Project design document form for small-scale CDM project activities

(Version 07.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	12 MW hydropower plant in Bhandardara in Maharashtra, India.
Version number of the PDD	09[1]
Completion date of the PDD	16/07/2016
Project participant(s)	Dodson – Lindblom Hydro Power Private Limited (DLHPPL) Statkraft Markets GmbH
Host Party	India
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	Applied Methodology : AMS-I.D. - Grid connected renewable electricity generation, version 18, dated 27/11/2014
Sectoral scope(s) linked to the applied methodology(es)	Sectoral Scope: 1, Energy Industries (renewable/ non – renewable sources)
Estimated amount of annual average GHG emission reductions	35,042 tCO_2e

[1] During the intimation of Renewal Crediting Period, PDD version 06, dated 22/01/2015 was submitted to UNFCCC, which was the PDD-form version 5. Hence, the PDD has been now revised to the latest version of the template, i.e. version 7.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Purpose of project activity:

The main purpose of the project activity is to generate electricity from the potential energy in the water released from Bhandardara dam and export the net electricity to the grid.

Project description:

The Bhandardara dam (Wilson dam) is operated and maintained by Government of Maharashtra Irrigation Department (GOMID), now renamed as Government of Maharashtra Water Resources Department, hereinafter referred to as GOMID/GOMWRD. The Bhandardara dam is one of the oldest masonry gravity dams in Maharashtra state. The construction of the dam started in 1910 and was completed in 1926. There are two hydro power plants near Bhandardara dam. One is the project activity, which is 12 MW foot of dam hydropower plant and is known as BH-1. Another hydroelectric project of 34 MW was constructed later 10 kilometres downstream from BH-1, which is referred as BH-2. BH-1 is the small scale project activity.

The project activity (BH-1) is constructed at the foot of a hill adjacent to the Bhandardara dam. BH-1 was originally built by the GOMID with a single hydropower generating unit of 10 MW in 1984. In Maharashtra state, all state owned hydroelectric plants are constructed by GOWRD and handed over to Maharashtra State Electricity Board (MSEB) (now Maharashtra State Electricity Generation Company) for operation and maintenance. The generating unit at BH-1 was commissioned in 1986 and entered commercial operation in 1987. After operating for eight years, a mishap occurred which severely damaged the entire plant and the plant ceased to operate. The rehabilitation and operation of this plant was awarded on a lease, own, operate and transfer basis to Dodson – Lindblom International Inc (DLI), an Ohio, USA, based company. DLI is part of DLZ Corporation, one of the foremost engineering and water resource companies in the Midwestern United States. An operating company by the name of Dodson – Lindblom Hydro Power Private Limited (DLHPPL) was formed to implement and operate the hydropower plants in India. Although, technically it was called rehabilitation, the work involved construction of new plant. The damaged equipment was beyond use and plant could not be used and operated anymore; and hence disposed as scrap. The accident had caused such damage that entire plant had to be reconstructed. The generated power from the project activity is connected to state electricity grid owned and operated by Maharashtra State Transmission Company Ltd (MSTCL).

Process:

The water released from the Bhandardara reservoir for irrigation purposes is conducted to a turbine in the power plant and jetted on to the turbine. This action rotates the turbine, which in turn causes the rotation of the alternator connected to the turbine, thereby producing electricity. One 12 MW Francis type turbine is installed in BH1 with availability of overload capacity. The maximum generation possible at the dam site is 14.84 MW as dictated by the topological conditions at site[2]. The generated electricity from the project activity after auxiliary consumption is exported to MSTCL grid.

Power generation:

BH-1 project is one of several water management projects in the upper Pravara river basin. The electricity generation from BH-1 is dependent on irrigation and domestic water releases from the Bhandardara reservoir. The catchment area for Bhandardara dam is 121.7 square kilometres. The

[2] Reference: Hill diagram and chart for reservoir (Submitted to the DOE during project verification in 2009)

gross storage of reservoir is 318 million cubic metres (MCM) and storage for power is 249 MCM. The electricity is generated from the water released from the dam. The project activity exported to the grid 19,714.8 MWh in the year 2001 (27/07/2001 to 31/12/2001), exported 36110.4 MWh in the calendar year 2002, exported 45,268.8 MWh in the year 2003 and 30,105.6 MWh in the year 2004 and 48,574.8 MWh in the year 2005, 42,600 MWh in the year 2006 and 46,543.2 MWh during 2007 to the grid. Bhandardara powerhouse (BH-2) of 34 MW capacity is located 10 kilometres downstream from BH-1. BH-1 has no impact on the generation of BH-2. BH-2 is designed as peaking project which has been transferred on lease to DLHPPL in December 2006 for refurbishment/rehabilitation and currently being operated and maintained by DLHPPL. The plant is designed to operate only during peak hours of demand. The control of the release of water for irrigation needs is exercised from Bhandardara dam. To satisfy the current demand of irrigation, water is released at rates much larger than that can be utilised for power generation at BH-1. At the same time, farmers of the command area are not happy with inadequate irrigation water releases. To provide comprehensive solution to these problems, GOMID has been constructing a new irrigation dam, the Nilwande dam, along the Pravara river, about 20 kilometres downstream from BH-2. This dam, even when partially constructed to elevation of 613 metres (against full height of 648 metres) will facilitate regulation of water discharge from Bhandardara dam permitting sufficient storage so as to allow BH-1 to operate at optimum capacity and efficiency, while at the same time meeting the current irrigation demand. This dam is expected to be completed till height of 613 metres by end 2009. When Nilwande dam is commissioned to the elevation of 613 metres, power generation from BH-1 is expected to increase to 52,000 MWh in a year.

Baseline Scenario: The baseline scenario identified at the validation of the project activity was the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project.

The project activity has been registered with UNFCCC on 30/09/2006 and the project registration number is 0430. The project opted for the renewable crediting period valid and the duration of the first crediting period is from 27/07/2001 – 26/07/2008 and second crediting period is from 27/07/2008 – 26/07/2015. This is third crediting period is from 27/07/2015 – 26/07/2022. The estimate of annual average is 35,042 tCO_2e and total GHG emission reductions for the third crediting period is 245,294 tCO_2e.

<u>UNFCCC project webpage confirm that the proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs.</u>

Contribution of the project activity to sustainable development in view of project participant.

