CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Modification and retrofitting of the existing 34 MW hydropower plant at Bhandardara -2 (project activity) in Maharashtra state in India by Dodson – Lindblom Hydro Power Private Limited (DLHPPL).
Version : 03
Date : 02/03/2009

A.2. Description of the project activity:

The Upper Pravara River Basin Water Management System envisions a comprehensive development of the water resource potential of the area and includes several multi purpose dams and reservoirs. The system is currently operated and maintained by Government of Maharashtra Water Resources Department, hereinafter referred to as GOMWRD. Several key elements of the system are already in place and others are being implemented or are slated for construction in the near future. The scheme involves the following major elements:

- Bhandardara dam, is one of the oldest masonry gravity dams. The water released for irrigation could be fully utilized by power houses further downstream and currently the irrigation releases are controlled from this dam;
- Bhandardara Power House No. 1 (BH-1): draws its water from the Bhandardara reservoir and is a single hydro generating station of 12 MW;
- Bhandardara Power House No. 2 (BH-2): is 10 KM downstream from BH-1 and draws its water from a small reservoir formed by Randha Weir; and
- Nilwande Dam: is 20 KM downstream from BH-2 and will collect the water released for irrigation from Bhandhardara reservoir as well as the run off water from the catchment area between Bhandaradara Reservoir and Nilwande. This dam is currently under construction. Once this dam is partially constructed, it could be used to control irrigation releases to the downstream command area. This dam will include intake facilities to feed a powerhouse and irrigation areas.

BH-2 has been operating intermittently since year 1999 and uses water discharged from both BH-1 and directly from the Bhandhardara dam. BH-2 was designed to operate as a peaking station, but has essentially been operating as a base-load station at approximately 50% of its rated capacity. Severe limitations resulting from irrigation release criteria and the lack of availability of a balancing storage mechanism have significantly impaired the operation of BH-2 as originally envisioned by GOMWRD. These restrictions have forced GOMWRD to operate the project whenever possible barely at its technical limits. In addition, several technical problems at the plant over the years have further affected normal operations of this facility.

Lack of funds with the GOMWRD have limited their ability to partially construct the required downstream balancing storage facility as well as to make the necessary improvements in a timely and technically requisite manner to allow proper operations of the BH-2 plant. The Government of Maharashtra decided to privatize the operation of the BH-2 plant on a lease, own, operate and transfer basis. ***It is envisaged that the funds received from this effort would be utilized to fund the construction of the balancing storage facility that would permit the efficient utilization of scarce water resources in the region.*** The rehabilitation and operation of BH-2 was awarded on a lease, own, operate and transfer basis to Dodson Lindblom Hydro Power Private Limited (DLHPPL) on December 31, 2004.

BH-2 has been designed to operate as a peaking station i.e. 3 hours in the morning and 3 hours in the evening. The Randha Weir, which is the pick-up weir has a small reservoir having a live storage capacity of 0.87 MCM, built to supply water to the power house. In order for the plant to operate at its full load capacity of 34 MW, the turbine needs water at the rate of 77 cubic meters per second (cumecs). Also the inflow of water from BH-I needs to be first stored in Randha weir to its maximum level and then released through the BH-II turbine. As per the design, release from BH-I is about 20 cumecs and with this continuous release, BH-II can operate for 3 hours only after every 9 hours. Thus in a day, BH-II can operate only for 3 hours in the morning and 3 hours in the evening.

The existing BH-2 project uses a 34 MW vertical Francis type turbine, which was previously damaged and is currently operating through temporary repairs.

DLHPPL as a project activity will completely overhaul, rehabilitate and modernise the plant. The anticipated rehabilitation measures are detailed in the Enclosure-1 and will include complete automation of the plant. In addition, the project activity will provide the ancillary benefit of improving the water management system in the region. The rehabilitation and automation of BH-2 would result in increased generation.

The historic generation of BH-2 for the past 5 years (2002 - 2006) has been evaluated and the average of the 5 years data has been considered as the baseline generation. The additional generation over the average historic baseline generation will be considered for estimation of emission reductions.

It has been estimated that due to retrofitting, modernization and efficient operation and maintenance of the plant the project activity will generate additional about 15.14 GWh during first year and 21.14 GWh from the second year onwards than the average historic generation at BH-2 which has been estimated at 29.86 GWh from the 5 year historical data.

<u>Contribution of the project activity to sustainable development</u>

The Designated National Authority for India has identified the following attributes to measure the contribution of the project activity for sustainable development :

i) Social well being
ii) Economical well being
iii) Environmental well being
iv) Technological well being

<u>i) Social well being</u>
The social well being is assessed by contribution to improvement in living standards of the local community. Bhandardara is a remote village in an industrially backward area. The implementation of the project activity will provide job opportunities to the local community, contribute in poverty alleviation of the local community and development of basic amenities to the community, leading to improvement in living standards. Thus the project activity will contribute to social well being.

The project facilitates partially the construction of the Nilwande Dam, which in turn results in several social benefits. The construction of the dam would result in the improvement and optimal implementation of the water management system in the region, which in turn would facilitate more water for the people in the vicinity for irrigation and potable use.

A burning social need in the entire state of Maharashtra is the energy shortfall during peak hours of the day. The project will not only satisfy this need, but also improve the dependability of the electricity supply for the community.

ii) Economic well being

The project activity has created direct and indirect job opportunities to the local community during construction and shall provide permanent job opportunities during operation. During operation of the project activity, about 25 persons would be employed directly, apart from indirect employment. Economic well being refers to additional investment consistent with the needs of the local community. DLHPPL proposes to invest about INR 784 Million for the project and this investment is quite significant in a rural area. Also, the project activity would result in more reliable electricity supply which would in turn provide economic benefits to industries that utilize the power.

Due to the construction of the dam, there would be increased water supply for irrigation, which in turn would result in better farming and revenue generation. These activities will contribute to the economic well being of the local community.

iii) Environmental well being

The project activity produces electricity without any greenhouse gas (GHG) emissions. Additionally, the project activity generates electricity from "renewable energy source", a source of energy that gets replenished naturally and does not suffer permanent depletion due to use.

The project activity is an environment friendly electricity generation project with no significant impact on the environment. This is a very important contribution of the project activity for environmental well being. Electricity generation of Maharashtra is predominantly thermal. Moreover, the project activity generates electricity from a renewable source of energy where the source gets replenished and is available for use. This is another important contribution of the project activity to the environmental well being.

Therefore, the following environmental benefits are derived from the project activity:

- Produces electricity without GHG emissions.
- Hydro power plant with no increase in volume of reservoir and no land inundation
- Produces electricity from a renewable energy source.
- Rural development as the project activity location is in rural area.

Environmental impacts due to the project activity are discussed elsewhere in this document.

iv) Technological well being

Efficient operation and maintenance of the power plant would ensure the durability and availability of the power plant. DLHPPL proposes to refurbish the existing power plant and operate the plant at its optimum capacity. In addition, the repairs and proposed automation will improve the reliability of the plant resulting in lower down times and thereby contributing to technological well being.

The project activity improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Hydropower plants provide local distributed generation, provide site-specific reliability and transmission and distribution benefits including:

- increased reliability, shorter and less extensive outages;

- lower reserve margin requirements;
- improved power quality;
- reduced lines losses;
- reactive power control;
- mitigation of transmission and distribution congestion, and;
- increased system capacity with reduced T&D investment.

In light of the above, the project proponent believes that the project activity has contributed on all sustainable development attributes**.**

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	Dodson –Lindblom Hydro Power Private Limited (DLHPPL) – Private Entity	No
The State of the Netherlands	IFC-Netherlands Carbon Facility (INCaF)	No.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

Maharashtra state

A.4.1.3. City/Town/Community etc:

Bhandardara, Akola Taluk, Ahmednagar district.

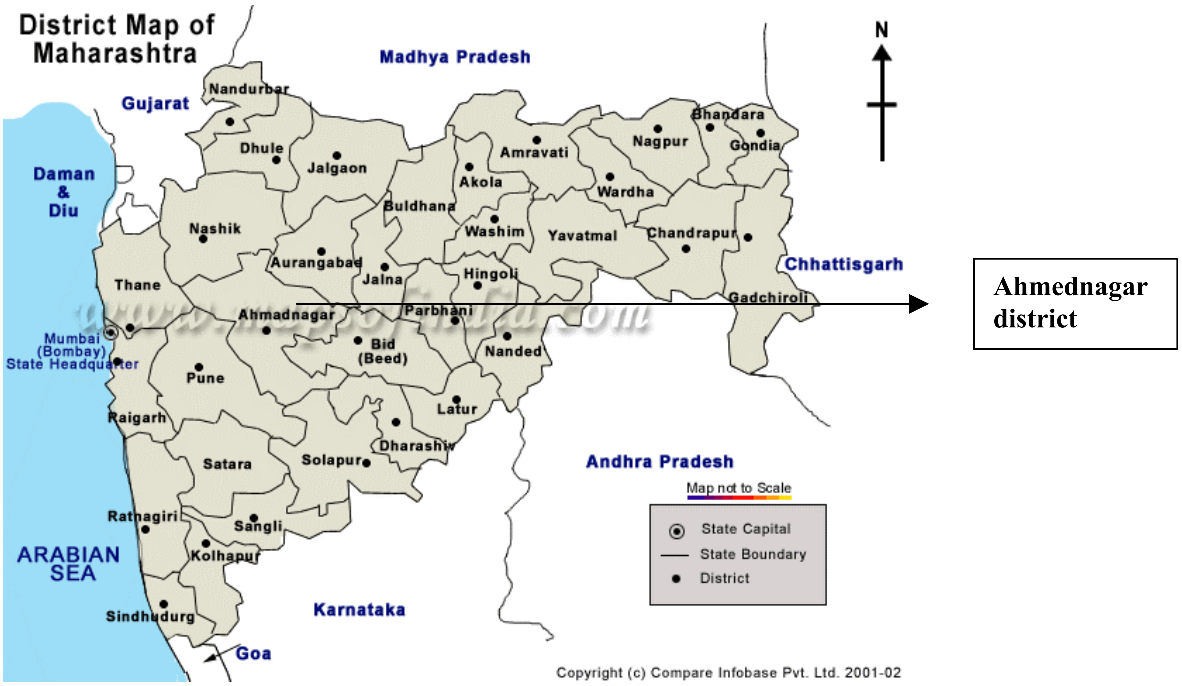
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

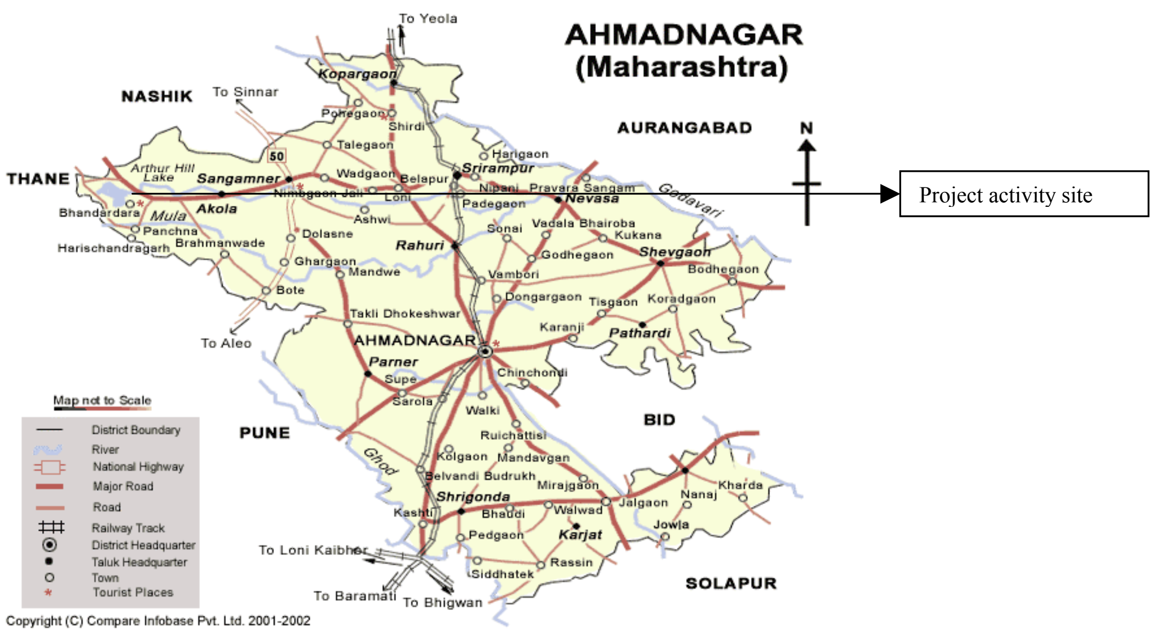
Bhandardara is in Akola Taluk in Ahmednagar district in the state of Maharashtra in India. River Pravara is a tributary of river Godavari. It is located at a latitude of 19-33'-15"N and longitude of 73-45'-0"E.

