not available. The project promoters are required to develop these facilities before implementation of the project. Steel and cement required for project construction have to be procured from Chandigarh (265 kms) and Darlaghat (220 kms) respectively which will have substantial impact on the cost of these materials.

Only unskilled labour is available locally or in the adjoining area and the same will be employed. Suitable skilled workmen and technicians, for skilled works of various components, are not likely to be available in and around the project area and may have to be brought from other parts or neighboring states. Retaining the available skilled manpower for long time is difficult due to poor accommodation and transport facilities. As the location is far off and inaccessible it is difficult to provide necessary technical skills and spares in case of breakdowns, necessitating long shutdown requiring heavy expenditure and loss of revenue.

Construction Risks

The climate of Andhra basin is extremely harsh and cold during winter and is pleasant during summer season. Temperature falls below zero degree centigrade during winter and rises to about 30 degrees centigrade during summer. The catchment area gets rainfall from South-West monsoon and snowfall in winter due to Westerly disturbances. A part of the catchment area in the upper reaches is above permanent snow line and remains snow-clad. In addition, due to elevation of power house at 2100 meters above sea level, work is hindered during winter season from approx. December to March. This again translates into risks of delay for the construction and start of revenue generation.

Geological Barriers

- Flash Flood

Andhra Khad is a tributary of Pabber river. This khad has a history of flash floods which normally occur during rainy season (June- September). These floods have caused enormous damage in the past. It was understood that floods occurred in the year 1997 (11th August), 2000 and 2005. In 1997, a number of people were reported dead apart from substantial damage to the existing 16.95 MW Andhra Stage-I hydro project, owned and operated by HPSEB. The power plant was shut down for more than one and half years. On 5th July 2005 there was a flash flood which caused damage to the roads, intake works, retaining works in dumping areas and along the roads owned by the project proponent. Materials such as RCC laggings, steel ribs and rock bolts were also washed away. LT lines laid by the company were damaged resulting in disruption of power supply for about three months. Trash rack of trench weir of Andhra Stage-I was totally damaged and RCC box were blocked with boulders and muck. This incidence of flash floods presents a significant risk and barrier for this project as the diversion weir and the powerhouse of the proposed scheme is located just about 2.6 kms and 0.75 km respectively from the diversion weir of existing 16.95 MW Andhra stage-I HEP.

- Earthquake

From the seismic zoning map of India (I.S. 1992-44), the project site lies in the seismic zone IV. The project area has experienced five major shocks in the past. Recently, the area experienced shock of Uttar Kashi earthquake (20th October, 1991, isoseismic IV-VII M.S.K Scale). The epicenter tract lies within 70 km radial distance from the project area. The earthquake is reported to have a magnitude of 6.6 on the Richter scale and focal length of 12 km. The area also experienced another earthquake of magnitude 5 in 1994 (Refer Page No: 39, Seismicity of the Area, Section 5, Geology of DPR). Thus the project area and its components are

vulnerable to any earthquake in future. Project proponent will have to consider these issues while implementation of the project, which leads to higher investment.

- Land Slide

In addition, there is a relevant risk of land slides. Normal annual rainfall in the region is about 998 mm. In the rainy season, heavy rain falls are common, resulting in a risk of land slides which can damage the access roads, power supply, and project infrastructure such as RCC laggings, steel ribs etc. The resulting damages are multiple and include delays in the construction, repair cost for physical damages, as well as lost revenues if plant operation is affected.

Hydrological Barriers

- Inadequate Rainfall Data

The actual rain gauge data is not available for the Andhra khad. The nearest rain gauge station is at Rohru. The rainfall data from 1951 to 1972 and from 1981 to 2001 is available and the average works out to 998.07 mm (Refer Page No: 3, Rainfall Data of DPR). Considering the same pattern of rainfall in the Andhra Valley, may lead to error in the actual calculation.

- Snowfall

There is no snow gauge in the Andhra Khad Valley. Only the snowfall data of Khadrala located at 2800 m above M.S.L. measured by the Forest Department of Himachal Pradesh is available for the year 1962-69. This data is convincingly incomplete and potentially outdated.

- Discharge

The discharge of the Andhra Khad at the diversion site was observed for a period of 15 months starting from 1.12.2000, which is not sufficient for estimation of discharges for the long term period

From the above it can be observed that the dependability factors for this project such as various flows, mean rainfall have to be stimulated from incomplete and potentially outdated data. This represents a major risk for any investor as the key data on nearby catchments characteristics such as run-off, absorption etc., are not available at the project planning stage. In the absence of reliable data for estimation of power generation, the project proponent has considered the power generation achieved by Andhra Khad I operated by HPSEB which is a downstream project.

The generation details of Andhra Khad I for four years ending March 2004 are furnished below (data from HPSEB).