Contribution to sustainable development is generally measured through following attributes:

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

i) Social well being

The social well being is assessed by contribution to improvement in living standards of the local community. The project activity should provide job opportunities to the local community; contribute in poverty alleviation of the local community and development of basic amenities to community leading to improvement in living standards of the community. During construction of the project activity, job opportunities were given to several local people. Since the project activity is in a rural

area, project activity caused the improvement of basic amenities. Thus the project activity has contributed to social well being.

ii) Economic well being

The project activity has created direct and indirect job opportunities to the local community during construction and operation. During implementation of the project activity, several persons were provided with job opportunities continuously for long periods. During operation of the project activity, about 14 persons are employed directly, apart from indirect employment. Economic well being refers to additional investment consistent with the needs of the local community. DLHPPL has invested Rs. 520.7 million (US$ 11.87 Million at I US$ = Rs.43.8) for the project activity. This investment is quite significant in a rural area. These activities have contributed 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”. The renewable energy source is generally defined as 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. Maharashtra electricity generation is predominantly thermal with nearly 75 % of installed capacity is thermal generation. 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 on the environment due to the project activity is discussed elsewhere in this document.

iv) Technological well being

BH-1 was successfully rehabilitated and established that severely damaged plants can be successfully rehabilitated. In the absence of the project activity, valuable renewable energy would have been lost. The generated electricity from the project activity is connected to the grid. The project activity improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Small-scale hydropower run-of-river plants provide local distributed generation, these small scale projects 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, DLHPPL believes that the project activity has contributed on all sustainable development attributes**.**

A.2. Location of project activity

A.2.1. Host Party

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India

A.2.2. Region/State/Province etc.

>>
Maharashtra

A.2.3. City/Town/Community etc.

>>
Bhandardara village, Akola Taluk, Ahmednagar district.

A.2.4. Physical/Geographical location

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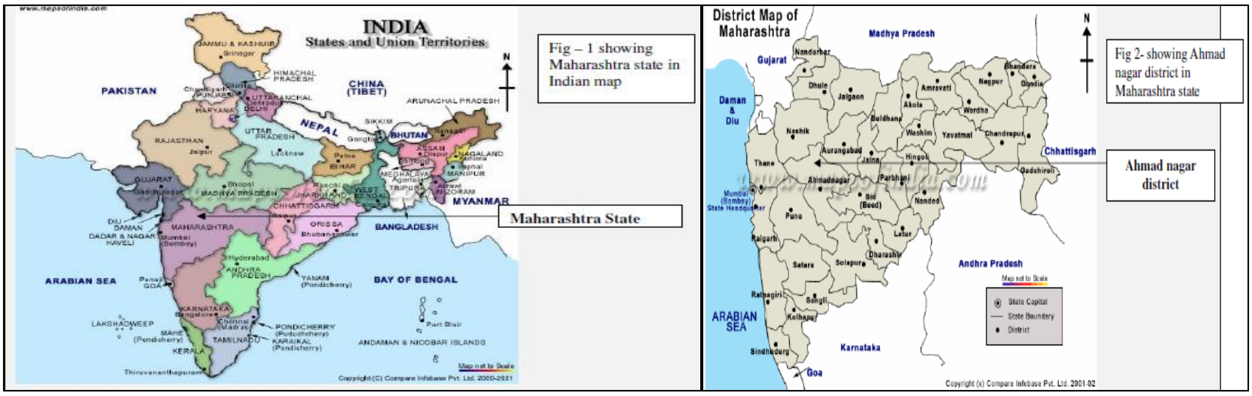
The project activity is located at a foot of a hill adjacent to the Bhandardara dam in Lake Arthur Hill reservoir in the upper Pravara river basin. Bhandardara is in Akola Taluk in Ahmednagar district in the state of Maharashtra in India. River Pravara is a tributary of river Godavari. Maharashtra state 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 project activity is located at latitude 19°33’15” N and longitude 73°45’0” E and the location is depicted in following figures – Fig 1-3:



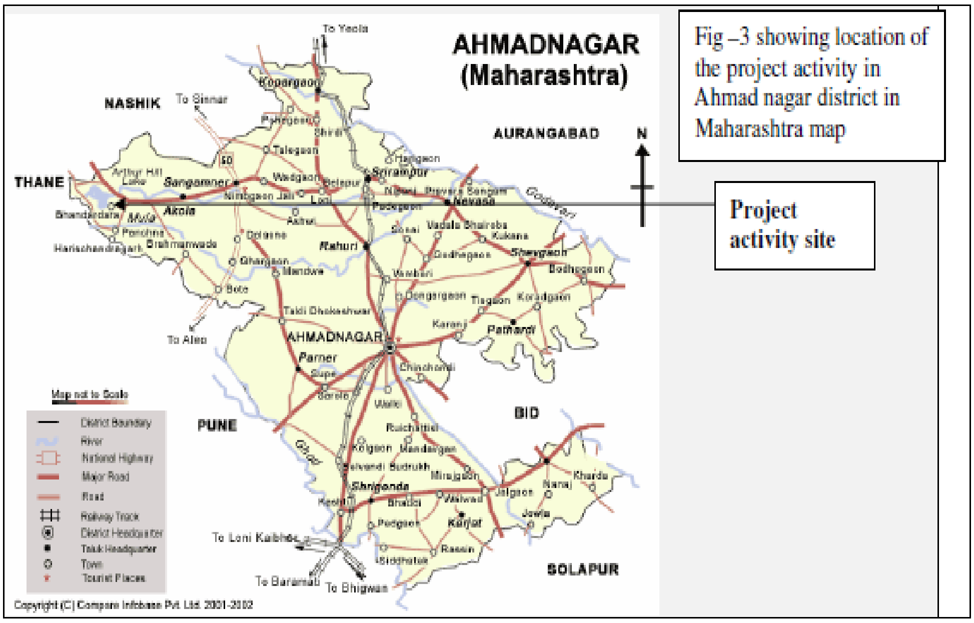


Fig –3 showing location of the project activity in Ahmad nagar district in Maharashtra map

A.3. Technologies and/or measures

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Scope : 1
Sectoral Scope : Energy Industries (Renewable -Non renewable sources)
Type : I - Renewable energy project
Category : I.D - Grid connected renewable electricity generation

The project activity is a hydropower plant and the installed capacity is to generate 12 MW. The maximum instantaneous generation of the project is constrained up to 14.84 MW as per the Hill diagram for the reservoir; which is lesser than 15 MW. Also, as per the historical records for past generation till December 2009, the maximum instantaneous generation has not exceeded 14.84 MW. Thus, the project qualifies for small scale CDM project activity. As per the provisions of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities Version, Type I.D version 18, dated 28/11/2014 "comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel or nonrenewable biomass fired generating unit". The project activity comprises hydropower plant supplying electricity to the Maharashtra state grid, part of the Western regional grid, which is being supplied by several fossil fuel and non renewable generating units and having a combined margin emission factor of 0. 6889 kgCO2/kWh derived from Central Electricity Authority (CEA), CO2 baseline database, Version 10. With above considerations, the Type I.D. is the most appropriate category for the project under discussion. The project activity does not comprise any electricity generation from nonrenewable energy sources.