Maharashtra state is in the western part of India. Bhandardara is about 140 kilometers from Mumbai (Bombay), capital of Maharashtra state and one of the important cities of India. The nearest big town is Ghoti and closest railhead is at Igatpuri which is 40 kilometers away. Ghoti is 36 kilometers from the project activity and is on busy Mumbai–Agra national highway number 3. The nearest airport is at Mumbai, which is an international airport with connections to all major cities of the world.

The location of project activity is shown in following figures :

Maharashtra State





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

The project activity is categorised as a modernization and retrofitting of the existing 34 MW run of river hydro power plant. The project activity is in line with approved consolidated baseline methodology ACM0002/Version 06 dated 19th May, 2006.

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

The basic technology is that potential energy is converted into mechanical energy and then into electrical energy. Water at a head of 59.5 meters is jetted on to turbines, which causes the turbines to rotate. The rotation of turbines causes rotation of connected generators, thereby producing electricity.

One unit of 34000 kW of vertical Francis type hydraulic turbines is installed. The turbines are designed for 10 % overloading capacity for the highest efficiency and suitably selected to avoid pitting due to cavitations.

Technical specification of BH-2
The power plant consists of water conductor, intake, power house, generation unit and a transformer.

Randha pick up weir	
Gross storage	1.42 Mm^3
Live storage for power	0.87 Mm^3
Water conductor	
Number	1
Type	Tunnel excavated in rock
Design discharge	77 m^3/s
Size	6 m dia
Length	1112 m
Surge shaft	Non-spilling type
Intake	
Full supply level	668.35 m
Minimum draw down level for power	666.45 m
Power house	
Type	Well, excavated into rock
Size	21 m dia
Floor level	Service bay 646 m
Level of CL of turbine	607.3 m
Capacity of OH crane	150/30 tonnes
Generation unit	
Max gross head	59.5 m
	50 m
Net design head	

Type of generating unit	Vertical, Francis, umbrella
Number	1
Excitation	Static
Connection to grid	
Transformer capacity	132kV, 37 MVA, 3 phase, ONAN
Connection point	BH-2 switchyard
Protection System	Multi functional digital relay system
Control & monitoring operation	Computer based c/w interface for remote operation
Circuit Breakers	SF6

The technology is well established and is available in the country and hence there is no transfer of technology.

The project activity produces electricity without any impact on the environment. There is no significant impact on air, water, and land due to the project activity. A brief impact on the environment due to project activity is discussed in section D. Thus, an environmentally safe technology is being employed in the project activity.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
2008-09	11,684
2009-10	16,385
2010-11	16,385
2011-12	16,385
2012-13	16,385
2013-14	16,385
2014-15	16,385
2015-16	16,385
2016-17	16,385
2017-18	16,385
Total estimated reduction (tonnes of CO2e)	159,140
Total number of crediting years	10
Annual average over the crediting period of estimated reductions ((tonnes of CO_2 e)	15,914

A.4.5. Public funding of the project activity:

The project has not received any public funding.

SECTION B. Application of a baseline and monitoring methodology

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

Title of the approved baseline methodology: Consolidated baseline methodology for grid-connected electricity generation from renewable energy sources.
Reference: Revision to approved consolidated baseline methodology ACM0002/Version 06, dated 19th May, 2006[1]

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

The approved consolidated baseline methodology ACM0002 /Version 06 has been chosen since the project activity meets the following applicability condition mentioned in the methodology ACM0002/version06:

- Run of river hydro power plant; hydropower project with existing reservoirs where the volume of the reservoir is not increased. Retrofitting and modernization of the existing hydro power plant.

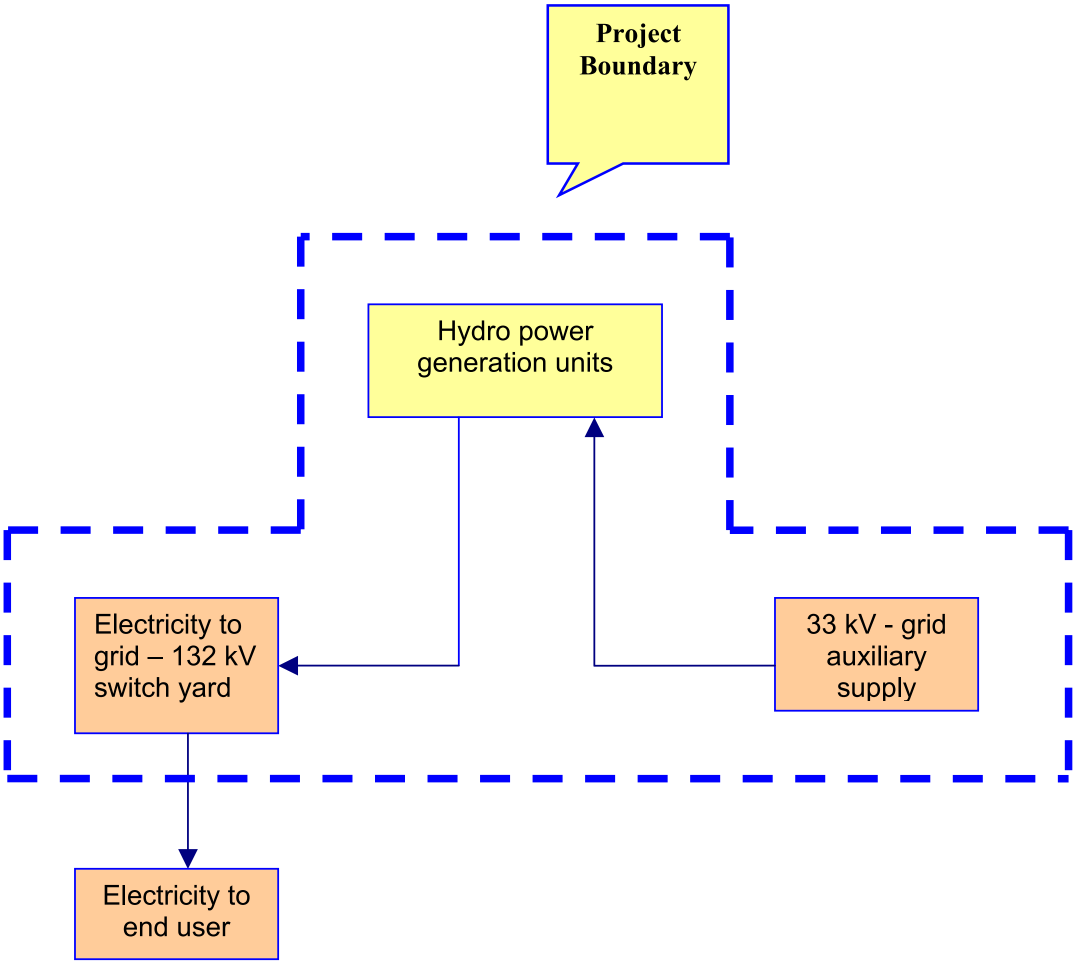
Since the project activity is a run of river hydropower project with existing reservoir where the volume of the river is not increased and is proposed for retrofitting and refurbishment, therefore satisfies the applicable condition of the approved consolidated baseline methodology ACM0002 /Version 06, this methodology has been chosen for the project activity.

B.3. Description of how the sources and gases included in the project boundary

	Source	Gas	Included	Justification/Explanation
Baseline	Grid Electricity	CO_2	Yes	Main emission source
		CO_2	No	Not Applicable
		CH_4	No	Not Applicable
Project Activity	Electricity Generation	CO_2	No	Not Applicable
		CO_2	No	Not Applicable
		CH_4	No	Not Applicable

The line diagram that delineates the project boundary is as follows

1 http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html



B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

As per the ACM0002 methodology, for project activities that modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid ($EG_{baseline}$, in MWh/year) at historical average levels ($EG_{historical}$, in MWh/year), until the time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project activity ($DATE_{Baseline\ Retrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production ($EG_{baseline}$) is assumed to equal project electricity production (EGy , in MWh/year), and no emission reductions are assumed to occur.

$EG_{baseline} = EG_{historical}$ until $DATE_{Baseline\ Retrofit}$ **(1)**
$EG_{baseline} = EGy$ on/after $DATE_{Baseline\ Retrofit}$

Where $EG_{historical}$ is the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e., by 5% or more), expressed in MWh per year. A minimum of 5 years (120 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities.

Alternatives to the project:

Alternative-I: Operation of the project activity without CDM funds
Alternative-II: Continuation of the existing power plant without retrofit and refurbishment

The most plausible baseline scenario identified for the project activity is continuation of current practice i.e. operation of the existing hydel power plant without modification. This would result in additional power generation from the grid connected power sources, which include coal, gas & renewable energy.

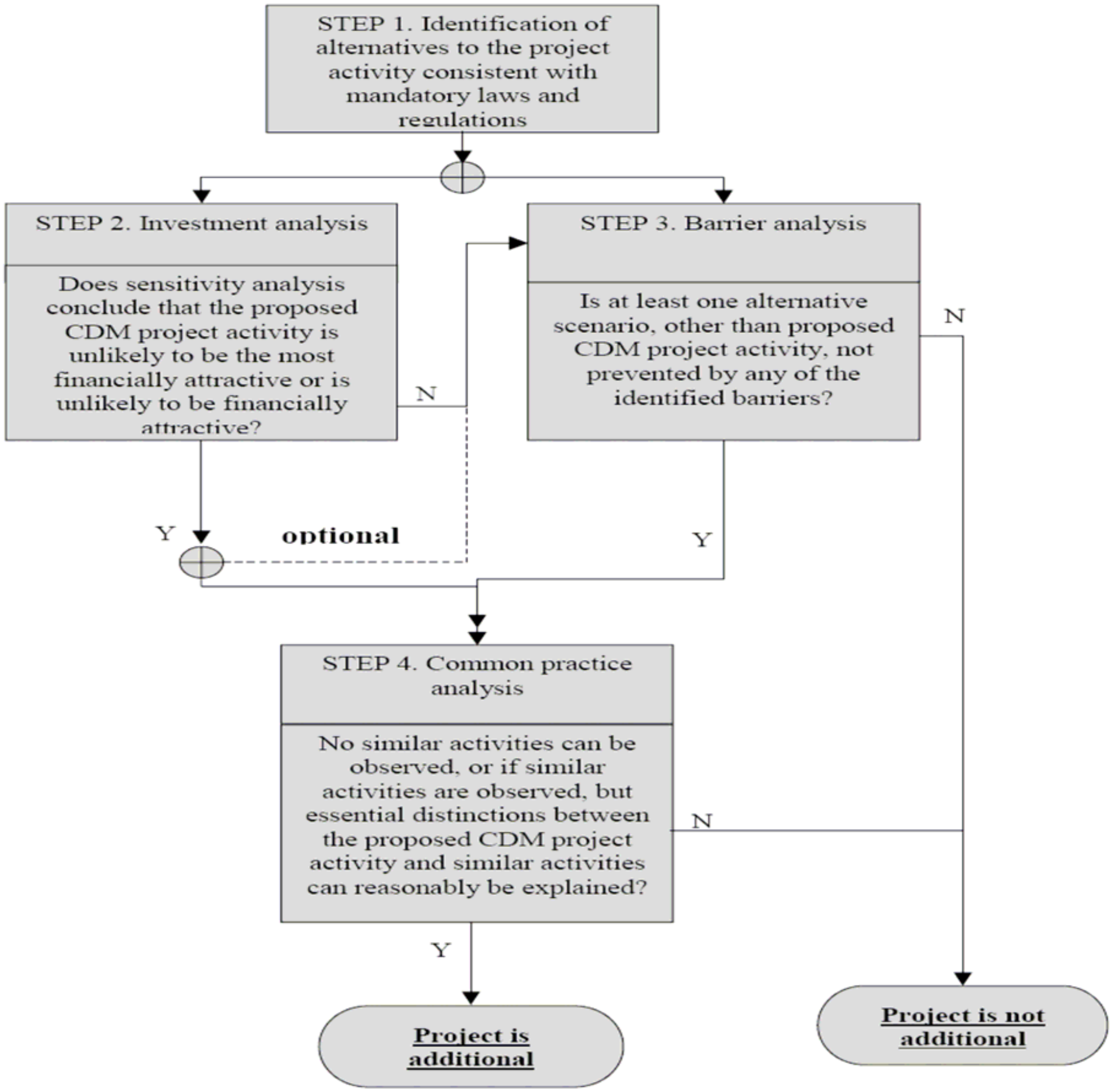
The operation of the project activity without CDM funds is not a feasible option due to the various barriers the project has faced as discussed in the subsequent section.