Year	Power Generation (GWh)	PLF (%)
2001-02	59.365	40%
2002-03	69.085	47%
2003-04	69.537	47%
2004-05	52.914	37%

The average for the above four years worked out to 42.75 % and is considerably less for the year 2004-05 at 37%. The proposed project is in the Andhra Khad of Yamuna Basin, same as that of the existing 16.95 MW Andhra Stage-I project, which is in the downstream of the proposed project at a distance of only 8 kms. Hence the PLF of the proposed 5 MW project is considered above the average PLF of past 4 years of 16.95 MW Andhra stage-I (i.e.) 45%, the estimation of power generation would be more realistic for the project activity.

B. Common Practice Analysis

Generally entrepreneurs flock to a particular project activity if it yields a return commensurate with the risk involved. In other words, the project activity should meet the profit *expectation* of the entrepreneur. Flocking of entrepreneurs to a particular project activity renders the project activity a *common practice*. Therefore, *common practice* signifies the inherent profitability (for the like-minded entrepreneurs) of the project activity. A corollary to the theorem is that entrepreneurs would not be attracted to a project activity if it fails to meet their profit *expectation* and hence such projects would not be *common practice*. Therefore, if a project activity is *not* a *common practice,* it signifies the risks associated with the project activity and its inability to yield a risk-adjusted rate of return without *additional supports*. This is one aspect.

A second and equally important aspect is that when a project activity is a *common practice*, which implies a large number of firms in that particular industry, by virtue of operation of economic principles, it gives rise to the development of necessary infrastructure, supply of required skills, availability of necessary spare parts in time and in proximity, among others, to facilitate successful operation of the project. A project activity, which is not a *common practice* would be deprived of these imperative supports. Deprivation of basic supports, therefore, becomes a barrier for new projects.

A corollary to the foregoing is that if a project activity is not a common practice, entrepreneurs would desist from venturing into that project. This invariably sets in motion demonstration effect in that entrepreneurs are dissuaded from entering into this project line. As if to support the veracity of the claim, unfortunately, today, in Himahcal Pradesh, there are no convincing success stories to prove that small hydro power projects are attractive business proposition for investors in the absence of CDM benefits. The dissuasion, coupled with absence of success stories, act as a deterrent and barrier. It requires additional financial incentive to motivate the entrepreneur to venture into such project area.

Thus, common practice, viewed against the foregoing, is a barrier, albeit as a proxy for various risks. The PP had listed various factors and furnished necessary statistics to drive home the point that small hydro power projects are not common practice - not only in the country as a whole, but also in Himachal Pradesh in particular, which offers immense potential for development of small hydro power projects.

In the Indian power sector, the common practice is investing in only medium or large scale fossil fuel fired power projects. In order to demonstrate that project activity i.e. generation of electricity through a small hydro project of 5 MW, is not a common practice reliance has been placed on the published statistics in respect of installations of small hydro projects in India, in the Northern region as well as in the state of Himachal Pradesh in relation to the total installed capacity of power generation.

There are two main indicators to prove that investment in small hydro power (defined as plants with a capacity not exceeding 25 MW) is currently neither a common practice in India nor in Himachal Pradesh:

- The total contribution of small hydro to the overall power supply is very small
- The available potential for small hydro has been tapped to a small degree only (about 15%), despite Government's continuous efforts to promote small hydro.

In addition few small-scale hydro plants existing in the project region (Himachal Pradesh) are different from the proposed project in material aspects, in particular:

- The vast majority of the small hydro power projects existing in the state are quite old i.e., they were constructed well before the year 2000.
- These projects were generally constructed with public funding, by Himachal State Electricity Board (HPSEB)

Each of these indicators is analyzed in more details below:

a) Contribution of small hydro to total power supply

Table B.3: Installed Capacity as on 31st March 2005 [2]

Region	Hydro	Thermal	Nuclear	Wind	Total	Small Hydro[3]	Share of small hydro
All India	30,080.23	79,451.45	2,720	2,488.13	**114,739.81**	**1,693.34**	**1.47%**
Northern Region	10,596.57	19,392.69	1180	178.5	**31,347.76**	**502.18**	**1.60%**
Himachal Pradesh	2,634.67	116.13	14	0	**2,764.8**	**108.04**	**3.90%**

As seen from the Table B.3 above, the total installed capacity of power projects in India is 114,739.81 MW as on 31st March 2005. Against this small hydro projects in operation in India is 1,693.34 MW, giving an idea of the contribution of small hydro projects in the total power generation at 1.47%, which is negligible.