Technology:

The process is conversion of the potential energy, embodied in the water flowing from a higher point to a lower point, into mechanical energy and then into electrical energy. This flowing water is guided through a head race tunnel and penstock gate and jetted on to a turbine. This action rotates the turbine, which is connected to a synchronous generator. The rotation of turbine causes the rotation of the generator thereby producing electricity. The generated power is stepped up to 132 KV and exported to MSTCL grid, which is part of regional grid.

The technology employed is an established one. Francis turbine is employed in BH-1. The Francis turbine is the most widely used among water turbines (Figure 4). This is a type of hydraulic reactor turbine in which the flow exits the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high flow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates.

The low momentum water then exits the turbine through a draft tube. A load is applied to the turbine by either means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output energy to the energy supplied.

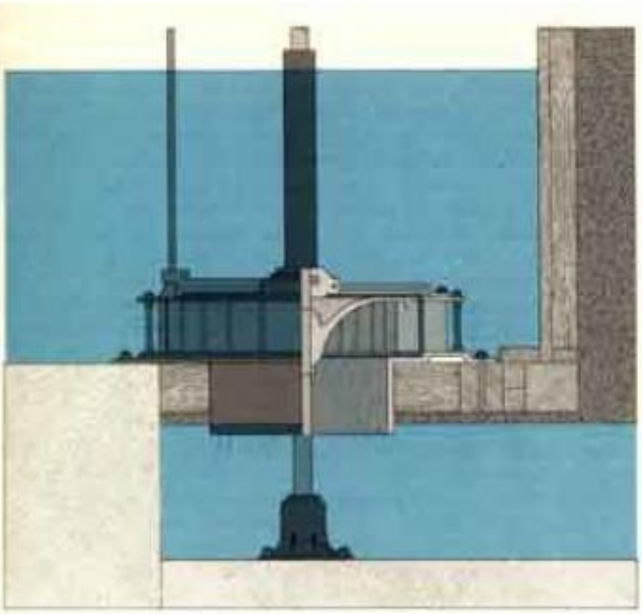

Fig 4 – A sketch showing Francis type turbine

Technical Specification of BH1:

The power plant consists of water conductor, intake, power house, generation unit and a transformer.

Bhandardara reservoir:

Type of dam	: Masonry gravity dam
Gross storage	: 318 million cubic metre (Mm3)
Live storage for power	: 249 Mm3
Top of dam	: 746.04 m

Water conductor

Number	: 1
Type	: Steel
Design discharge	: 24 m3 /s
Size	: 3.0 m dia
Length	: 318.8 m

Intake

Full supply level	: 744.73 m
Minimum draw down level for power	: 720.7 m

Power house

Type	: Surface, RCC and masonry
Size	: 21.5 m x 29.25 m
Floor level	: 674.15 m
Level of CL of turbine	: 665.5 m
Capacity of OH crane	: 65/15 tonnes

Turbine unit

Max gross head	: 77 m
Net design head	: 69 m
Design discharge	: 19.25 m3/s
Type of generating unit	: Vertical, Francis, top mounted thrust bearing
Number	: 1
Installed capacity	: 12.564 MW
Serial No.	: V – 0037/1
Excitation	: Static

Generator unit

Guaranteed output	: 12 MW
Rated power factor	: 0.9
Efficiency at 0.9 power factor	: 97.62 % at 100 % load 97.38 % at 75% load 96.69 % at 50% load 94.90 % at 25% load
Rated voltage	: 11 kV
Serial No.	: C21 /001

Connection to grid

Transformer capacity	: 132kV,17.5MVA, 3 phase, OMAN
Connection point	: BH-1 switchyard

Protection System	: Multi functional digital relay system
Control & monitoring operation	: Computer based c/w interface for remote operation

The project activity produces electricity with very little 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 transferred to the Host Party.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host Party)	Dodson Lindblom Hydro Power Private Limited (DLHPPL)	No
Switzerland	Statkraft Markets GmbH	No

A.5. Public funding of project activity

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There is no public funding for the project activity from Annex 1 Parties.

A.6. Debundling for project activity

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In line with the para 102 & 103 of Project Standard version 9.0 “GUIDELINES ON ASSESSMENT OF DEBUNDLING FOR SSC PROJECT ACTIVITIES” has been followed – De-bundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. The full project activity or any component of the full project activity shall follow the regular CDM modalities and procedures. The following results into de-bundling of large CDM project:

The small-scale project activity is not a de-bundled component of a large project activity since there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category or technology; and
- Registered within the previous two years; and

- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

The project participant confirms that within 2 years prior to the registration of the project activity, the project participant has not registered any another small scale project activity.

Additionally, it may be noted that the project participant has been taking forward the following large scale project activity towards registration as CDM project at the UNFCCC with the title ‘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)’, whose validation is nearly completion and is likely to be submitted for registration shortly. However, it may be noted that the Bhandardara powerhouse (BH-2) of 34 MW capacity is located 10 kilometres downstream from BH-1.

Thus, the project activity is not a de-bundled component of any large scale activity.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Title of approved baseline methodology:

Renewable electricity generation for a grid in accordance with approved small scale methodology AMS I.D :

Type I : Renewable energy project
Sectoral Scope : 1, Energy Industries
Category I.D : Grid connected renewable electricity generation, version 18; 28th Nov 2014.
Reference : Reference has been taken from the list of the small-scale CDM project activity categories contained in '*Appendix B of the simplified M&P for small-scale CDM project activities.*

The following tools and guidelines are used in this document:

1. Tool to calculate the emission factor for an electricity system – Version 05.0.0
2. Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period." Ver 03.0.1
3. Tool to Calculate project or leakage CO2 emissions from fossil fuel combustion, Version 02".