The above-mentioned alternatives are tested for their compliance with the applicable legal and regulatory requirements. All alternatives are found to meet all the legal and regulatory requirements in India. In addition, any law does not require implementation of the project activity.

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 CDM project activity (assessment and demonstration of additionality): >>

Explanation to show that project activity is additional

As per approved consolidated baseline methodology ACM0002/Version 06, additionality of the project activity has been demonstrated with the Additionality tool, version 04. The flowchart presented below provides a step-by-step approach to establishing additionality of the project activity as per the additionality tool:



DLHPPL has considered CDM revenue in the project cash flow even prior to the commencement of the present project activity. This remains justified from the following facts[2]

- DLHPPL has executed Green House Gas Emission Reduction Purchase Agreement with International Finance Corporation (IFC) on 27 th September, 2006 which is prior to the project activity start date.

[2] All the related documentary evidence in support of CDM consideration prior to the starting date of the present project activity has been provided to the DOE during validation.

- The Board Resolution dated 9th February, 2004 evidently discuss about consideration of CDM revenue for the present project activity.

- DLHPPL has registered another small scale hydro power project viz. "12 MW hydropower plant in Bhandardara in Maharashtra, India." (Project reference number: 0430)[3] on 30th September, 2006 i.e. prior to the starting date of the present project activity.

In addition to the points mentioned above a chronology of events from the receipt of the BID invitation by DLHPPL from GOMID to physical handing over of the asset (Present project activity) is furnished below.

Chronology of events of the project activity[4]

Date	Activity	Documents submitted to DOE/ Remarks
December, 2003	Invitation of BID from private entrepreneurs received from the Government of Maharashtra Irrigation Department (GOMID) for operation of Bhandardara Hydro Electric Project, Power House - II on advance lease, operate and transfer basis.	BID invitation document.
9-Feb-04	The board discussed about the importance of carbon revenue towards improving the financial viability of the project and decided to initiate the necessary action towards realising carbon revenue.	The certified true copy of the minutes of the meeting of the Board of Directors of DLHPPL.
21-May-04	The BID document submitted to GOMID by DLHPPL	BID submission document.
31-Dec-04	The rehabilitation and operation of BH-2 was awarded on an advanced lease, own, operate and transfer basis to DLHPPL.It was stipulated in the lease deed that the physical hand over of the asset will take place only after successful ratification of the following condition. **a**.Furnishing performance security along with this agreement on registered stamp paper to sign the Lease Deed within one month from the Notification of Award. **b.**Financial closure procedure to be completed within next six months.	Lease Deed

[3] http://cdm.unfccc.int/UserManagement/FileStorage/1HLXJHFR0P5RQF842JCUCVBKZKZ5LR

[4] All the evidences have been provided to the DOE during validation

	c.Payment of first instalment of quoted price and signing of Lease Deed within next one month. **d.**Handing over of Bhandardara Power House - II within one month from the receipt of first instalment of quoted price and signing of Lease Deed by M/s DLHPPL with GOMWRD.	
21-Dec-05	The loan agreement signed with International Finance Corporation (IFC)	Term Loan Agreement
28-Jun-06	The Power Purchase Agreement (PPA) signed between DLHPPL & MSEDCL.	PPA with MSEDCL for BH - 2
25-Jul-06	The lease agreement signed with GOMWRD	Signed lease agreement
27-Sep-06	The Emission Reduction Purchase Agreement (ERPA) signed with International Finance Corporation (IFC)	ERPA with IFC
19-Dec-06	Physical handing over of the asset as per the terms stipulated in the Lease Deed dated December 31, 2004.	

Hence all the facts stated above very evidently lead to the conclusion that DLHPPL has seriously considered the inclusion of CDM revenue in the project cash flow prior to the commencement of the project activity.

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

Sub-step 1a. Define alternative scenarios to the proposed CDM project activity:

In sub-step 1a realistic and credible alternative(s) that were available to the project proponent or similar project developers that provide output or services comparable with the project activity are identified.
The following paragraphs illustrate the alternatives:

Alternative 1- Implementation of the project activity not undertaken as a CDM project activity;

In this alternative, the project activity is connected to the western grid and therefore it displaces an equivalent amount of electricity of the grid mix of western grid. About the identification of alternatives to the project activity consistent with current laws and regulations, it is noted that the approach under this heading needs to take into account the particular nature of the DLHPPL project, in the sense that it is not a new development of a project but the refurbishment and modernization of an existing project resulting in a more modern and efficient hydropower plant.

Alternative 2- No project activity; Continuation of current situation

In this alternative, in the absence of the project activity, BH-2 would continue to operate at lower efficiency and generate lesser electricity

In Alternative 2 *i.e.* in absence of the project activity, an equivalent amount of electricity (Additional generation of around 15.14 GWh during first year and 21.14 GWh from the second year onwards) would be generated by the power plants comprising the western grid mix, which is thermal predominant. An equivalent amount of carbon dioxide would be generated at the thermal power generation end. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

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

The above alternatives are in compliance with applicable legal and regulatory requirements. Moreover, there is no foreseeable regulatory change that would make the above alternatives non- compliant.

Step 2 Investment analysis OR Step 3 Barrier analysis

For the project activity, additionality has been established by conducting both the Step 2: (Investment Analysis) and Step 3. (Barrier Analysis). To conduct the investment analysis, the following sub-steps have been applied:

Sub-step 2a Determine appropriate analysis method

The project activity will sell the electricity to the local state utility. Hence, the project activity generates financial or economic benefits by means of sale of electricity other than the expected CDM revenue.

As per the additionality tool, version 4, the simple cost analysis (Option I) cannot be considered in cases where the project generates financial benefits other than CDM related income. Therefore the Option I – simple cost analysis would not be an appropriate analysis method.

Amongst the other two options – investment comparison analysis (option II) and benchmark analysis (option III), the benchmark analysis has been adopted wherein the project IRR (Post-tax) of the project activity has been used as a benchmark to evaluate the economic attractiveness of the project activity.

Sub-step 2b – Option III. Apply benchmark analysis

The project proponent has used post tax project IRR as a financial indicator for financial analysis and additionality justification.

The benchmark for the project activity is calculated based on para 6 b of the additionality tool.

(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;

The project activity involves both equity and debt component. Hence the cost of financing has been derived based upon weighted average of the cost of debt and equity component as determined for the project activity.

1. Cost of Equity:

The cost of equity has been determined based upon the Capital Asset Pricing Model (CAPM).

1.1 CAPM: The Capital Asset Pricing Model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

The underlying algorithm of CAPM is as follows

$$r = R_f + Beta\ (R_m - R_f)$$

Where,

r = Expected return from a security

R_f = Rate of a risk free investment

R_m = Expected market return

Beta = Indicator towards measuring the volatility of the security, relative to the asset class.

It is apparent from the above equation that the expected return from a security is the return of a risk-free investment plus Beta times the difference between the expected market return and the return from the risk-free investment (termed as market risk premium). Hence CAPM justifies that the expected return of an investor should be commensurate with the higher expected risk of the investment.

In words, the algorithm says

Expected Return from a security = Risk free return + Market risk Premium * Beta

Thus, in order to apply CAPM, the following estimates are required

- Risk Free rate
- Market Risk Premium
- Beta

1.2Risk Free Rate

The risk free rate is the return on a security (or a portfolio of securities) that is free from default risk. Typically, the rate of long term government bonds are used to determine the risk free rate

In the context of the present project activity YTM[5] (Yield to Maturity) at primary issues over a period of 10 years has been considered to represent the risk free rate.

[5] Reserve Bank of India - Annual Report, 2004. Page no.172 of the report (http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/56232.pdf)

The value is 7.34%.

1.3 Market Risk Premium

The market risk premium is the difference between the expected market rate of return and risk free rate and is usually measured by looking at the average of the historical returns on a market portfolio.

In the context of the present project activity, the period of 2002 to 2004 has been selected to calculate the expected market return. Towards calculating the average of the historical returns on a market portfolio, the project participants had the following stock market indices[6] to select from:

BSE SENSEX

BSE Sensex stands for Bombay Stock Exchange Sensitive Index. It is an index composed of the 30 largest and the most actively traded stocks in the market. These companies hold around one fifth of the market capitalization of the BSE. It is regarded as the pulse of share market, the dips and rise of the Indian share market can be identified through the Sensex.

BSE 100

BSE 100 index is called as BSE National Index as it works as a broad-based index reflecting the stock market at national level. Launched in 1989 this index was compiled of 100 companies from "Specified" and the "Non-Specified" list of the five major stock exchanges, viz. Mumbai, Calcutta, Delhi, Ahmedabad and Madras

BSE 200

Launched in 1994, BSE 200 index comprises of the 200 selected companies and their equity shares from the specified and non specified lists of the major exchanges. Companies are short listed on the basis of their current market capitalization and certain fundamental factors like the market performance of the company, volumes of the company turnover etc.

Jaiprakash Hydro Power Ltd. (the only listed IPP having its presence exclusively in hydro sector) forms a part of this index.

BSE 500

Due to the changing pattern of the economy, Bombay Stock Exchange coined a new index as, BSE 500 comprising 500 scripts. The index represents about 93% of the total market capitalizations, ideally said to represent the total market.

[6] Project proponent is headquartered in Mumbai and the operating stock exchange from Mumbai is Bombay Stock Exchange.

The market returns from these indices are as mentioned in the table below

	Year	Geometric Mean of Opening Index (for the month of Jan)	CAGR ON AVERAGE
SENSEX	2002	3353.31[7]	**33.64 %**
	2004	5988.90	
BSE 100	2002	1601.63	**40.55 %**
	2004	3163.75	
BSE 200	2002	375.28	**44.67 %**
	2004	785.5	
BSE 500	2002	1035.07	**52.80 %**
	2004	2416.59	

It is evident from the above analysis that amongst the Bombay Stock Exchange (BSE) indices the returns were maximum for BSE 500 index and the least for SENSEX.In order to be conservative SENSEX was selected as the portfolio of securities that represents the expected market return.

It may be worthwhile to discuss that among the many factors that influence and determine the market risk premium, variance in the underlying economy and the market structure are the most significant. **Risk premiums for emerging markets like India are larger than developed countries owing to their high growth and high risk economies** .Further, if the companies listed on the market are mostly large, stable, and diversified, risk premium is smaller. On the other hand when the companies listed on the market are generally small and not diversified, the risk premium is larger.

[7] Geometric mean of opening Indices price for the respective moth (Jan 2002). The opening data is taken from the website http://www.bseindia.com/histdata/hindices.asp

Thus the market risk premium estimated is

Market risk premium (Rm – Rf) = 33.64 – 7.34

= 26.30%

However the market risk premium should not be viewed on a standalone basis.

The over all risk premium depends on market risk premium as well as on a parameter called Beta, which has been explained below. While computing the expected return on equity a very conservative value of beta has been taken.

1.4 Beta:

Equity Beta is the measure of the expected volatility of a particular stock relative to a well-diversified market portfolio. It measures the systematic risk of a stock, i.e. the risk that cannot be eliminated in a well-balanced, diversified portfolio. The beta of equity is calculated as the covariance between its return and the return on a well-diversified market portfolio, divided by the variance of the return on a well-diversified market portfolio.