In the Northern region, the total installed capacity of power plants is 31,347.76 MW against small hydro installations of 502.18 MW indicating that small hydro projects account only to a negligible 1.60 % of total generation in the Northern region, whereas it is only 3.9 % when compared with total installations in Himachal Pradesh.

b) Tapping potential for Small Hydro

The estimated small hydropower (less than 25 MW) potential in the state of Himachal Pradesh is 750 MW[4] and out of which only 108.04 MW has been commissioned so far over number of years. Thus, the penetration of small hydro power in Himachal Pradesh is hardly significant. The majority of small hydro power stations operating in Himachal Pradesh are publicly owned and quite old (constructed before 2000 or even before 1990). In particular, the existing 16.95 MW Andhra-I hydropower station is owned by HPSEB and was commissioned already in 1987. Compared to the project activity the downstream project Andhra Stage I is in Pubber Valley with all developed infrastructure like roads and other civil amenities. Andhra Stage I is in a reasonably developed town (Chirgaon) compared to the project activity which is about 12 km upstream with no roads to the power house. As the Andhra Stage I is sponsored by the Government, it would have received all necessary support from various agencies. Due to their lower specific cost, the investment focus of HPSEB is today on large hydropower stations, while the investment opportunities for small stations are generally left to the private sector.

Very few small hydro power stations have been commissioned recently. These are generally privately owned and rely on CDM. Relevant projects registered recently include Dehar (5 MW, CDM-Ref. #0035), Maujhi (4.5 MW, #0098) and Aleo Manali (3.0 MW, #0244).

---

[2] Page No: 125 (Statement – I), Page No: 130 (Statement – VI), Annual Report, 2004-05, Ministry of Power, Govt. of India

[3] Page No: 63, Table 8.2, Annual Report, 2004-05, Ministry of Non-Conventional Energy Sources, Govt. of India.

[4] http://www.hpseb.com/hydro_potential.htm

c) Analysis of existing plants in the state

The small hydro projects of Himachal Pradesh State Electricity Board (HPSEB) in operation are provided in Table B.4. The analysis shows that the majority of these projects were commissioned well before the year 2000. Given the public ownership and mandate of HPSEB, these projects cannot be directly compared with the proposed project activity. Today the focus of HPSEB is clearly on large-scale hydro projects of several hundred MW, as evidenced by the decreasing trend in new capacity additions of small hydro plants (see Figure 2 below for illustration). Hence implementation of small-scale project, such as the proposed project cannot be considered a common practice of HPSEB:

Table B.4. Details of small hydro projects in operation in Himachal Pradesh

S.No	Name of the Project	River/Khad	Owner	Commiss. Date	Capacity (MW)
	Yamuna Basin				
1	Andhra	Andhra	HPSEB	1987	16.95
2	Gumma SHP	Gumma Khad	HPSEB	2000	3.00
	Total:-				**19.95**
	Satluj Basin				
3	Rongtong	Rongtong	HPSEB	1986	2.00
4	Rukti	Rukti	HPSEB	1979 & 1980	1.50
5	Nogli Stage-I	Nogli	HPSEB	1963, 1969-70, 1974	2.50
6	Chaba	Nauti	HPSEB	1912 & 1919	1.75
7	Ganvi	Ganvi khad	HPSEB	2000	22.50
	Total:-				**30.25**
	Beas Basin				
8	Binwa	Binwa	HPSEB	1984	6.00
9	Baner	Baner	HPSEB	1996	12.00
10	Gaj	Gaj	HPSEB	1996	10.50
	Total:-				**28.50**
	Ravi Basin				
11	Gharola	Gharola	HPSEB	1975	0.05
12	Bhuri Singh P/House		HPSEB	in operation	0.45
13	Sal-II	Ravi	HPSEB	2000	2.00
14	Holi	Ravi	HPSEB	2004	3.00
	Total:-				**5.50**
	Chenab Basin				
15	Sissu	Sissu	HPSEB	in operation	0.10
16	Billing	Billing	HPSEB	in operation	0.20
17	Shansha	Shansha	HPSEB	in operation	0.20
18	Thirot	Thirot	HPSEB	1995-96	4.50
19	Killar	Mahal	HPSEB	1995-96	0.30
	Total:-				**5.30**
	G. Total				**89.50**

(Source: Himachal State Electricity Board, www.hpseb.com)

Apart from the above projects owned by HPSEB, the state also tried to facilitate implementation of small hydro projects with private participation through its HIMURJA program. The list of projects in the HIMURJA pipeline is furnished in Table B.5 below. As could be seen from the list, the projects which are comparable with the proposed project activity in terms of capacity are already registered for CDM. The few other existing projects are not necessarily comparable with projects in the range of 5-25 MW, since they involve much lower level of financial and construction barriers.

Therefore, it is justified to say that small hydro projects of the proposed type are not a common practice in the region, which presents a significant barrier.