B.2. Project activity eligibility

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As per the approved small scale methodology AMS ID, version 18 this category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

The identified project is a hydro power project of 12 MW (< 15 MW) capacity and there is no non-renewable components linked with it. The project will displace electricity in the NEWNE grid via western regional grid which is mostly thermal intensive.

Justification of the category:

Sl No	Technology /Measure as per AMS-I.D, version 18	Measure of project activity

Sl No	Technology /Measure as per AMS-I.D, version 18	Measure of project activity
1.	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass : (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The project activity is a renewable energy generation unit based on hydro source. The generated energy is supplied to Maharashtra State Transmission Company Ltd (MSTCL) grid, which is a regional grid, part of NEWNE grid of India which is dominated by fossil fuel based power generating sources. The project activity therefore meets this applicability requirement (a), i.e. supplying electricity to a national or a regional grid
2.	As per Appendix table 1 of AMS.I D version 18 is applicable for following project types: a) Project supplies electricity to a national/regional grid b) Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)	The project activity is a renewable energy generation unit based on hydro source. The generated energy is supplied to MSTCL grid, which is a part of NEWNE regional grid which is dominated by fossil fuel based power generating sources. The project activity therefore meets this applicability requirement (a), i.e. supplying electricity to a national or a regional grid
3.	This methodology is applicable to project activities that (a) install a Greenfield plant); (b) involve a capacity addition in (an) existing plant(s); (c) involve a retrofit of (an) existing plant(s); or (d) Involve a rehabilitation of (an) existing plants(s)/unit(s); or (e) involve a replacement of (an) existing plant (s).	This project activity is a green field project. BH-1 plant with capacity 12 MW was newly constructed in the project location. However, originally there was a single hydropower generating unit of 10 MW operated for about eight years after starting commercial operation in 1987, then a mishap occurred which severely damaged the entire plant and the plant ceased to operate. Thereafter, the project activity of DLHPPL involved construction of new plant considering that the damaged equipment was beyond use and plant could not be used anymore. The entire plant had to be newly constructed. Therefore it may be justified that the project activity involved complete replacement of the existing facility and did not involve any addition of renewable energy generation units at existing renewable energy power generation facility. Hence the project activity is applicable to the point (a), i.e. install a Green Field plant.
4.	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project emissions section, is greater than 4 W/m^2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2.	The project activity was implemented in an existing reservoir, it has not changed in the volume of the reservoir. Hence the condition met.

Sl No	Technology /Measure as per AMS-I.D, version 18	Measure of project activity
5.	If the new unit has both; renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	There is no non-renewable component in this project activity and the total installed capacity of the project activity is 12 MW which is less than the eligibility limit of 15 MW for a small scale CDM project activity. Hence, the project activity meets this applicability criterion.
6.	Combined heat and power (co-generation) systems are not eligible under this category.	The project activity is a small hydro power project and not a co-generation system. Hence, this applicability requirement is not relevant.
7.	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[3] from the existing units.	This is not relevant to the project activity as it does not involve any addition of renewable energy generation units at existing renewable energy power generation facility.
8.	In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement unit shall not exceed the limit of 15 MW.	As explained under the point 3, though the project was started as rehabilitation, but the overall plant was newly constructed and the final capacity of the plant is only 12 MW, hence well below 15 MW limit.
9.	In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	This is not relevant to the project activity since the project activity a small hydro power project.
10.	In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	This is not relevant to the project activity since the project activity a small hydro power project.

From the above table, it is evident that the project activity meets all the applicability conditions of the approved small scale methodology AMS I.D (version 13, dated 14/12/2007) - Grid connected renewable electricity generation

B.3. Project boundary

As mentioned under paragraph 18 of the small-scale baseline methodology AMS I.D. (Version 18), Grid connected renewable electricity generation "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to."

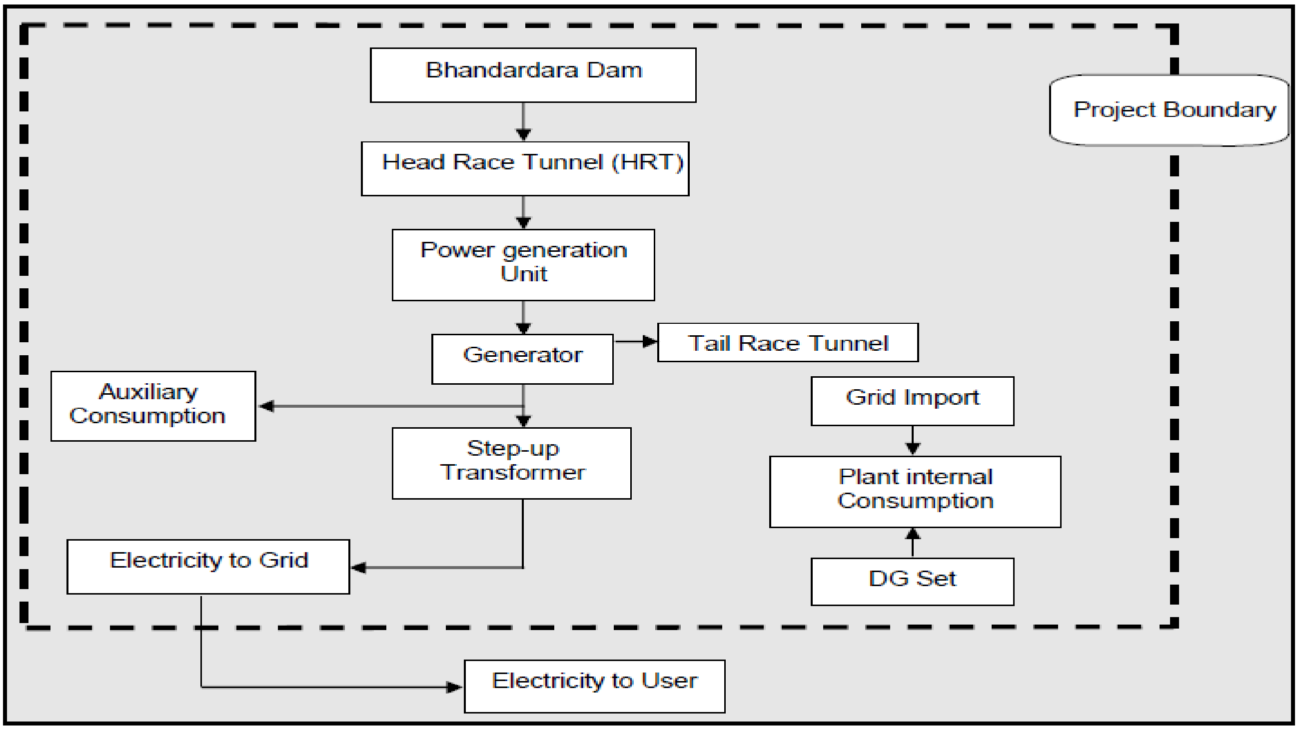
	Source	Gas	Included	Justification/Explanation
Basel	Grid Electricity	**CO_2**	**Yes**	**Main Emission Source**