Equity Beta (□**e**) = Covariance (**r**, **rm**) / Variance (**rm**)

Where:

r is the return from the equity investment in a single stock

rm is the return from the equity investment in the well-diversified market portfolio

The measured equity beta for a particular firm relates to the unique capital structure of that firm and a change in the capital structure will change the degree of financial risk borne by the equity holders and hence the equity beta. A common practice to allow equity betas to be compared across firms with different capital structures is to adjust the estimated equity beta into the equivalent asset beta (which is the equity beta that would apply if the assets were financed wholly with equity) using the following formula:

$Beta_a = Beta_e / \{1+ (1- \mathbf{T})*(\mathbf{D} / \mathbf{E})\}$

where:

$Beta_a$ is the Asset beta or unlevered beta of the firm

$Beta_e$ is the Equity beta or levered beta of the firm

T is the marginal tax-rate of the firm

D / E is the debt-equity ratio of the firm

As an asset, beta is purged of the financial risks associated with gearing and it can be compared with other asset betas derived from different capital structures. The asset beta can then be adjusted into an equity beta that is consistent with the target project's level of gearing and compared, say, to an equity beta that can be estimated directly from the market.

Towards determining the value of Equity Beta, listed companies which are also involved in the similar business domain have been compared.

Company	Beta Value[8]
Jaiprakash Hydro Power Ltd (JHPL)	1.078
GVK Power & Infrastructure Ltd (GPIL)	1.101
Tata Power Company Ltd (TPCL)	0.964

Amongst the above listed companies, JHPL is a hydro power based Independent Power Producer (IPP) and TPCL also has mix of hydro power plants in their portfolio. GPIL is involved in establishing only thermal power plants and hence the corresponding Beta value has not been taken into further consideration.

Using the Equity beta value of JHPL, the asset beta has been determined

Company	Equity beta	debt to equity ratio (as per balance sheet of 31.03.2004)	Asset beta Or unlevered beta	Debt to equity ratio of the project	**Equity beta of project**
Jaiprakash hydro	1.078	1.94	0.39	2.33	**1.22**

Equity Beta applicable to the project has been determined by levering the asset beta determined above and using the same formula

Beta$_e$ = Beta$_a$ * *{1+ (1- T)*(D / E)}*

Where

Where D/E is the actual debt-equity ratio of the project and T is the actual effective tax rate of the project (MAT). Thus the equity beta applicable to the project is significantly higher than the equity beta of JHPL.

[8] Source : http://cdm.unfccc.int/Projects/DB/RWTUV1190101228.6/ReviewInitialComments/6USZ3WQZ5259KXKF5CYLILNL8YA8GL (Source: Bloomberg)

However, in India, activities in the electricity sector such as generation, distribution, transmission and trading of power come under the purview of a comprehensive legislation called the Electricity Act 2003 (EA 2003)[1]. As per the EA 2003, the power to determine the tariff relating to generation, transmission and distribution of electricity is vested with the Electricity Regulatory Commissions. In compliance with EA 2003, the government of India issued the National electricity policy in the year 2005. The policy required offering investors **a rate of return** on investment based on a clear understanding and evaluation of the risks and opportunities involved in the sector in order to attract investment in the sector (refer section 5.8.4 of the policy). At the same time, the policy also requires maintenance of an appropriate balance between the interests of the consumers and the need for investment while choosing the appropriate return on investment (section 5.8.4). The National Tariff policy, issued subsequently in the year 2006, also stated similar requirements for consideration while calculating tariffs. Accordingly, the Central Electricity Regulatory Commission (CERC) had fixed this appropriate return on investment as 16%.

However during executive board meeting no 40, EB has decided not to accept this benchmark. The exact extract is mentioned below:

"The Board noted that many proposed CDM project activities in the energy sector in India seek to demonstrate additionality by means of investment analysis applying a benchmark of 16%, which is based on tariff orders published in accordance with the Central Electricity Regulation Commission. The Board is concerned with the use of this value as a benchmark for proposed CDM project activities, as this value is used in tariff determination for CDM projects and for non-CDM projects. Therefore the Board is of the view that this value is not a suitable benchmark."

Thus taking due consideration of the above mentioned facts and figures, the conservative beta value taken in the calculation is only 0.60. The conservatism adopted in the computation of expected return on equity should thus be evident.

The table below and the explanation further on justify the conservativeness

Sources	**Value**	**Benchmark return on equity**
Equity Beta of JHPL	1.078	35.69 %
Equity Beta of TPCL	0.964	32.69 %
Equity beta applicable to the project	1.22	39.43%
Assumed Beta	0.6	23.12%

Return on equity (pre tax) ***= 7.34 + 0.6 * 26.30***

= 7.34 + 15.54

= **23.12%**

Impact of variation of Beta

JHPL is the only hydropower company which is listed and has a Beta value of 1.078

Using this value of Beta:

Return on equity = ***7.34 + (1.078 * 26.30)***

= 7.34 + 28.35

= **35.69%**

Therefore the values used by the project proponent in computation of Return on equity in CAPM model are conservative.

Thus it is evident that the project proponent has computed market risk premium based on the given guidance from UNFCCC and local financial system. The over all risk premium depends both on beta value and the market risk premium.

2. Cost of Debt:

The cost of debt has been ascertained from the interest rate charged by different Financial Institutions (FIs) who have taken term loan exposure in the present project activity. The project proponent has taken loan from three financial institutions with the varying interest rates. The weighted average interest cost adjusted for minimum alternative tax is considered as cost of debt.

Lenders	Loan (INR'0000000)	Interest rate	Interest
SBI	10.0000	8.750%	0.88
IFC	36.7860	10.945%	4.03
DEG	28.4131	6.478%	1.84
Tot/Avg	**75.1991**	**8.965%**	**6.74**

The post tax cost of debt has been calculated by multiplying the pre-tax cost of debt with (1- effective tax rate) which yields a value of 8.28 %.

Post Tax Cost of debt = Pre tax Cost of debt * (1 – effective tax rate)

= 8.965 % * (1 – 0.0768)

= 8.28 %

3. **Calculation of Benchmark**

Return on equity post tax: Considering the dividend distribution tax of 12.83[9]% and transfer to reserve of 10%, the return on equity is estimated to be 29.46%.

Sources	Weight age	Cost %	Rate
Share Capital (Million INR)	30%	**29.46%**	8.84%
Term loan (Million INR)	70%	**8.28 %**	5.79%
Total	100%		
Weighted average cost of capital	**14.63%**		

Thus, the weighted average cost of capital is

= 30% * 29.46 % + 70 % * 8.28 %

= 14.63 %

Thus the benchmark for the project activity is 14.63%.

All the relevant information and assumption towards project IRR (Post -tax) computation are as follows

Information and assumptions for project IRR (Post - tax) computation[10]

Sl. No.	Parameters	Value	Remarks
1.	Capacity of the project	34 MW	-
2.	Energy Tariff	INR 3.05 per unit and 3% escalation after every 10 years.	Please refer to the paragraph "9" of the Ad-Interim order dated 3rd December, 2002 (In the matter of Approval of Tariff for Second Year energy exported to MSEB against tri-partite Power Purchase Agreement (PPA), dated 21.1.1999 entered into between the MSEB, Irrigation Department of GoM and the Dodson-Lindblom

[9] http://www.personalfn.com/detailb.asp?date=7/10/04&story=6 (12.5%+surcharge)

[10] All the required documents will be made available to DOE during validation

			Hydro Power Private Limited, for Bhandardara Hydro Power Project Phase-1 (12 MW)) by Maharashtra Electricity Regulatory Commission wherein DLHPPL has clearly indicated that while formulating the project (Bhandardara Hydro Power Project Phase-1 (12 MW)) it was anticipated that there will be a maximum net rate of INR 3.05 per unit. The present project actiivity also being promoted by DLHPPL the same assumption has been used in deciding upon the tariff rate.
3.	Gross Generation	45,900 MWh (Pre - Nilwande) 52,020 MWh (Post – Nilwande)	The BID Document of Government of Maharashtra Irrigation Department (GOMID) specifies the following gross generation 36000 MWh (Pre Nilwande) 43560 MWh (Post – Nilwande) DLHPPL envisaged that the generation could be increased to the level as projected in the financial.
4.	Auxiliary Consumption	2% of Gross Generation	As experienced by DLHPPL from the other hydro power generating station under the same group.
5.	Net Generation	45,000 MWh (Pre - Nilwande) 51,000 MWh (Post – Nilwande)	Auxiliary consumption deducted from the gross generation.
6.	Total project cost	Upfront 600 Million INR Refurbishment 20 Million INR Engineering & Testing 5 Million INR Other Development 10 Million	The upfront payment of 600 Million INR is mentioned in the GOMID BID Document. The additional cost of 65 Million has been assumed by DLHPPL

		INR Finance Cost 10 Million INR Bank Guarantee 20 Million INR -- Total (600 + 65) Million INR	
7.	Equity	INR 199.5 Million (30% of the project cost)	-
8.	Debt	INR 465.5 Million (70% of the project cost)	-
9.	Operation & Maintenance expenses	2.5% of the project cost in the first year and 4% annual escalation every year from the 2nd year onwards. Towards computing the O&M expenses the project cost has been considered as the aggregate of initial lease payment (INR 600 Million) and the balance lease payment (INR 320 Million). The Net Present Value (NPV) of the balance lease amount of INR 320 Million has been computed at INR 2627 Million which is quite evident in the GOMID BID document which is pre-facto evidence as against the starting date of the project activity.	As experienced by DLHPPL prior to the project activity start date from the other hydro power generating station in the vicinity of the project activity under the same group. Escalation has been considered in line with the rate of annual inflation in India during 2003-04.
10.	Insurance expenses	0.5% of the project cost in the first year and 4% annual escalation every year from the 2nd year onwards.	-
11.	Balance lease amount which is to be paid to GOMID over a period of 30 years.	INR 2627 Million	As per the BID Document of Government of Maharashtra Irrigation Department (GOMID)
12.	GOMID charges	Upon installed capacity - INR 1,000 per MW and 10% annual escalation Water Cess & Maintenance Cess - INR 0.05 water cess per unit + INR 0.06 maintenance cess per unit and 10 % annual escalation	As per the BID Document of Government of Maharashtra Irrigation Department (GOMID)

13.	Depreciation	90% of the project cost has been equivalently distributed over a period of 30 years.	As per the CERC tariff order dated 26th March 2001.
14	Residual value	Residual value has been considered at 20th year which is equal to the difference between the initial lease payment and the aggregate of the depreciated value from year 1 to year 20.	-
15.	Rate of interest on long term debt	11.0%	-
16.	Standard tax rate	35.88%	-
17.	Tax rate during tax holiday	7.69%	-
18.	Duration of tax holiday	10 Years	

Sub - step 2c – Calculation and comparison of financial indicators

The project IRRs (Post - tax) have been computed over a period of 20 years based upon the project cash flow up to 20 years. It may be noted that the financial model of the project activity involves an initial upfront lease payment of INR 600 million and other related expenses amounting to INR 65 million. Besides this the project activity also involves balance lease payment to GOMID aggregating to INR 2627 million which has been distributed over the entire lease period of 30 years. The annual schedule of the balance lease payment is provided below

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Amount (Million INR)	0	0	0	5	5	7.50	7.50	10	10	10
Year	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Amount (Million INR)	10	10	30	30	30	30	30	120	170	170

Year	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Amount (Million INR)	170	172	200	200	200	200	200	200	200	200

In the present context since the project IRR (Post - tax) computation has been limited only up to 20 years a major share of the Balance lease payment (INR 1942 million i.e. 74% of the Balance lease payment of INR 2627 million) which is to be projected as expenses from 21st year to 30th year has not been reflected in the project cash flow that determines the project IRR (Post - tax).Hence it can be concluded that ,overall, a conservative approach has been adopted by means of limiting the project IRR (Post - tax) up to a period of 20 years.

The project IRRs (Post-tax) with and without CDM revenue is tabulated below.

Project IRRs (Post Tax) with and without CDM funds

Project IRRs (Base -Case)	
Project IRR – (Post - Tax) without CDM (%)	**Project IRR – (Post - Tax) with CDM (%)**
11.78	13.14

Comparison against the benchmark return of 14.63%

The project IRR (Post - tax) without CDM revenue for the project activity as computed over a period of 20 years remains below the benchmark value of 14.63%.