Table B.5. List of hydropower projects under HIMURJA[5]

S. No	Name of the Project	Capacity
1	Raskat	0.8 MW
2	Titang	0.9 MW
3	Dehar* [6]	5 MW
4	Maujhi* [7]	4.5 MW
5	Ching	1 MW
6	Manal	3 MW
7	Aleo* [8]	3 MW
8	Manjhal	1 MW
9	Baragran	3 MW
10	Salag	0.15 MW
	Total	**22.35 MW**

(Note: * Project activities which are registered with CDM Executive Board)

A decreasing trend can be observed in the addition of new small hydro capacity (see figures below drawn from table 1 and 2 above). Since the year 2000, not many small hydro projects are installed in the state, while at the same time in a nationwide perspective large-scale thermal has grown at an unprecedented rate. This can be explained by the fact that the state utility HPSEB has in the recent years had an even clearer focus on medium (>25 MW) and especially large (> 100 MW) hydro. Conversely, the State Program HIMURJA has had very limited effectiveness in promoting third party investments in small hydropower, as shown above. As a result, small hydro power is still far from being used to its full potential in the state. At the current rate of expansion, it would take many decades until the small hydro power potential in the state is fully harnessed.

[5] www.himachal.nic.in/himurja/ongprojects.html

[6] Reference No: 0035, 18th July 2005, http://cdm.unfccc.int/Projects/registered.html

[7] Reference No: 0098, 6th November 2005, http://cdm.unfccc.int/Projects/registered.html

[8] Reference No: 0244, 14th April 2006, http://cdm.unfccc.int/Projects/registered.html

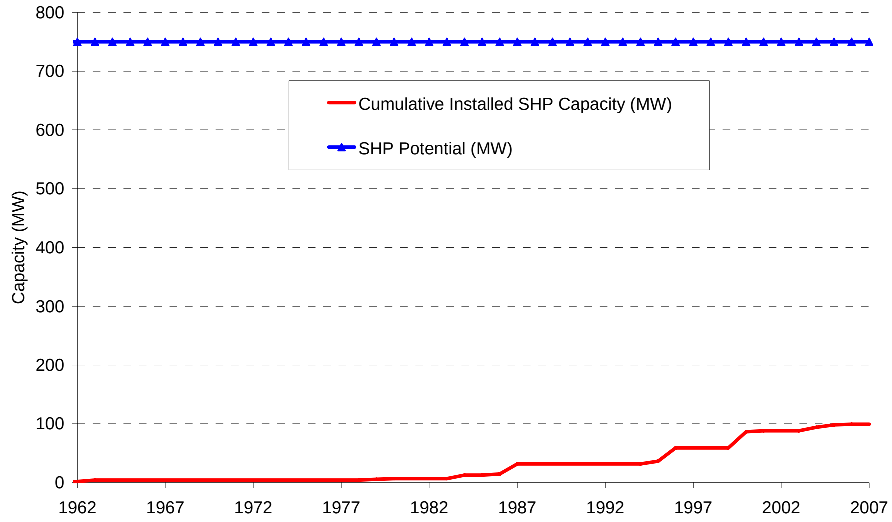


Figure 1: Cumulative small hydro power capacity in the State of Himachal Pradesh (excluding CDM projects).

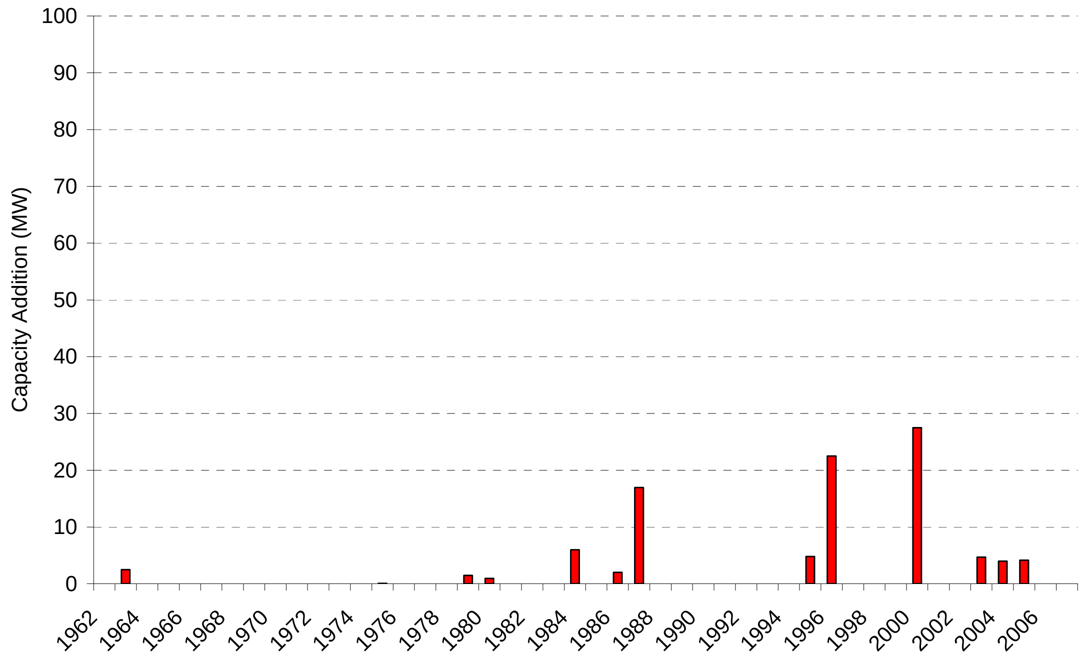


Figure 2: Capacity additions of small hydro power in Himachal Pradesh over time (excluding CDM projects).