[3]Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

		CH_4	No	Excluded for simplification. This is Conservative
		N_2O	No	Excluded for simplification. This is Conservative
Project Activity	On site fossil fuel consumption due to the project activity	CO_2	No	Maybe an important emission source
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Combustion of waste gas for electricity generation	CO_2	No	Not applicable
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

There is one Francis turbine is employed in the project activity. The flowing water is guided through a head race tunnel and penstock gate and jetted on to a turbine. This action rotates the turbine, which is connected to a synchronous generator. The rotation of turbine causes the rotation of the generator thereby producing electricity. The generated electricity is stepped up to 132 kV and exported to MSTCL grid, which is part of regional grid.

Schematic Diagram of the Project Activity:



B.4. Establishment and description of baseline scenario

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Updated baseline for the second crediting period in line with the **"Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period."Ver 03.0.1.**

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 300 of Project Standard & 49 (a) of the modalities and procedures of the clean development mechanism.

The tool stipulates the following steps to be carried out.

Step 1: ***Assess the validity of the current baseline for the next crediting period***

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 223,343.60 MW as on 31.03.2013, consisting of 151530.49 MW Thermal, 39491.40 MW Hydro and 4,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1 that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO2 emissions in the country by increased use of renewable energy sources. Furthermore, project participant has considered the latest available CO_2 Baseline Database (CEA database, version 10[4]) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission.

Table 1: Sector- wise installed capacity (MW) as on 31.03.2013 (CEA Database version 10)

Table 1: Sector- wise installed capacity (MW) as on 31.03.2013.

Sector	Hydro	Thermal				Nuclear	Renew.	Total
		Coal	Gas	Diesel	Total			
State	27437.0	51660.50	5676.32	602.61	57939.43	0.00	3748.19	89124.62
Central	9459.40	44055.01	7065.53	0.00	51120.54	4780.00	0.00	65359.94
Private	2595.00	34505.38	7368.00	597.14	42470.52	0.00	23793.52	68859.04
All India	39491.40	130220.89	20109.85	1199.75	151530.49	4780.00	27541.71	223343.60

Note: These capacities are not identical with those listed in the Excel database, because the database excludes renewable, few small diesel and steam units.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) ***or an investment is the most likely scenario for the crediting period for which renewal is requested***

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. Therefore this condition is not applicable to the project activity.

[4] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Step 1.4: Assessment of the validity of the data and parameters
This step stipulates that *"Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity."*

In the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

Step 2: Update the current baseline and the data and parameters
As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version available at the time of PDD submission for renewal.

In line with the paragraph 13.9.1 of the project standard version 9, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity

The Government of India enacted the Electricity Act in the year 2003[5] to harmonize and rationalize the provisions in the then existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy[6] on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides term loan assistance towards establishing biomass power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PDD of the project activity and still continue to exist.

However, in spite of the financial incentives given by the government to renewable power projects in India the generation from the low cost must run resources connected to the NEWNE Regional Grid has not increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the NEWNE Regional Grid.

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5 http://www.powermin.nic.in/acts_notification/electricity_act2003/pdf/The%20Electricity%20Act_2003.pdf
6 http://powermin.nic.in/indian_electricity_scenario/national_electricity_policy.htm

The approved consolidated baseline methodology, AMS-I.D., (Version 18), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "Tool to calculate the emission factor for an electricity system" (version 04.0) has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the *Project Standard para 13.9.1,* national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario .Hence the baseline scenario as applied for the present project activity remains justified.

As per AMS-I.D., (Version 18), paragraph 22, Baseline emissions include only CO_2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,y} \quad (1)$$

Where:

BE_y : Baseline Emissions in year y; t CO_2

$EG_{PJ,y}$: Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{grid,y}$: Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO2/MWh)

The Emission Factor can be calculated in a transparent and conservative manner as follows:

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

OR

(b) The weighted average emissions (in tCO2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used."

The approach proposed in the "Option (a)" i.e. "Combined Margin" has been used for ascertaining Baseline Emission Reductions. The operating margin and the build margin emission factor have been considered from the information (Baseline Carbon Dioxide Emission Database -Version 10, Dated: December 2014)[7] published by the Central Electricity Authority (CEA), Ministry of Power, Govt. of India which have been computed according to the procedures prescribed in 'Tool to calculate the emission factor for an electricity system" version 05.0.

The baseline scenario has been identified as per the combined margin (CM) approaches which consists of operating margin (OM) and build margin (BM) factors as described in this section.

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[7] Reference: http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

STEP 1. Identify the relevant electricity System:

The Indian power system is divided into two independent grids, namely new Integrated Northern, Eastern, Western, and North-Eastern regional grid (NEWNE) and the Southern Grid. The project activity is located at a foot of a hill adjacent to the Bhandardara dam in Lake Arthur Hill reservoir in the upper Pravara river basin which comes under NEWNE Grid. In the proposed baseline, NEWNE Grid has been used as the reference grid system for estimating the baseline emission.