As apparent from the table above that the project IRR (Post-tax) improves only after accounting for the CDM revenue in its cash flow.

Sub-step 2d. Sensitivity analysis:

In the context of the present project activity the annual energy generation has been considered as one of the key parameters that determine the revenue from the project activity and hence the same has been further analysed as a suitable variable parameter to carry out the sensitivity analysis. The table below demonstrates how the profitability of the project activity will be impacted if the annual sale of power is reduced by another 10% or increased by 10%.

Reduction in annual generation: **Project IRRs (Post –Tax) with and without CDM funds (-10% generation)**

As per the BID document of GOMID the gross generation has been envisaged as 36,000 MWh (Pre - Nilwande) and 43,560 MWh (Post - Nilwande) which is lower than the projected generation in the financial. Hence a sensitivity analysis was carried out reducing the generation by 10% of the base generation. The project IRRs (Post -tax) with and without CDM revenue at reduced generation is tabulated below.

Project IRRs (-10% reduced generation)	
Project IRR – (Post - Tax) without CDM (%)	**Project IRR – (Post - Tax) with CDM (%)**
8.85	9.96

Comparison against the benchmark return of 14.63%

The result of the above sensitivity analysis reveals that the project IRRs – (Post -Tax) both with and without considering CDM revenue will remain well below the benchmark value of 14.63% if the power generation by the project activity is further reduced which is a very realistic consideration when compared against the generation as indicated in the BID document of GOMID.

Increase in annual generation: Project IRRs (Post -Tax) with and without CDM funds (+10% generation)

A sensitivity analysis was carried out considering increase in generation and the project IRRs (Post -tax) with and without CDM revenue at increased generation are tabulated below.

Project IRRs (+10% increased generation)	
Project IRR – (Post - Tax) without CDM (%)	**Project IRR – (Post - Tax) with CDM (%)**
14.45	16.04

Comparison against the benchmark return of 14.63%

As apparent from the above sensitivity analysis, with increase in power generation, the project IRRs (Post-tax) both with and without consideration of CDM revenue has improved. Project IRR (Post - tax) at increased generation without CDM revenue almost eclipses with the benchmark value of 14.63 % and it exceeds the benchmark value when CDM revenue is considered in the project cash flow.

Therefore the above analysis lead to the conclusion that the project activity could not ensure the benchmark return and inclusion of additional cash flow to the project in the form CDM revenue would muffle the financial risk to a certain extent. All the related financial data and calculations towards computing the project IRR (Post-tax) with and without CDM revenues and the benchmark return have been provided to the Designated Operational Entity (DOE) during validation.

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity

Investment barriers

The rehabilitation and operation of BH-2 was awarded on an advanced lease, own, operate and transfer basis to DLHPPL on December 31, 2004 with an upfront payment of INR 600 Million. However, there has been considerable delay in determination of tariff by MERC at which energy is to be purchased by Maharashtra State

Electricity Distribution Company Limited (MSEDCL), and hence delay in signing the PPA and Lease Agreement by the GOMWRD, which had led to the increase in project cost considerably.

The BH-2 peaking station operated by DLHPPL will be the first irrigation based peaking station operated by an Independent Power Producer (IPP). While deciding upon the investment in the project there was no peaking tariff available with Maharashtra Energy Regulatory Commission (MERC). This lack of tariff policy has created significant uncertainty in the viability of a peaking project and is a major barrier which mar's the ability of the project to commence. DLHPPL also as a part of their lease agreement will pay GOMID about INR 3227 Million over the 30 years lease period and water royalty to GOMWRD at INR 0.05 per kWh in the first year followed by annual increases indexed to the Wholesale Price Index (WPI), which will affect the revenues generated from the project. The further delay in introducing the peaking tariff would further hamper the project economics. Additionally, the escalation is indexed to WPI, which is totally dependent on other external factors and decided by the statutory authorities. This figure varies every year on account of which, the project proponents are unable to project the future income of the project activity.

The lack of project related data has been a major hindrance in procuring finance. DLHPPL had approached many Indian national banks to avail finance, however the lenders were not prepared to evaluate their application until a signed PPA and Lease Deed were available. Even so, Indian lenders were not willing to consider debt financing on a project finance basis. Indicative terms discussed included balance sheet financing with a loan with a term of 8 years with no moratorium on principal during the improvement period. The indicative interest rate was a variable rate in the range of 11% to 12 % per year. DLHPPL's balance sheet could not guarantee the size of the debt without additional collateral support. DLHPPL had to approach foreign financial institutions and procure debt on project finance basis by consolidating its assets and providing cross-collateralization from other affiliates.

Hydrological barrier

The BH-2 project depends on water released from the Bhandardara dam. Water discharge is a sensitive issue as it involves irrigation of the downstream "command area" and hence water discharge depends on irrigation and drinking water requirements and not the project activity's requirements. Irrigation release and control is presently from Bhandardhara Dam and the requirement for irrigation varies from 34 cumecs to 45 cumecs. The turbine is designed to handle 77 cumecs of water for 100% load. Hence, the plant will not be able to operate if the discharge is less than 40 Cumecs. Though DLHPPL were aware of this fact, they have gone ahead and bid for the project, because DLHPPL was confident that by making the necessary improvements, the operating environment of the Pravara River water management System can be improved and the requisite operating philosophy of the BH2 plant can be implemented to ensure optimal utilization and generation. Thereby, DLHPPL have taken a risk by deciding to invest in the project, knowing the fact that there would not be continuous water release from the reservoir.

The storage capacity of the existing Bhandardara reservoir is substantially lower than the mean annual inflow in to the river system. As it is the only major storage reservoir in the basin, the capability of the current scheme is severely limited in meeting the water demand. Hence GOMWRD is forced to release water for irrigation purposes at a constant rate which is barely above 50% of the design discharge capacity of the BH 2 plant, thereby severely limiting the generation from BH2 and additionally, negatively impacting plant efficiency. In addition, releases for drinking water are made at a much lower rate at which the BH2 plant cannot operate.

The water availability in the reservoir depends on the monsoon rain. Over 65 % of the annual generation of the project activity is from post – monsoon releases. Of late, monsoons have become erratic and unreliable. Although, the monsoons largely follow a regular pattern, during recent years the phenomenon has been quite erratic and becoming more and more unpredictable. In cases of below normal rainfall, GOMWRD may be forced to make adjustments in irrigation water release patterns to conserve available water resources. Such conservation measures can severely limit the ability of the BH2 plant to operate, if the release rates during an irrigation release cycle fall below minimum allowable machine limits.

In addition, the design of the various components of the Pravara River water management system have a major influence on the electricity generation profile from BH2. As the height of Nilwande Dam and resultant water levels in the reservoir increases, the backwater impacts the available head at BH2 and results in reduction of the electricity generation from the plant. Uncertainty in the construction schedule poses uncertainty and risk to the generation profile from the project. DLHPPL has assumed progressive reductions in generation from the project as the height of Nilwande Dam increases.

Institutional Barriers

The rehabilitation and operation of BH-2 was awarded on an advanced lease, own, operate and transfer basis to DLHPPL on December 31, 2004 and the lease agreement has been signed with GOMWRD on 25th July 2006.While deciding upon the investment in the project, there was no peaking tariff available with Maharashtra Electricity Regulatory Commission (MERC) which has resulted in the delay in signing the PPA. This lack of tariff policy has created significant uncertainty in the viability of a peaking project and is a major barrier, which impairs the ability of the project to operate profitably.

Due to the non-availability and delay in framing the peaking tariff policies, MERC has proposed to sign an interim PPA on the normal tariff of INR 2.84 per kWh with an annual escalation of INR 0.03. (During the period 11th to 15th year the tariff will remain constant.) till the peaking tariff policies are established. The peaking tariff policies will be established only when the plant would be able to operate as a peaking station, which is dependent on the completion of the construction of the dam. Due to the lack of clarity of dates of completion of construction, DLHPPL have a huge risk of signing the PPA at a lower tariff rate of INR 2.84 per kWh as compared to relatively high peaking tariff.

It is to be noted that DLHPPL had bid for the project to operate as a peaking station and receive peaking tariff. It is envisaged that the funds received (i.e. INR 600 Million) from DLHPPL would be utilized to fund the construction of the balancing storage facility that would permit the efficient utilization of scarce water resources in the region. The plant can operate as a peaking station once the construction of the Nilwande Dam is completed and subsequently receive the peaking tariff. As DLHPPL have no control over the completion of the construction of the dam and operate the plant as a peaking station, DLHPPL would have to continue operating the plant as a normal run of river hydro power plant with periods of shut down dictated by the irrigation requirements.

The timeframe of 3 years to raise the height of the dam to 613 m as indicated by Government of Maharashtra Irrigation Department is only indicative and there is no firm commitment to that extent. With no firm schedule for raising the height, DLHPPL will have to take the risk of operating the plant as a non-peaking station and receive lesser tariff.

Sub step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives

It may be seen that the identified barriers would not prevent the implementation of the project activity. It should be noted that there are no other known hydro power plants of this magnitude and serving this type of purpose (peaking and water management) in Maharashtra. Hence, the only alternative left would be continuation of the operation of the power plant in the existing condition.

Step 4 . Common practice analysis

It is further required to conduct the common practice analysis as a credibility check to complement the barrier analysis (Step 3).

Sub-step 4a. Analyze other activities similar to the proposed project activity:

The common prevailing practice in Indian power investment scene is investing in only medium or large scale conventional power projects, as several projects that are coming up are mostly large scale fossil fuel based power generation stations. This is mainly due to the assured return on investment, economies of scale and easy availability of finances.

The total installed generation capacity as on 31.03.2006 in the State of Maharashtra[11] was 16,089.84 MW of which the installed capacity of hydro power was 3224.66 MW (owned by State, Private and Central sectors). The installed capacity of hydro power was about 20.04% of the total installed capacity in the State. Of the hydro power installed capacity of 3224.66 MW, only 447 MW was owned by the Private sector (M/s Tata Power) which constituted only about 13.86% of the total hydro power installed in the State. It may be noted that the private owned hydro power projects (like that of the project activity) constituted only about 2.78% of the total installed generation capacity in the State as on 31.03.2006.The entire installed capacity of 447 MW (Private sector owned hydro power project in the state of Maharashtra as on 31.03.2006) belong to M/s Tata Power which are operational since pre-independence era[12]. Hence the project activity is not common practice in the State of Maharashtra since the proportion of the installed hydro power project in the state by private entities is quite insignificant (2.78%) when compared against the total installed capacity.

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

Thus in view of the above discussion it can be concluded that the project activity is not a common practice in similar sector in the region and hence the project facility has opted for the proposed project only after taking CDM funding into consideration.

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[11] Reference: Western Regional Power Committee (WRPC) Annual Report 2005-06 - http://www.wrpc.nic.in/annualreport0506/annex6.pdf

[12] http://www.prdomain.com/companies/T/TataPower/newsreleases/200832554755.htm; http://www.tatapower.com/services/power-projects.aspx;

http://www.domain-b.com/companies/companies_v/voith_siemens/20030626_online.html

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As per the ACM0002 methodology, for project activities that modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid ($EG_{baseline}$, in MWh/year) at historical average levels ($EG_{historical}$, in MWh/year), until the time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project activity ($DATE_{Baseline\ Retrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production ($EG_{baseline}$) is assumed to equal project electricity production (EGy , in MWh/year), and no emission reductions are assumed to occur.

$EG_{baseline} = EG_{historical}$ until $DATE_{Baseline\ Retrofit}$ **(1)**
$EG_{baseline} = EGy$ on/after $DATE_{Baseline\ Retrofit}$

Where $EG_{historical}$ is the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e., by 5% or more), expressed in MWh per year. A minimum of 5 years (120 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities.

All project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

In order to estimate the point in time when the existing equipment would need to be replaced in the absence of the project activity ($DATE_{Baseline\ Retrofit}$), project participants may take the following approaches into account:

(a) The typical average technical lifetime of the type equipment may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.
(b) The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment.