The prevalence of barriers has been brought out in various research publications. Links for some of the research material are given below:

1) Floods and flash floods in Himachal Pradesh: A geographical Analysis
www.nidm.net/idmc/Proceedings/Flood/B2-%206.pdf
2) Natural disaster management- planning commission report on HPhttp://planningcommission.nic.in/plans/stateplan/sdr_hp/sdr_hpch3.pdf

3) Damage scenario of a hypothetical 8.0 magnitude earthquake in Kangra region of Himachal Pradesh – http://www.bmtpc.org/pubs/techno/chapter-5.pdf

In conclusion, the fact that small hydro is not a common practice in the project area is a real barrier for the proposed Project Activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The project activity is generation of electricity using hydro potential and exporting the same to the grid system, which is also fed by other fuel sources such as fossil and non-fossil types. Emission reductions due to the project activity are considered to be equivalent to the emissions avoided in the baseline scenario by displacing the grid electricity. Emission reductions are related to the electricity exported by the project and the actual generation mix in the grid system.

Baseline

As the project activity does not modify or retrofit an existing electricity generation facility, the baseline scenario is electricity delivered to the grid by the project that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

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 tCO2 /GWh).

$BE_y = EG_y * EF_y$

where,

EG_y = the net electricity exported to the grid system during the year *y*

EF_y = the emission factor of the grid to which the project exports electricity

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/Govertment%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. The overall power flows are managed by the Northern Regional Load Despatch Centre. Other regions viz. Southern, Western, Eastern and North Eastern 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 in to 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 ACM 0002.

According to the ACM 0002, grid emission factor is calculated as Combined Margin (CM), comprising the Operating Margin (OM) emission factor and the Build Margin (BM) emission factor. The following procedure was adopted for estimating the grid electricity emission factor:

Step 1 – Calculation of the Operating Margin
Step 2 – Calculation of the Build Margin

Step 3 – Calculation of the grid emission factor (Combined Margin)

Step 1 – Calculation of the Operating Margin

The approved consolidated methodology ACM 0002 recommends the use of dispatch data analysis as the first methodological choice. However, in India availability of accurate data on grid system dispatch order for each power plant in the system and the amount of power dispatched from all plants in the system during each hour is practically not possible. Also, still the merit order dispatch system has not become applicable and is not likely to be so during the crediting period. In view of this it is proposed to apply other choices as suggested in the ACM 0002. Since the power supplied by low cost must run power plants[9] to the Northern grid during 2005-06 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 southern region is considered,. The CEA baseline is derived using the following formulae to calculate simple OM.

$$EF_{OM,simple,y} = \frac{\sum F_{i,j,y} \times COEF_{i,j}}{\sum GEN_{j,y}} \qquad (1)$$

Where:

$EF_{OM,simple,y}$ is emission factor of the Operating Margin by Simple method, in tCO_2/MWh

$F_{i,j,y}$ is the quantity of fuel *i* consumed by plant j in year y in tonnes of fuel *i*

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel *i* for relevant power plant *j* in the year in tCO_2/tonnes and

$GEN_{j,y}$ is the generation from power plant *j* in the year in MWh

Table 1: Operating Margin[10]

Most recent three years	2003/04	2004/05	2005/06
Operating Margin* (OM) in t CO_2 / GWh	987	976	995
Average of 3 years	**986**		

* including imports

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

Step 2 – Calculation of the Build Margin

ACM 0002 offers two options for determination of build margin emission factor: *ex ante* and *ex post* determination of the Build Margin (BM). Option 1 is selected wherein the build margin emission factor is calculated *ex- ante* based on most recent information available on plants already built for sample group *m* in

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

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

Northern Region. This simplifies the monitoring procedures, but also offers a conservative approach of BM calculation. The sample group *m* shall be the one having higher power generation between (a) five power plants that have been built most recently and (b) the capacity additions in the electricity system that comprises 20% of the system generation built most recently. It is found that the option (b) has higher generation compared to option (a). Hence option (b) is selected.