GRID	NEWNE Grid				Southern Grid
	Northern	**Eastern**	**Western**	**North-Eastern**	**Southern**
STATES	Chandigarh Delhi Haryana Himachal Pradesh Jammu & Kashmir Punjab Rajasthan Uttar Pradesh Uttarakhand	Bihar Jharkhand Orissa West Bengal Sikkim Andaman-Nicobar	Chhattisgarh Gujarat Daman & Diu Dadar& Nagar Haveli Madhya Pradesh **Maharashtra** Goa	Arunachal Pradesh Assam Manipur Meghalaya Mizoram Nagaland Tripura	Andhra Pradesh Karnataka Kerala Tamil Nadu Pondicherry Lakshadweep

STEP 2. Choose Whether to Include Off-Grid Power Plants in the Project Electricity System (Optional):
Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation

Project participant has chosen option I to include only grid power plants in the calculation.

STEP 3. Select a method to Determine the Operating Margin (OM)
As per the “tool to calculate the emission factor for an electricity system”, version 05.0.0, “the operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity.”

Further, the OM is to be determined based upon the following methods
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

The simple OM method (option a) can only be used if low cost/must run resources[8] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

In the context of the present project activity simple OM has been considered since the contribution of low cost must run resources in the NEWNE regional grid mix amongst the five most recent years generation of the NEWNE regional grid mix is less than 50% of total grid generation. Hence, the statistics provided in the table above quite evidently demonstrate the fact that power generation

[8] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

from the low cost must run resources within the NEWNE regional grid is less than 50 % of the total generation. Hence, the use of simple operating margin method towards formulation the baseline scenario remains justified.

Further as per Step 3, the emission factor can be calculated using either of the two data vintages:

- ***Ex-ante option***: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation.

- ***Ex post option***: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year *y-1* may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year *y-2* may be used. The same data vintage (*y*, *y-1* or *y-2*) should be used throughout all crediting periods.

For the project activity, the Ex-ante option is chosen for emission factor estimation.

The Simple OM factor is calculated as under in Step 4.

Step 4: Calculate the Operating Margin Emission Factor According to the Selected Method
As per Step 3 of the ‘tool to determine the emission factor of an electricity system’, the simple OM emission factor can be calculated using the ex-ante option which states that for calculation of OM ‘*A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period’.*

In this regard, the simple OM emission factor has been sourced from the most recent data available at the time of submission of the PDD for renewal and has **therefore been fixed for this third crediting period** (see Appendix 3 & 4 for data related to operating margin in NEWNE grid).

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit;

or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO_2

Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the “Tool to calculate the emission factor for an electricity system, Version 05.0.0”. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

As per ‘Tool to calculate the emission factor for an electricity system’, Option A (“Based on the net electricity generation and a CO_2 emission factor of each power unit”) is used to calculate simple OM emission factor. Where Option A is used, the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \Sigma (EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}$$

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

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

$EF_{EL,m,y}$ CO_2 emission factor of power unit m in year y (tCO_2/MWh)

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

y The relevant year as per the data vintage chosen in STEP 3

The CO_2 emission factor ($EF_{EL,m,y}$) data for simple OM, available under the CEA database[9] (Version 10.0, Dec 2014) for the last three years is as follows.

CO_2 emission factor for simple OM (tCO_2/MWh) (incl. Imports)			
Grid	**2011-12**	**2012-13**	**2013-14**
NEWNE	0.9699	0.9919	0.9953

Net Generation Total (MWh)			
	2011-12	**2012-13**	**2013-14**
NEWNE	6,27.166	6,60.622	6,93.952

The net electricity generation ($EG_{m,y}$) data, available under the CEA database[10] (Version 10) December 2014, of all generating power plants (not including low-cost / must-run power plants / units) for the last three year has been taken from the database.

Thus, as can be seen from the above tables, the 3 years generation-weighted OM average for the most recent three years available at the time of PDD for validation, i.e. 2011-12, 2012-13 and 2013-14 for NEWNE grid is:

The ex-ante OM value obtained is 0.9861 tCO_2/MWh

Step 5: Calculate the Build Margin (BM) Emission Factor

[9] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver10.pdf

[10] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver10.pdf

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project participant has chosen Option 1 for vintage of the data

Therefore BM for the third crediting period, the build margin emission factor calculated for the second crediting period has been used to be $EF_{grid,\ BM,y}$= 0.59 tCO_2e/MWh[11].

Step 6: Calculate the Combined Margin Emissions Factor

Combined Margin has been used for ascertaining Baseline Emission Reductions. The combined margin emission factor consists of two components i.e. the operating margin and the build margin. The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the simple operating margin and build margin emission factor for the NEWNE regional grid. According to 'Tool to calculate the emission factor an electricity system' version -05, the combined margin emission factor is calculated as follows:
The weighted average CM method (option A) is preferred for calculation of combined margin emission factor.

$$EF_{grid,CM,y} = EF_{grid,OM,y} x\ W_{OM} + EF_{grid,BM,y} x\ W_{BM}$$

Where:

$EF_{grid,OM,y}$	: Operating Margin CO_2 emission factor in the year *y* (tCO_2/MWh)
W_{OM}	: Weighting of operating margin emission factor (%)
$EF_{grid,BM,y}$	: Build Margin CO_2 emission factor in the year *y* (tCO_2/MWh)
W_{BM}	: Weighting of build margin emission factor (%)

The combined margin emission factor has been derived from the simple operating margin and build margin emission factors after considering/ factoring the weights of 0.25 and 0.75 for operating margin (OM) and build margin (BM) emission factors respectively relevant to the hydro power generation project activities as per the 'Tool to calculate the emission factor for an electricity system (Version 05)

Combined Margin (CM) in tCO_2/MWh for grid is

$EF_{CO2,grid,\ y}$	**=**	0.25 x Average of OM for last 3 years + 0.75 x BM
	=	0.25 x 0.9861 + 0.75 x 0.59
	=	0.6890

[11]Refer ER sheet for detailed calculation.

Hence combined margin emission factor for the NEWNE grid ($EF_{CO2,grid, y}$) is 0.6890 tCO_2/MWh.

B.5. Demonstration of additionality

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Sectoral and national policies for hydropower project

Hydropower is recognized as a renewable source of energy, which is non-polluting and environmentally benign. The history of hydropower generation in India is more than 100 years old. The first hydropower station in India was a small hydro power station of 130 KW commissioned in 1897 at Sidrapong near Darjeeling in West Bengal. With the advancement in technologies and increasing requirement of electricity, emphasize was shifted to large sized hydro power stations. In 1963, the hydropower had attained a share of 50.62% in the total installed capacity of power generation in India. While there has been a continuous increase in the installed capacity of hydropower stations, which now stands on 22,439 MW, the share of hydropower has been reduced to 25% currently as focus had been development of thermal fossil fuel based power plants.