The point in time when the existing equipment would need to be replaced in the absence of the project activity should be chosen in a conservative manner, i.e. if a range is identified, the earliest date should be chosen.
The baseline emissions and the emission reductions from the project activity are estimated based on the quantum of additional electricity exported by the project activity to the grid and the baseline emission factor (BE_y) of the chosen grid calculated as a Combined Margin (CM), consisting of the combination of Operating Margin (OM) and Build Margin (BM) factors.

<u>Baseline emissions due to displacement of electricity by project activity</u>

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction *ERy* by the project activity during a given year y is the difference between baseline emissions (*BEy*), project emissions (*PEy*) and emissions due to leakage (*Ly*), as follows:

$ER_y = BE_y - PE_y - L_y$

where the baseline emissions (*BEy* in tCO2) are the product of the baseline emissions factor (*EFy* in tCO2/MWh), times the electricity supplied by the project activity to the grid (*EGy* in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities (*EG baseline* in MWh), as follows:

$BEy = (EGy – EG_{baseline}) \cdot EFy$

Electricity generation from the project activity

The project activity proposes to export additional 15.14 GWh during first year and 21.14 GWh from the second year onwards. Hence the project will displace an equivalent amount of electricity that would be generated by the western grid mix. Without the project activity, the same energy load would have been taken up by power plants of the project electricity system and equivalent CO_2 emissions would have been occurred due to fossil fuel combustion.

Project Emissions:

During the lean period DLHPPL imports power from the MSEB grid in order to satisfy their lighting load and other power requirement during the plant start up. Hence project emission has been considered on account of power import from the MSEB grid.

Leakage:

As per the ACM0002/ Version 06, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). The methodology specifies that the project participants do not need to consider these emission sources as leakage in applying this methodology. Therefore the leakage is not considered. Similarly, the project activity does not claim any credit for the project activity on account of reducing these emissions below the level of the baseline scenario.

Emission Reductions:

The emission reduction ERy due to project activity during a given year y is estimated as the difference between baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly), as per the formulae given below:

$$ER_y = BEy – PE_y - L_y$$

where

BEy = Baseline emissions in tCO_2
PEy = Project emissions;.
Ly = Emissions due to Leakage in tCO_2.

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

(Copy this table for each data and parameter)

Data / Parameter:	EF
Data unit:	T CO_2/MWh
Description:	Combined Margin-Western Grid
Source of data used:	CO_2 baseline database, version 3–Central Electricity Authority (CEA), Ministry of Power
Value applied:	0.79
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the CO_2 baseline database, version 3, published by Central Electricity Authority (CEA), Ministry of Power, the combined margin baseline emission factor for western grid has been estimated based on ACM0002, version 7 which refers to “Tool to calculate the emission factor for an electricity system”. As stated in section B.1 & B.2 in this document, the methodology ACM0002, version 06 has been applied to the project activity. It may be noted that the CO_2 baseline database, version 2, published by CEA is based on ACM0002, version 06 and could have been used for the project. However as a conservative approach, the CO_2 baseline database, version 3 (based on ACM0002 version 7) has been referred to in order to determine the Combined Margin emission factor of the Western Grid.
Any comment:	Details given in Annexure-3

Data / Parameter:	$EG_{Baseline}$
Data unit:	MWh
Description:	Baseline Power generation
Source of data used:	Average power generation from BH-2 during 2002 & 2003
Value applied:	29,863
Justification of the choice of data or description of measurement methods and procedures actually applied :	The power generation from BH-2 during 2002 & 2003 were collated and the average value of the data collected is considered as the baseline power generation.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

As per ACM0002/version 06, the baseline emissions (*BEy* in tCO2) are the product of the baseline emissions factor (*EFy* in tCO2/MWh) multiplied by the electricity supplied by the project activity to the grid (*EGy* in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities (*EG baseline* in MWh), as follows:

$$BEy = (EGy - EG_{baseline}) \cdot EFy$$

In order to calculate EG $_{Baseline}$, the annual historical generation at BH-2 from 2002 to 2006 was collated and is given in the table below and the $EG_{baseline}$ is calculated to be 29.86 GWh. GWh. The project activity will additionally export about 15.14 GWh during first year and 21.14 GWh from the second year onwards.

GROSS GENERATION FOR BH-II (kWh)

	Year				
	2002	**2003**	**2004**	**2005**	**2006**
Annual generation	35,070,970	35,170,690	27,051,820	25,783,160	26,242,980
Average historical generation for 5 years	29,863,924				

The emission factor EF $_y$ for the Western Grid for the year 2006-07 as calculated and published by the Central Electric Authority (CEA), Ministry of Power, India is *0. 79 t CO_2/MWh*. The details of the baseline emission factor are given in Annexure-3.

Project Emission

The average power import over the complete one year period (June, 2007 to May, 2008) has been estimated at 0.78% [13]of the net export.

Hence estimation of project emission is as follows

Year	Power exported to the grid (Million kWh)	Power imported from the grid (Million kWh)	Emission Factor (Tonnes of CO2/MWh)	Project Emission (Tonnes of CO_2)
2008 -09	45	0.35	0.79	277
2009-10 to 2017-18	51	0.40	0.79	316

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

Year	**Estimation of project activity**	**Estimation of baseline**	**Estimation of project**	**Estimation of overall emission**

[13] The supporting documents have been provided to the DOE during validation

	emissions (tons)	emissions (tons)	emission (tons)	reductions (tons)
2008-09	0	11,961	277	11,684
2009-10	0	16,701	316	16,385
2010-11	0	16,701	316	16,385
2011-12	0	16,701	316	16,385
2012-13	0	16,701	316	16,385
2013-14	0	16,701	316	16,385
2014-15	0	16,701	316	16,385
2015-16	0	16,701	316	16,385
2016-17	0	16,701	316	16,385
2017-18	0	16,701	316	16,385
Total	**0**	**162,266**	**3121**	**159140**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**Gross Electricity Generation**
Data unit:	MWh
Description:	Gross electricity generated by the project activity
Source of data to be used:	Joint Meter Readings (JMRs) taken and signed by authorised officials of MSEDCL.
Value of data	45,900 MWh during Year 1 & 52,020 MWh from Year 2 onwards.
Description of measurement methods and procedures to be applied:	The generation meter measures the units generated. The monthly Joint Meter Reading (JMR) of the generation meter shall be taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Records of the joint meter reading of energy generated shall be maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD. Daily and monthly reports stating the power generated shall also be prepared by the shift in-charge and verified by the plant manager of DLHPPL which shall be used to cross check the generation. The generation is measured in plant premises at generator terminals and is monitored and recorded continuously through PLC.
QA/QC procedures to be applied:	The data will be directly measured and monitored at the project site. The meters installed at the generator end shall be checked for accuracy for every six months and the calibration is done once in a year. If the accuracy of meter is found to be beyond permissible limit even after calibration then the meter shall be replaced with spare tested, calibrated meter.
Any comment:	DLHPPL shall archive all the JMRs and the complete metering data at generation end on paper and all the data would be preserved for at least two years after end of the crediting period.

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	Electricity Export ($EG_{, y}$)
Data unit:	MWh
Description:	Electricity exported to the grid by the power plant during the year, y
Source of data to be used:	Joint Meter Readings (JMRs) taken and signed by authorised officials of MSEDCL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	45,000 MWh during Year 1 & 51,000 MWh from Year 2 onwards
Description of measurement methods and procedures to be applied:	The measurement at 132 KV side for supply to MSETCL grid gives the Energy supply reading. The units exported will be measured at the interconnection point. Monthly Joint Meter Reading (JMR) of main and check meters installed at the substation shall be taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Joint meter reading of the main meter shall be the basis for monthly invoice of energy exported to the grid. Records of the joint meter reading of energy exported to the grid shall be maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD. Daily and monthly reports stating the power export shall be prepared by the shift in-charge and verified by the plant manager of DLHPPL.
QA/QC procedures to be applied:	For measuring the energy exported to the grid, one main meter and one check meter are maintained. Joint meter reading of the main meter is the basis of billing and emission reduction calculations, so long as the meter is found to be within prescribed limits of accuracy during the periodic check. Monthly joint meter reading of main and check meters are taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Records of this joint meter reading are maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD. The Meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year.
Any comment:	DLHPPL shall archive and preserve all the JMRs pertaining to the electricity exported and also the monthly invoices raised against saleable electricity, for at least two years after end of the crediting period. JMR of check meter shall be used for cross checking the export data.

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	Electricity Imported ($L_{,y}$)
Data unit:	MWh
Description:	Electricity Imported from the grid by the project activity
Source of data to be used:	Monthly billing records of MSEDCL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Year -1 – 350 Year -2 onwards - 400
Description of measurement methods and procedures to be applied:	The energy is imported at 33KV feeder and a separate independent energy meter is installed by MSEDCL to measure the units imported by DLHPPL. The units imported are recorded monthly and bills are issued by MSEDCL Bills of MSEDCL shall be the source of data for electricity imported. This data will be used to estimate the emissions due to the electricity imported from the grid and it will be considered as part of project emissions.
QA/QC procedures to be applied:	Import meter is under the custody of MSEDCL, and DLHPPL has no access to meter and the calibration details pertaining to the same. Hence calibration records are not maintained by DLHPPL for the import meter.
Any comment:	-

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	Auxiliary Consumption
Data unit:	MWh
Description:	Unit consumed by the plant
Source of data to be used:	Plant record book
Value of data	2% of gross generation
Description of measurement methods and procedures to be applied:	The difference between the gross electricity generation ($E_{\mathbf{Gen}}$) and electricity exported to the grid (EG_y) as per the JMR gives the total Auxiliary Consumption in the plant. This Auxiliary consumption includes losses in Generator step up transformer, in cables and in excitation system, which are not actually measured. Besides these other auxiliary consumption are measured at Unit Auxiliary Board
QA/QC procedures to be applied:	The data is calculated using the gross electricity generation and electricity exported as per the JMRs.
Any comment:	This data would be calculated based on gross electricity generation and electricity exported as per the JMRs. This data will also be used in calculating electricity export in the event of simultaneous failure and /or defect in accuracy of both the main meters and check meters.

Data / Parameter:	**Hourly Electricity Export (HEE_{main_meter})**
Data unit:	kWh
Description:	Hourly electricity exported to the grid by the project activity as recorded at the main meter and check meter. This parameter is relevant to conditions/ circumstances (those days) where the dates of Joint Meter Readings (JMRs) pertaining to the project activity do not match the individual verification periods.
Source of data to be used:	Log book records for the main meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	This data is recorded on an hourly basis by DLHPPL based on data recorded at the main meter.
QA/QC procedures to be applied:	For measuring the hourly energy exported to the grid, one main meter and one check meter are maintained. The hourly meter reading of the main meter is the basis of emission reduction calculations, so long as the meter is found to be within prescribed limits of accuracy during the periodic check. Hourly meter reading of the check meters would be used for cross checking. The meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year.
Any comment:	This parameter is relevant to conditions/ circumstances (those days) where the dates of Joint Meter Readings (JMRs) pertaining to the project activity do not match the individual verification periods

B.7.2 Description of the monitoring plan:

Key project parameters affecting emission reductions:

Electricity generated by the project activity: The power exported by the project activity would be monitored to the best accuracy and as per section B.7.1.

Power exported to the grid: The project revenue is based on the units exported by the project activity.

The general principles for monitoring above parameters are based on:

- Frequency
- Data recording
- Reliability

- Experience and training

Frequency

Joint meter reading (JMR) of main and check meters installed at the substation shall be taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Daily data recording by the shift in-charge of DLHPPL is there at generation end. Joint meter reading shall be the basis for monthly invoice of energy exported to the grid.

Data recording

Records of the joint meter reading of energy generated and exported to the grid would be maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD. Daily and monthly reports stating the generation and power export would be prepared by the shift in-charge and verified by the plant manager.

Reliability

For measuring the energy exported to the grid, one main meter and one check meter are maintained. Joint meter reading of the main meter is the basis of billing and emission reduction calculations, so long the meter is found to be within prescribed limits of error during the periodic check.

Joint meter reading of main and check meters are taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD once every month. Records of this joint meter reading are maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD.

The main and check meters installed are jointly inspected and sealed and are not interfered with, by either DLHPPL, MSEDCL or MSETCL except in presence of the other party. The meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year. The meters are checked for accuracy and/or calibrated at MSETCL's laboratory and sealed by MSEDCL, MSETCL and DLHPPL jointly.