Build Margin emission factor[4] is determined as below:

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

<u>Step 3 – Calculation of the baseline emission factor (Combined Margin)</u>

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 weighted with 50%. As noted above, the resulting Combined Margin is fixed ex ante for the duration of the crediting period:

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

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

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 in combustion or generation of emissions from fossil fuels. However, as the project is equipped with diesel generator of capacity 100 kVA to meet the emergency requirements of power house etc., emissions out of usage of fossil fuel (diesel) will be accounted as project emissions based on the following equation as provided in the approved consolidated methodology.

$$PE_y = FF_{i,y} \cdot COEF_i$$

Where

PE_y Project emissions from combustion of fossil fuel (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 factor of the fuel type *i*

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 10).
Any comment:	The value applied is the arithmetic mean of the Operating Margin (OM, adjusted for imports) and the Build Margin (BM), where: - OM = 0.986 t CO_2/MWh. This is the generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission (according to ACM0002 Version 06, p.6), being: FY 2003-04 111,450 GWh 0.987 t CO_2/MWh FY 2004-05 115,151 GWh 0.976 t CO_2/MWh FY 2005-06 120,869 GWh 0.995 t CO_2/MWh - BM = 0.601 t CO_2/MWh. This is the build margin for the latest year for which data is available at the time of PDD submission, being 2005-06.

Data / Parameter:	$COEF_i$
Data unit:	*kg CO_2/TJ*
Description:	CO_2 emission factor of fuel type i
Source of data used:	IPCC 2006 default values
Value applied:	Diesel : 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 to meet the emergency power requirement of the project. Hence only emission factor of diesel is provided in the parameter

B.6.3 Ex-ante calculation of emission reductions:

>>

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

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

BE_y = 18.13 GWh * 793 tCO_2/GWh

BE_y = 14,380 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 kg CO_2/TJ

$PEFF_y$ = 0 tCO_2

Leakage

No leakage is applicable

Emission reductions

ER_y = BE_y - PE_y - L_y
ER_y = 14,380 - 0 - 0
ER_y = 14,380 tCO_2 (ER_y = BE_y)

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

>>

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_2e)	Estimation of leakage (t CO_2e)	Estimation of overall emission reductions (tCO_2e)
2007-08	0	14380	0	14380
2008-09	0	14380	0	14380
2009-10	0	14380	0	14380
2010-11	0	14380	0	14380
2011-12	0	14380	0	14380
2012-13	0	14380	0	14380

2013-14	0	14380	0	14380
2014-15	0	14380	0	14380
2015-16	0	14380	0	14380
2016-17	0	14380	0	14380
Total (tonnes of CO_2 e)	**0**	**143,800**	**0**	**143,800**

In the above table, the year 2007-08 corresponds to the period starting from 01.12.2007 to 30.11.2008. Similar interpretation shall apply for remaining years for the purpose of this projection.

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:	Gross power generation
Source of data to be used:	Onsite measurement
Value of data	19.71GWh
Description of measurement methods and procedures to be applied:	The gross energy would be recorded on a daily basis and aggregated monthly and annually.
QA/QC procedures to be applied:	The gross energy meters would be calibrated using as per the industrial standards and practices of India.
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:	$EG_{Auxiliary}$
Data unit:	GWh
Description:	Auxiliary electricity consumption of the project
Source of data to be used:	On-site measurements
Value of data	1.58 GWh
Description of measurement methods and procedures to be applied:	Measured monthly using calibrated meters and aggregated annually or 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:	Meters will be calibrated as per industry standards. Sales records to the grid and other records are used to ensure consistency. If the data is calculated as the difference between gross and net power export, no QA/ QC procedures are applicable, since, the both parameters are already underwent the QA/QC procedures.
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_y**
Data unit:	kWh
Description:	Net power exported to grid
Source of data to be used:	Measurement
Value of data	18.13 GWh
Description of measurement methods and procedures to be applied:	For measuring the energy delivered by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter will be provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point will be taken by the designated officials of the company and HPSEB on the synchronisation date of each unit as well as at 12 Hrs on the first day of the next month and subsequently at 12 Hrs of the first day of each month. The joint meter readings will be recorded and signed by the authorised representative of both the parties on each of the above instances.
QA/QC procedures to be applied:	The main meter and check meter will be test checked for accuracy at site 15 days before synchronization of the unit and every six months thereafter. The test for the main meter and the check meter will be done with reference to a portable Sub Standard meter, which will be of accuracy class compatible with the class of meter under test and as per the Prudent Utility Practices. Sales bills / receipts may be used for cross-checking the net amount of power exported to the grid.
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:	Measured monthly using calibrated meters and aggregated annually.
QA/QC procedures to be applied:	Meters will be calibrated as per the industry standards. Project proponent will pay to the HPSEB based on the meter reading recorded in the import meter. The maintenance and/or other quality control measures are taken by HPSEB, since any false reading in the meter is a financial loss to HPSEB. Hence, HPSEB 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 liters*

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:

>>

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 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.