Ministry of Power in the Government of India is responsible for the development of large hydro power projects in India. In order to maintain the balance between hydro power and thermal power, Ministry of Power has announced a Policy for accelerated development of hydro power in the country. Ministry of Non-conventional Energy Sources (MNES) is responsible for development of small and mini hydro projects of 3-25 MW station capacity. Ministry of Non-conventional Energy Sources has created a database of potential sites of small hydro based on information from various States and on studies conducted by Central Electricity Authority. An estimated potential of about 15,000 MW of small hydropower projects exists in India. Small and mini hydel projects have the potential to provide energy in remote and hilly areas where extension of grid system is un-economical. These projects although are not economically very attractive like large power plants, they are environmentally friendly and still are viable. 4,096 potential sites with an aggregate capacity of 10,071 MW for projects up to 25 MW capacity have been identified. India has 420 small hydro power projects up to 25 MW station capacity with an aggregate capacity of over 1423 MW out of total national installed capacity of generation mix of 123,462.81MW. Many projects for a total installed capacity of about 521 MW are under construction.

The small hydropower projects are developed in the potential regions by the State Electricity Boards/ State Agencies responsible for SHP development. Most of the SHP projects are grid connected.
However, there are some projects, which are decentralized and are managed by local community/NGOs. Many states in India have announced policies for development of small hydropower projects with various incentives like wheeling of power produced, banking, attractive buy-back rate, facility for third party sale, etc. But still the capacity additions have not been very high. Still the share of small hydro power projects upto 25 MW is only 1.5% including the projects under construction.

In Maharashtra, hydropower projects are constructed by The Government of Maharashtra Water Resource Department (GOMWRD). After completion of construction, the project is handed over to MSEB for operation and maintenance. There are about 38 hydro power plants with total installed capacity of 2434 MW including small and large sized projects. There are four large hydropower projects through private investment for an installed capacity of 444 MW. There are only three small hydropower projects from private investment of which one is the project activity and the other two are Vajra and Chaskaman hydropower projects.

Since the Government could not establish hydroelectric project for want of resources, it was decided to invite private investment for establishing hydropower projects and approached

Maharashtra Energy Regulatory Commission (MERC). The Commission conducted hearings and issued comments on the proposed policy (vide letter dated February 22, 2002). GOMWRD thereafter issued their policy through Government Resolution (G.R.No.HEP (7/2001) HP) dated November 28, 2002 for projects upto 25 MW.

The projects were to be awarded to the private investors on a 30 year Build, Own and Operate basis. The tariff was decided GOMWRD has proposed tariffs for SHPs taking guidance from the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations 2004, for each year of the 30 years of the BOT period. It is assumed that at the end of the BOT period the absolute ownership of the SHP shall stand transferred to GOMWRD free of cost.

During the policy implementation process of GoM's policy dated 28.11.02, a number of suggestions were received requesting certain amendments to the provisions in the state policy in light of provisions of Electricity Act 2003. In line with this, the GoM has revised policy for development of SHPs up to 25 MW capacity, through the private sector participation. This revised policy dated 15th September 2005 by GOMWRD[12] through Government Resolution No. PVT-1204/(160/2004)/ HP seeks to replace the earlier policy dated 28th November, 2002. The revised policy is intended to encourage the participation of both the Captive Power Producers (CPPs) and Independent Power Producers (IPPs) in development of SHP in the state. One of the prime objectives of this policy is to harness green power in the state with the help of Private sector. The revised policy would not affect the project activity, however it may be noted that the following promotional incentives were offered by the Government of Maharashtra (GoM) considering that the small hydropower plants (SHPs) are renewable non – polluting energy sources:

- ***"C-1** The developer is supposed to commission the project within 24 months from the date of authorisation. If the developer commissions the project at earlier date, he will be exempted from water royalty charges & maintenance charges to an extent of units generated before scheduled date of commissioning.*

- ***C-2** CPPs shall be exempted from Electricity Duty on the self consumption of electricity only for first five years after commissioning if the consumption unit is located in Maharashtra.*

- ***C-3** CPPs shall be exempted from tax on Sale of Electricity only if the consumption unit is located in Maharashtra.*

- *C-4 Technical Consultancy at nominal charges.*

- ***C-5** Maharashtra Energy Development Agency, (MEDA), Pune shall assist the developers in getting incentives for SHPs from Ministry of Non-Conventional Energy Sources (MNES), Government of India (GoI)."*

It may be noted that the above incentives are not available to the project activity.

Justification for additionality of the project

Simplified modalities and procedures for small scale CDM project activities guides to establish additionality of the project activity as per Attachment A to Appendix B. The Attachment A to appendix B mentions various barriers and requires explanation to show that the project activity would not have occurred due to at least any one barrier.

Barrier analysis

Establishing the project activity is a voluntary step undertaken by DLHPPL with no direct or indirect mandate by law. The main driving forces to this 'climate change initiative' have been:

- GHG reduction and subsequent carbon financing against sale consideration of carbon credits.

[12] http://www.maharashtra.gov.in/pdf/hydroPowerPolicy.pdf

- Rural development of the region by creating job opportunities for the local people.
- Demonstration of developing such projects to the other entrepreneurs.

However, the project participant was aware of the various barriers associated to project implementation. But it was felt that the availability of carbon financing against a sale consideration of carbon credits generated due to project activity would help to overcome these barriers.

The barriers faced by the project activity are discussed below:

Investment barriers

The project activity already faced investment barriers during construction and yet there are other barriers for investment in the project activity, which are discussed below.

Capital cost increase

When BH-1 was not under operation and had to be rehabilitated, neither GOMID nor MSEB had sufficient funds for the purpose. So, it was decided to revive the plant with private participation. Global bids were invited by GOMID to rehabilitate, operate and maintain the project on lease, build, operate and transfer basis. DLHPPL had bid for the project with capital cost estimation of Rs. 365.377 Millions (US$ 8.341 Million at 1 US$ = Indian Rs.43.8). The lease agreement, final approval at the cabinet level of Government of Maharashtra, power purchase agreement etc., took more than two years and during this time there was enormous increase in the capital cost which jumped to Rs.520.7 Million (US$11.888 Million). This had a negative effect on the bottom line reducing the return on investment. Further, the legal costs incurred for negotiation of various agreements was not considered as part of project cost. These legal costs had to be absorbed by the project participants.