If during periodic test check, main meter is found to be within permissible limits of error and check meter is found to be beyond permissible limits, then billing as well as emission reduction calculations are as per main meter as usual. However, the check meter would be calibrated and/ or replaced if required. If during test check, the main meter is found to be beyond permissible limits of error but check meter is found to be within permissible limits, then billing as well as emission reduction calculation for the month and up to date and time of the calibration/replacement of defective main meter shall be as per check meter. The main meter would be immediately calibrated and/ or replaced, as may be necessary where after billing as well as emission reduction calculation would be as per main meter.

If during the periodic test checks, the main and check meter are both found to be beyond permissible limits of error, then both the meters would be immediately calibrated or replaced if required..In such an event, the emission reduction calculations for the period (which starts on the day of the previous accuracy or calibration which ever is later and ends on the day when the meter is calibrated and/ or replaced – also referred to as ‘defect period’) would be calculated based on the gross electricity generation data taken from the JMR and the auxiliary consumption. For this purpose, the auxiliary consumption would be worked out as a percentage of gross electricity generation pertaining to the same calendar period (also referred to as ‘reference period’) as that of the defect period corresponding to the previous year. The percentage auxiliary consumption will be the maximum of the monthly percentage auxiliary consumption in the reference period. This maximum of the monthly percentage auxiliary consumption would be used to compute the electricity export and therefore the emission reduction for the defect period.

The meters installed at the generator end shall be checked for accuracy every six months at the MSETCL laboratory and the calibration is done once in a year at MSETCL. If the accuracy of the meter is found to be beyond permissible limit even after calibration then the meter shall be replaced with spare tested, calibrated meter.

DLHPPL shall archive and preserve all the JMRs pertaining to the energy generated and exported by the project activity, for at least two years after end of the crediting period. DLHPPL shall also archive the complete metering data at generation end and export data on paper and all the data would be preserved for at least two years after end of the crediting period.

Trippings due to grid failure

Number of trippings due to grid failure are recorded and verified with the allowable pre-defined number for the equipment. Monitoring plan has been established to verify and to ensure that the number of failures is less than prescribed limits.

Management structure for monitoring of parameters:

Hourly data recording of the generation and export to the grid will be made by the electrician of the shift and verified by the shift engineer of DLHPPL and these data will be there at generation end. Daily and monthly reports stating the generation and power export are prepared by the shift in-charge and verified by the plant manager of DLHPPL. Records of joint meter reading would be maintained by plant manager of DLHPPL at site. MSEDCL (MSEB) also maintains the records of joint meter readings at their office. Monthly invoices are prepared based on Joint meter readings, which will be used for cross checking the energy exported to the grid. The plant manager is a qualified engineer with considerable experience in power industry. All the shift engineers are qualified engineers and have undergone related training including plant operations, data monitoring, report generation etc.

Procedures for handling data uncertainties: '*In the event when verification period dates and JMR dates in the project activity, does not coincide':*

For electricity exports:

In the event when the individual verification period dates and the date of JMR pertaining to the project activity do not coincide, the following procedure would be adopted to estimate the electricity supplied to the grid during the specific period/ or days where there is a mismatch. The hourly electricity export readings (HEE_{main_meter}) recorded at the main meters would be monitored by DLHPPL for the project activity in their log book. For the mismatch period, the hourly electricity export readings would be considered in order to arrive at the electricity supplied/ exported by the project activity to the grid during that period. This method would be followed in cases where the starting or ending / last dates of the verification period do not match the JMR dates of the project activity.

For electricity imports:

This is in the event when the individual verification period dates and the date of Monthly records for electricity imports (recorded by MSEDCL) pertaining to the project activity do not coincide. It is to be noted that the units imported are recorded on a monthly basis and issued by the MSEDCL. The maximum monthly electricity imports during the previous 12 month period (prior to the date of mismatch) would be arrived at. For the mismatch period, the maximum monthly electricity import as identified above would be taken and the daily import would be worked out based on the number of days during the concerned month. This daily import as worked out would be applied for those specific days of mismatch to estimate the total import for the mismatch period. .

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

04/06/2008

Name of responsible person (s) / entity (ies)

Mr.Prem. S. Paunikar
Director (Maharashtra Projects)
Dodson-Lindblom Hydro Power Private Limited.

Mr. Prem. S. Paunikar represents the project proponent i.e. DLHPPL and is a project participant. The address and the contact details of the project proponent have been provided in Annex – 1.

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:

19/12/2006

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

30 years, 0 months

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

Fixed crediting period of 10 year is chosen

C.2.1. Renewable crediting period

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:

01/10/2008 Or subsequent to the project registration date, whichever is later

C.2.2.2. Length:

10 years, 0 months

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The project activity involves the modification and retrofitting of the existing facility i.e. the 34 MW hydropower plant at Bhandhardara -2. The project activity being a modification and retrofitting activity of an existing facility, does not require environmental clearance. It may be noted that the existing facility had already obtained the necessary approvals.

However, DLHPPL has carried out an Environmental Review Summary (ERS) of the project activity. A brief of the same applicable for the project activity is discussed below;

The following potential environment, health and safety and social aspects of the project were analyzed:

- land acquisition, compensation and physical and/or economic resettlement;
- national and local government permitting requirements;
- potential impacts on downstream users; and
- provision of housing, hygiene facilities, water, and power (including fuel storage) during construction and operation;
- Impact on air, water and ecology due to project activity
- Social and economy issues

Land acquisition, compensation and physical and/or economic resettlement

There has been no separate land acquisition due to the project activity as BH-2 is an existing unit. Hence, there is no physical and/or economic resettlement. Since the project activity does not increase the reservoir size and does not cause any land inundation, there are no land submergence issues and hence no resettlement and rehabilitation was involved.

National and local government permitting requirements

Since BH-2 is an existing operating unit the former operators obtained all applicable permitting requirements.

Potential impacts on downstream users

The water discharge levels from BH-2 are controlled by the GOM irrigation authorities, who release water at Bhandardara dam in accordance with agricultural demands downstream. The BH2 plant is required to operate on the basis of available releases and does not influence the release pattern. Therefore, the potential impacts on downstream users is not in the control of the project activity owing to the pattern of irrigation releases followed by GOM.

Provision of housing, hygiene facilities

DLHPPL has constructed a housing facility for its staff with adequate water, sanitary facilities.

Impact on Air, water and ecology

There is no impact on the air quality due to the project activity. No effluents are produced from the project activity and hence no impact on water. Hence, there are no significant impacts on the ecology due to the project activity.

Social and economy issues

The installation of the project activity will give job opportunities to the local community during refurbishment and operation of the project activity. The project activity has contributed for improving the standard of living of the local community.

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:

The environmental impacts of the project are not significant as apparent from the Section D.1 above.

SECTION E. Stakeholders' comments

>>

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

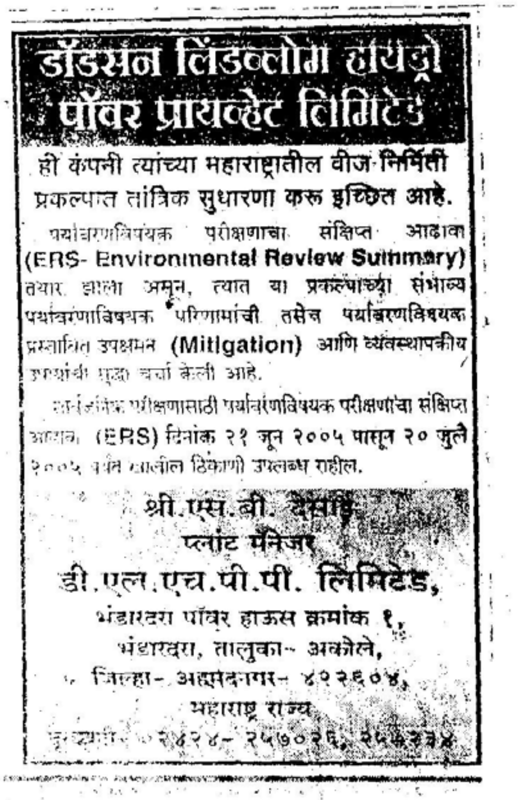
As part of CDM project, an ERS was prepared by DLHPPL by its consultants and this ERS was given for public scrutiny. An advertisement was given in Dainik Lokmat of Ahmednagar edition in Marathi language on 20/06/2005 (local newspapers) in vernacular language. The advertisements informed about the project activity and about the availability of ERS report and inviting public and local stakeholders to avail a copy of the document and offer their comments. ERS was kept for public inspection at the project sites. A register was maintained to make the entries of the issue of ERS. A scanned version of the newspaper advertisements and its translation in English is attached herewith. Besides this a stakeholders' meeting was conducted on 15th June, 2007 in the local Panchayat office. The stakeholders identified for the project are local villagers, representative from the local Pancayat etc. All the members present in the consultation process has given their consent in favour of the project.

Translation of the newspaper advertisement

This company wishes to technically upgrade their power generation project in Maharashtra. ERS – Environmental Review Summary has been prepared and it covers the probable environmental issues arising out of this project as well as environmental mitigations and management solutions have also been discussed.

The ERS is open for public inspection from 21st June 2005 to 20th July 2005 at the following address :

Shri S. B. Desai
Plant Manager
D. L. H. P. P. Limited
Bhandardara Power House No. 1
Bhandardara, Taluka: Aloka
District – Ahmednagar – 422604
State : Maharashtra
Tel : 02424 – 257026, 257234



डॉडसन लिंडब्लोम हायड्रो पॉवर प्रायव्हेट लिमिटेड

ही कंपनी त्यांच्या महाराष्ट्रातील वीज निर्मिती प्रकल्पात तांत्रिक सुधारणा करू इच्छित आहे.

पर्यावरणविषयक परीक्षणाचा संक्षिप्त आढावा (ERS- Environmental Review Summary) तयार झाला असून, त्यात या प्रकल्पाच्या संभाव्य पर्यावरणविषयक परिणामांची तसेच पर्यावरणविषयक प्रस्तावित उपशमन (Mitigation) आणि व्यवस्थापकीय उपायांची सुद्धा चर्चा केली आहे.

सार्वजनिक परीक्षणासाठी पर्यावरणविषयक परीक्षणाचा संक्षिप्त आढावा (ERS) दिनांक २१ जून २००५ पासून २० जुलै २००५ पर्यंत खालील ठिकाणी उपलब्ध राहील.

श्री. एस. बी. देसाई

प्लांट मॅनेजर

डी. एल. एच. पी. पी. लिमिटेड,

भंडारदरा पॉवर हाऊस क्रमांक १,

भंडारदरा, तालुका- अकोले,

जिल्हा- अहमदनगर- ४२२६०४,

महाराष्ट्र राज्य.

दूरध्वनी- ०२४२४- २५७०२६, २५[illegible]

E.2. Summary of the comments received:

There was no request from the stakeholders to review the environmental social review till the prescribed period of availability (20 July 2005) and there was no comment from anybody.

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

As no comments were received, no action has been taken in this regard.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant – 1

Organization:	Dodson-Lindblom Hydro Power Private Limited
Street/P.O.Box:	Ro.No.5
Building:	6, Shiv-Watsu, Tejpal Scheme
City:	Vile Parle (East), Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400057
Country:	India
Telephone:	+91 22 2682 6819/ 2682 6718 / 2682 6594
FAX:	+91 22 2683 4658
E-Mail:	dlhppl@dlz.com
URL:	
Represented by:	
Title:	Director (Maharashtra Projects)
Salutation:	Mr.
Last Name:	Paunikar
Middle Name:	S.
First Name:	Prem
Department:	
Mobile:	+91 98206 11688
Direct FAX:	
Direct tel:	
Personal E-Mail:	premsp@vsnl.net

Project Participant – 2

Organization:	The Netherlands represented by its Ministry for Housing, Spatial Planning and th Environment acting through the IFC-Netherlands Carbon Facility ("INCaF") an INCaF's Trustee
Street/P.O.Box:	2121 Pennsylvania Avenue NW
Building:	
City:	Washington,
State/Region:	DC
Postfix/ZIP:	20433
Country:	United States of America
Telephone:	+1 202 473-4194
FAX:	+1 202 974-4404
E-Mail:	carbonfinance@ifc.org;
URL:	
Represented by:	
Title:	Program Manager
Salutation:	Mr.
Last Name:	Widge

Middle Name:	-
First Name:	Vikram
Department:	Carbon Finance, Environment Finance Group, Environment and Social Development Department
Mobile:	-
Direct FAX:	+1-202-974-4404
Direct tel:	+1-202-473-1368
Personal E-Mail:	vwidge@ifc.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity is financed by internal accruals and loan from financial institutes. The funding for the project activity does not involve any Official Development Assistance (ODA) or public funding from Annex –1 Parties. Hence no diversion of ODA will result due to the project activity.