Monitoring Organisation

Project Participant, Gowthami Hydro Electric Company (P) Limited will be managed by a Board of Directors. The board will appoint a full time General Manager who will be assisted by a Manager (Operations), in-charge of all technical aspects and Manager (Finance) who looks after financial matters of the company. The Manager (Operations) who will be responsible for the hydro project will have under him one Asst. Manager for the hydro project.

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 prepare necessary audit reports for review by the management i.e. Board of Directors or its Committee for review.

The identified person in charge will be assisted by a team of experienced personnel in disciplines such as mechanical and electrical with experience in plant operation, measurements and management. The primary responsibility of the team is to collect, measure, monitor, record and report the information on various data items to the person in charge and the General Manager, in accordance with the applicable standards. Periodic calibration of various instruments used in the monitoring of the data and record keeping of the same also will be the responsibility of the team.

The responsibility of storage and archiving of information in good condition also lies with the designated person in charge. The person in charge 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 company may introduce an internal audit system for the GHG compliance. Internal auditing will be carried out as per the monitoring schedule and whenever necessary. An internal audit report will be prepared for review by the Board of Directors which will be later submitted for verification by 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.

Monitoring Requirements

The monitoring plan includes monitoring of energy parameters such as Gross energy, Auxiliary consumption, energy export to the HPSEB grid system, energy import to the project activity from grid and also consumption of diesel for DG set operation. Emission reductions resulted from the project activity will be calculated based on the energy export to the grid system 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 energy fed by the plant to HPSEB grid system by the proposed project. In accordance with the PPA, project proponents have to install two energy meters one is main meter and the other is check meter. Project proponent will calibrate both the meters according to the procedures laid down by PPA. 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.

Leakage Monitoring

The proposed 5 MW hydroelectric project is renewable energy type and it utilizes flowing water for power generation and it does not involve any GHG emission. No leakage is involved in the proposed activity.

Data Recording and Storage

The net energy fed to the grid system by the project activity will be recorded by project proponents using either of the two meters (main meter and check meter) in the presence of the representative of HPSEB in a document whose format is acceptable to HPSEB. Representatives of both the project proponent and HPSEB will sign the document which will contain all details such as the equipment data, calibration status, previous reading, current reading, export, import, net billable units, date and time of recording etc. This document 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 document.

The above document will be preserved for verification of emission reductions from the project, in safe storage. Supporting documents such as receipts of payments released by HPSEB will also be preserved 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)

>>

Date of completion of the application of the baseline and monitoring methodology: 02 July 2007

Name of the person responsible: Zenith Energy Services (P) Ltd., with contributions from Factor Consulting + Management AG, Switzerland

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, Masabtank,
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 028
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:	Attipalli
Middle Name:	
First Name:	Mohan Reddy
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:

>>
15/04/2005

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:

>>
01/12/2007 or from the date of registration of the project activity whichever is later.

C.2.2.2. Length:

>>
10 y – 0 m

SECTION D. Environmental impacts

>>

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

>>
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 line ministry for environmental issues in India, Environmental Impact Assessment (EIA) studies need not to be conducted for the projects less than Rs. 1000 millions[11, 12] Since the total cost of the project is only Rs.258 millions, the project activity doesn't call for EIA study.

Also, S.O. 1533[13], dated 14th September 2006, Ministry of Environment & Forests (MoEF), Govt. of India, states that the hydroelectric projects with less than 25 MW need not to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities. However the project activity is required to get permission from Himachal Pradesh State Environment Protection & Pollution Control Board (EPPCB) for setting up of the project. The project proponents have obtained necessary clearance in this regard.

Proposed project will not result in resettlement and rehabilitation in project site, as it is not under human habitation area. The scheme does not involve any impounding of water and hence no submergence or rehabilitation activity is needed. 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.

Beneficial impacts are envisaged on socio-economic conditions, as there will be rural and urban electrification. The industrial development may also take place, which will trigger the economic growth in the backward region of the state.

Soil conservation methods are also taken into account prior to implementation of the project, so the proposed project will not result in damage to soil profile in the construction phase. From the above discussions, it is evident that the proposed project is not likely to have any significant adverse environmental effects during execution or after commissioning.

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:

[11] 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.

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

[13] Page No: 10, Section 1(c), River Valley Projects, Ministry of Environment & Forests (MoEF), Govt. of India, http://envfor.nic.in/legis/eia/so1533.pdf

>>
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

>>

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

>>
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.

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.

Identification of Stakeholders

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 (EPPCB)	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	Is part of Himachal Pradesh Government and overseas utilization of water	Accords clearance for utilizing water resources in Himachal Pradesh state.
Ministry of Environment & Forests, Govt. of India	Part of Government of India responsible for overseeing utilization of forest land.	Provides permission for utilizing forestland for construction of the 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 20th March 2001.