Annex 3

BASELINE INFORMATION

(Source: Central Electricity Authority, CO2 baseline database, Ver 3.0)

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)							
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.72	0.73	0.74	0.71	0.72	0.73	0.74
East	1.06	1.03	1.09	1.08	1.05	1.05	1.00
South	0.74	0.75	0.82	0.84	0.79	0.74	0.72
West	0.90	0.92	0.90	0.90	0.92	0.89	0.86
North-East	0.42	0.41	0.40	0.43	0.52	0.33	0.40
India	0.82	0.83	0.85	0.85	0.84	0.81	0.80
Simple Operating Margin (tCO2/MWh) (incl. Imports)							
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.98	0.98	1.00	0.99	0.98	1.00	1.00
East	1.22	1.19	1.17	1.20	1.17	1.13	1.09
South	1.02	1.00	1.01	1.00	1.00	1.01	1.00
West	0.98	1.01	0.99	0.99	1.01	1.00	0.99
North-East	0.74	0.71	0.74	0.74	0.90	0.70	0.70
India	1.01	1.02	1.02	1.02	1.02	1.02	1.01
Build Margin (tCO2/MWh) (not adjusted for imports)							
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North					0.53	0.60	0.63
East					0.90	0.97	0.93
South					0.70	0.71	0.71
West					0.77	0.63	0.59
North-East					0.15	0.15	0.23
India					0.69	0.68	0.68
Combined Margin in tCO2/MWh (incl. Imports)							
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.76	0.76	0.77	0.76	0.76	0.80	0.81
East	1.06	1.05	1.04	1.05	1.04	1.05	1.01
South	0.86	0.85	0.86	0.85	0.85	0.86	0.85
West	0.87	0.89	0.88	0.88	0.89	0.82	**0.79**
North-East	0.44	0.43	0.44	0.44	0.52	0.42	0.46
India	0.85	0.86	0.86	0.86	0.86	0.85	0.84

Annex 4

MONITORING INFORMATION

The monitoring plan would be as per Section B.7.1 and Section B.7.2 of the PDD.

Appendix 1 –Abbreviations

BH-1	Bhandardara power house –1
BH-2	Bhandardara power house –2
BM	Built Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CPCB	Central Pollution Control Board
cusec	cubic feet per second
DLHPPL	Dodson –Lindblom Hydro Power Private Limited
DLI	Dodson –Lindblom International
ERS	Environmental Review Summary
GHG	Green house gases
GOM	Government of Maharashtra
GOMID	Government of Maharashtra Irrigation Department
GOMWRD	Government of Maharashtra Water Resources Department
GWh	Giga watt hour
HT	high tension
IPCC	Inter Governmental Panel on Climate Change
IREDA	Indian Renewable Energy Development Agency
$kgC0_2$ eq/kWh	Kilogram carbon di oxide equivalent per kilowatt hour
KV	Kilo Volt
kW	Kilo Watt
kWh	Kilo Watt hour
m	Meter
m^3	Cubic meter
m^3 /s	cubic meters per second
MCM	Million cubic meter
Mm^3	Million cubic metre
MERC	Maharashtra Electricity Regulatory Commission
MNES	Ministry of Non conventional Energy Sources, Government of India
MoEF	Ministry of Environment &Forests, Government of India
MSEB	Maharashtra State Electricity Board
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSPGCL	Maharashtra State Power Generation Company Ltd
MSTCL	Maharashtra State Transmission Corporation Limited

MU	Million kilowatt hour
MW	Megawatt
MWh	Mega Watt hour
NHPC	National Hydroelectric Power Corporation Limited
NPC	Nuclear Power Corporation Limited
NTPC	National Thermal Power Corporation Limited
OH	Over head
OM	Operating margin
PCB	Pollution Control Board
RCC	Reinforced cement concrete
Rs.	Indian Rupees
tCO_2e or tCO_2eq	tonnes carbon di oxide équivalent
tCO_2eq/ year	tonnes carbon di oxide équivalent/ year
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollars
WREB	Western Region Electricity Board

Appendix 2- List of References

Sl. No.	Particulars of the references
1.	United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
2.	UNFCCC document: Guidelines for completing the project design document (CDM-PDD), and the proposed new baseline and monitoring methodologies (CDM-NM) – Version 06.2
3.	UNFCCC document Clean Development Mechanism Project Design Document form (CDM-PDD) Version 03.1 – in effect as of: 28 July, 2006
4.	UNFCC Document - Revision to approved consolidated baseline methodology ACM0002/ Version 06, dated 19th May 2006 http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
5.	Revised 1996 IPPC guidelines for National Greenhouse Gas Inventories: Workbook and Reference Manual
6.	Ministry of Power (MoP), Govt. of India, www.powermin.nic.in
7.	Ministry of Non conventional Energy Sources www.mnes.nic.in
8.	Central Electricity Authority (CEA), Govt. of India, www.cea.nic.in
9.	Ministry of Environment and Forest, http://envfor.nic.in
10.	Maharashtra State Transmission Company Limited www.mahatransco.in
11.	Maharashtra State Electricity Board www.msebindia.com
12.	Maharashtra State Power Generation Company Ltd www.mahagenco.in
13.	Ministry of Environment and Forest, http://envfor.nic.in/cdm/host_approval_criteria.htm
14.	Detailed Project Report for Bhandardara Powerhouse II

Enclosure-1

Rehabilitation works to be implemented by the project participant

BH-2 consists of following components:

- Randha pick up weir
- Intake
- Head race tunnel
- Surge shaft
- Pressure shaft
- Power house
- Tail race tunnel and Channel
- Draft tube gate
- Downstream protective structures

Rehabilitation in Randha Pick-up Weir

- Lay electrical cables properly which are at present hanging free or lying on ground
- Replace roof sheets on electrical supply room and paint room
- Place emergency gate system in operation to allow repairs to sluice gates
- Replace the rubber seals on sluice gates and align hoist mechanism
- Clean and lubricate all hoist mechanisms
- Replace main switches (4 nos.) at L.T. Room
- Check control circuits and modify, as required, for proper operation of the gate
- Supply and install a water level gauge with remote indication in control room so that operator knows the water level in the reservoir at all times
- Provide lighting in gate area for safety during night time operation and inspection.

Rehabilitation in Intake

- Repair balancing valve when reservoir level is drawn down
- Repairs of civil work in checker plates, gates etc.)
- Lay properly electrical cables by supporting on structures and in cable trays
- Review power supply to this area and modify so that supply comes from powerhouse circuits from which emergency
- Install lights in area for safe working conditions at night
- Overhaul hoists, lubricate and renew protection on wire ropes

Rehabilitation in Head Race Tunnel

- Construct wall outside of Mucking tunnel entrance gate to catch boulders and material before it enters the tunnel which would facilitate easier annual maintenance.
- Repair the eight pockets in the crown of the lining and the miscellaneous pockets in the floor
- Clean the debris in the mucking tunnel at the masonry wall to facilitate access for concrete repairs.

Rehabilitation in Surge Shaft

- Construct a ladder from top rim of surge tank to floor of tank for maintenance access.
- Erect a chain link fence on top perimeter of surge tank .

Rehabilitation Work in Pressure Shaft

- Clean and repaint the metal of the pressure shaft

Rehabilitation Work in Power House

- Repair observed leaks in power house well.
- Clean the upstream walls of the powerhouse and service bay, paint with water sealing paint and install gutters to direct any water leakage to collection points.
- Clean the walls of the well, paint with water sealing paint and install gutters to direct any water leakage to collection points.
- Clean the powerhouse
- Repair the entrance gate shutter.
- Set right the doors of the control room
- Check emergency closing capability
- Repair oil leaks in the oil pressure system
- Repair greasing system
- Replace seal on internal valve door

Rehabilitation Work in Turbine

- Inspect runner for cracks where previous in-situ repairs were performed and conduct necessary repairs in a controlled environment to ensure proper operation.
- Inspect runner after monsoon operation and at the end of the irrigation water season each year, for signs of cracking and/or excess cavitation.
- Replace runner when hydraulic regime changes with construction of downstream reservoir.
- Overhaul governor oil system and repair leaks

- Clean the shaft, clean and paint turbine pit
- Check shear pin indication system and repair, if necessary
- Cut angles off draft tube walls and repaint

Rehabilitation Work in Generator

- Clean the generator
- Overhaul the dust collection system and place in operation
- Repair oil leak in level gauge connection
- Clean and test CO_2 system and establish a periodic testing program
- Design and install a ventilation fan on the service bay level with a duct blowing fresh air to the bottom of the well. Two fans and duct systems shall be provided to move sufficient air.

Rehabilitation of Miscellaneous Electro-Mechanical Works

Rehabilitation of Mechanical Works

- Replace or repair oil filter machine
- Install new CO_2 type extinguishers for confined areas as factory.
- Overhaul EOT Crane
- Overhaul workshop tools
- Add structural steel bracing the hoist tower for draft tube gates and shaft
- Purchase two hoists of the appropriate capacity and drum size
- Dismantle the hoist tower and mount the hoists directly onto the concrete pad.

Rehabilitation of Electrical Works

- Refurbish the circuits to the various equipment by dressing cables, repairing conduits and junction boxes and repairing glands/seals at equipment
- Clean and refurbish auxiliary starter panels, glands, doors, close unused openings, remount panels away from the walls in wet areas.
- Refurbish the auxiliary distribution board cabinet
- Clean all the contact surfaces of the joints in the excitation system bus work, repair doors on cubicles and glands/seals on entry points.
- Replace excitation brushes on generator and clean slip rings.
- Refurbish the cubicle for the main incomer distribution board
- Repair oil leaks on the station service transformer and refurbish terminal boxes

- Build a concrete block curb and a room around the station service transformer to contain any oil spills and fires. Alternatively replace the oil filled transformer with a dry type.
- Replace the switches, conduit and cable for the powerhouse lighting circuits.

Rehabilitation in Switch Yard

- Obtain MSEB approval for multi tap CTs and PTs to utilise the same switchyard layout.
- Specify and purchase the appropriate CTs and PTs.
- Construct a separate room in the emergency DG building to house the export and check meters.
- Check the operation of the line hardware and refurbish as required
- Check the 11 kV bus duct system, identify the sources of moisture, and install the necessary measures to exclude the moisture or install a system for maintaining dry air.

Automation of the Plant

- Local field instruments with field bus connectivity consisting of;
    - 75 units of RTDs with various immersion lengths,
    - 150 units of 240 V, 5 amp limit switches,
    - 40 units of pressure switches
    - 2 units of level measuring transmitters for pick up weir and tail race water level.
    - 1 Unit of Penstock flow measuring device
    - 15 nos. of pressure transmitters
    - 30 units of power transducers
    - 1unit of wicket gate positioner
- Supervisory Control and Data Acquisition (SCADA) system consisting of a Programmable Logic Control (PLC), panels, operator interface and field bus communication systems.
- Digital protection system with 40 relays suitable for LAN connectivity for the following equipment;
    - Station transformer
    - Main transformer
    - Excitation transformer
    - Main generator
    - Connectivity with digital governor system
    - Auto Synchronizer system
    - Man Machine Interface (MMI) consisting of a Personal computer for monitoring and control of the total operations of machine. MMI will be connected to SCADA system to have communication between operator and generating unit.

In order to facilitate cost-effective operations, the rehabilitation efforts will be completed concurrently with normal operations of the plant. It is anticipated that the various rehabilitation activities will be completed over a period of three years. During this period, it is estimated that the additional improvements to the Pravara River water management system resulting from the project activity will also be completed. The generated electricity from the project activity after auxiliary consumption is exported to MSTCL grid.