- The company has signed a Implementation Agreement (IA) with Govt. of Himachal Pradesh on 20th July 2004.

HPSEB

The project has obtained 'Techno-economic Clearance (TEC) from Himachal Pradesh State Electricity Board (HPSEB) vide **HPSEB/CE(P)/CC-Andhra-II/2003/865-73** dated 28th October 2003.

Pollution Control Board

The project has obtained 'Consent for Establishment' from Himachal Pradesh State Environment Protection & Pollution Control Board (EPPCB) vide **EPPCB/Andhra Stage – II SHEP Chirgaon - Rohroo Shimla/2004/2514–19** dated 11th October 2004.

Power Purchase Agreement

The project has entered into a Power Purchase Agreement (PPA) with Himachal Pradesh State Electricity Board (HPSEB) on 30th March 2005.

Civil Contract

The project has signed Civil Contract Agreement with M/s P & R Engg. Services, Chandigarh on 28th September 2004 for executing civil works.

Irrigation & Public Health

The project got 'No Objection Certificate' from Department of Irrigation & Public Health, Govt. of Himachal Pradesh vide **No. PB (PH) F(1)-2/2001-1** dated 25th November 2004.

Forests Clearance

The project got clearance from Ministry of Environment & Forests, Govt. of India for diversion of forests of land vide **No: 9-2304/2004-ROC/2079** dated 21st April 2005.

Village Panchayat

The project has obtained 'No Objection Certificate' from local Gram Panchayat on 23rd August 2004.

Detailed Project Report

Govt. of Himachal Pradesh and M/s Sidhardha Construction (P) Limited, Vishakapatnam has signed a Memorandum of Understanding (MoU) for preparation of Detailed Project Report (DPR) for the project activity on 20th March 2001.

Electro-mechanical Contract

The project has entered into an agreement with M/s Bouving Fouress Limited on 15th April 2005 for Design, Manufacture, Supply of Electro-mechanical equipment.

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	M/s Gowthami Hydro Electric Company (P) Limited
Street/P.O.Box:	No: 2-3-42/52, M.G. Road,
Building:	No 13, 4th Floor, Maitri Arcade,
City:	Secunderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 003
Country:	India
Telephone:	+91- 40- 6648 6644
FAX:	+91- 40- 6648 1144
E-Mail:	gowthamihyd@gowthami.com
URL:	www.gowthami.com
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Ravi Kanth
Middle Name:	
First Name:	M
Department:	
Mobile:	+91- 9949554466
Direct FAX:	+91- 40- 6648 1144
Direct tel:	+91- 40- 6648 6644
Personal E-Mail:	ravikanth@gowthami.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

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 (21 June 2007)"

Annex 4

MONITORING INFORMATION

This monitoring plan is designed for the 5 MW small hydroelectric project which is being implemented in Himachal Pradesh, India. This monitoring protocol, which will be registered with the CDM Executive Board (EB) as a part of the Project Design Document, describes about the monitoring organisation, parameters and variables, monitoring practices, QA and QC procedures, data storage and archiving etc. The project participant will implement this monitoring protocol before the start of operation of the project.

Parameters Requiring Monitoring

As detailed in Section – B.7.2, Gross energy generation, Auxiliary consumption, Electricity supplied to the grid by the project activity and electricity import to the project activity will be monitored under this monitoring plan using calibrated energy meters. As detailed in Section B.6.1 above, the Combined Margin emission factor is fixed ex ante and need not be monitored.

QA and QC Procedures

The project employs latest microprocessor based high accuracy monitoring and control equipment that will measure, record, report, monitor and control of various key parameters like generation by the project and net energy exported to the grid. Necessary standby meters or check meters will be installed, to operate in standby mode when the main meters are not working. All meters will be calibrated and sealed as per the industry practices at regular intervals. Hence, high quality is ensured for all the above parameters. Sales records will be used and kept for checking consistency of the recorded data.

The Power Purchase Agreement signed by the Project Participants and the HPSEB provides procedures for monitoring the energy fed to the grid, emergency preparedness, calibration of monitoring equipment, company's operation and maintenance responsibilities etc. The same will be adopted for GHG audits and will form part of the monitoring plan. Hence, no separate procedures for QA/QC are provided in this monitoring plan.

Data Storage and Archiving

All the above parameters monitored under the monitoring plan will be kept in electronic and hard copy format for 2 years after the end of crediting period or the last issuance of CERs for this project activity whichever occurs later.

The monitored data will be presented to the verification agency or DOE to whom verification of emission reductions is assigned.

Necessary formats / tables / log sheets etc. will be developed by the project participants for monitoring, recording and reporting of the data and will be made part of the registered monitoring protocol.