Power Purchase Tariff

The power purchase tariff was calculated with capital cost of Rs.365.377 Millions where as the actual project cost was Rs.520.7 Millions. The increase in project cost due to delay in according approvals was not considered for tariff calculation. As a result, the power purchase tariff was reduced. The table given below gives the PPA tariff per kWh based on project cost of Rs. 365.377 millions (PPA tariff) and tariff based on Rs.520.7 millions.

Table B.3-1. Comparison of power purchase tariff*

Description	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
PPA tariff	Rs.2.52	Rs 2.43	Rs 2.34	Rs 2.25	Rs 2.16	Rs 2.08	Rs 2.00
Tariff based on increased project cost	Rs. 3.01	Rs. 2.83	Rs. 2.77	Rs. 2.67	Rs. 2.61	Rs. 2.54	Rs. 2.47

* The tariff includes royalty charges of Re.0.12 per kWh to GOWRD.
Reduction in power purchase tariff was a major investment barrier.

Financing barrier

Indian financial institutes and banks were not too keen on financing a small hydropower project. The project participant had approached many Indian financial institutes and banks and the response from them was not encouraging. Therefore, overseas lenders were approached and 50 % of the debt portion was financed by a foreign lender and balance 50 % of the debt component was financed by Indian Renewable Energy Development Agency (IREDA) at a high interest rate of 16.5%.

Financial health of state electricity boards

A power purchase agreement has been signed with MSEB for purchase of all the power generated by the project activity. Most of the electricity boards in India are not financially sound and have huge gap in income and expenses. This gap is largely due to free / subsidised power to agriculture and domestic households. Due to this deficit in revenues, risk of delayed payment exists. This was also a major investment barrier for the project activity.

Technological barriers

As explained elsewhere, the project activity was a rehabilitation of an extensively damaged project. BH-1 project was originally established by Government of Maharashtra and operated by Maharashtra State Electricity Board. Mishap happened in 1995 and the plant became inoperative. MSEB/ Government of Maharashtra had no drive to rehabilitate the plant either due to financial constraints or other administrative reasons. The damage to the plant was so extensive that the rehabilitation of the plant was a real challenge. Since the project activity is located in a difficult terrain, rehabilitation of the plant was all the more difficult. Construction of water conductor system, dismantling of damaged machinery etc., posed challenges. Transportation of construction material and machinery to the project site was also difficult due to the terrain.

Hydrological risks

Water discharge

The BH-1 project depends on water released from the Bhandardara dam. Water discharge is a sensitive issue as it involves irrigation of the downstream "command area". Typically water releases during the monsoon (June - October) occur during periods of high inflow when the reservoir is nearly full and releases have to be made to avoid overtopping of the dam. After the end of the monsoon cycle, releases are made for irrigation and drinking water purposes. These post-monsoon (November - May) releases occur in cycles of water demand as determined by GOMID. The information provided by GOMID during the bidding process indicated that all inflows into the dam in excess of the storage capacity would be available for power generation during the monsoon period as would all irrigation water released in the post-monsoon period. Under GoI norms applicable at the time, GOMID was to assume the hydrology risk for a period of seven years. However, during detailed negotiations, GOMID was not prepared to assume the hydrology risk (although majority of it is controlled by GOMID). Instead of allowing all available water above the intake for the power house, GOMID agreed to release 200 MCM of water through the power house during the post-monsoon period. GOMID also agreed to allow advance releases during the monsoon to minimize spills and maximize generation. If followed, this would allow generation of about 32 GWh during the post-monsoon period, which could result in a total generation of between 42 GWh and 45 GWh in a normal year.

However, due to a large demand for irrigation water in the command area during the post-monsoon period, GOMID has been releasing water at rates far in excess of the capacity of BH-1 and that contemplated by them when the release quantities were agreed to. This has resulted in a faster depletion of water stored in the reservoir and thus, a smaller quantity of water available for power generation, because a significant portion by-passes the power house. In addition, during the monsoon, GOMID's policy does not allow for advance releases to minimize spills. These factors have resulted in a significant reduction in the energy generation from the project. Under the current release policies, it is expected that the generation from the plant in a 75% dependable year will be in the range of 32 GWh as compared with the design energy value of 36 GWh for a corresponding year. These constitute a significant barrier to successful and profitable operation of the project.

Monsoons

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.

Regulatory risks

Although Government of India was opening up the economy, the overseas investors were nervous and apprehensive about the regulations of statutory authorities. The regulatory risks were a barrier for investors, especially overseas investors.

Political risks

When there is a change in government, decisions taken by the earlier government were sometimes annulled or modified by the new government. Such things were not uncommon in India and this was also a barrier for the project activity.

Prevailing practice

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.

Prevailing practice in the country

The total installed capacity of small hydropower plants in India is 1423 MW[13] and another 187 small hydropower plants are under construction with an installed capacity of 521 MW2 totaling 1944 MW. The total installed capacity of power generation in India is 124,310.81 MW[14] as on 30 March, 2006 excluding small hydro, biomass and wind energy; the share of small hydropower projects is only 1.56 %. This shows that investing in small hydropower plants is not a common prevailing practice in India.

Prevailing practice in Maharashtra

The total installed capacity of small hydropower plants is 18 MW including the project activity of 12 MW. The total installed capacity and allocated capacity is 15,375 MW. Hence, the share of small hydropower plant in Maharashtra is only 0.1% including the project activity. If the project activity is excluded the share of private small hydropower plants is 0.03% only. This clearly shows that investment in small hydropower plants is not a common prevailing practice in Maharashtra state. The total installed capacity of hydro based power plants is 2902 MW (www.mahatransco.com)and thermal based power plants is 11591 MW in Maharashtra. The total installed capacity is 15375 MW, balance being nuclear, waste heat recovery plant and non conventional energy. Hence, the share of hydrogeneration is 18.8 % only where as thermal is 75.38%. This shows that the state is predominantly thermal and hence hydro generation is not a Business as Usual scenerio in Maharashtra.

CDM incentives for the project activity

The project activity was formulated in the year 2000. The project participants are basically a USA based engineering company and were planning to invest in emerging markets like India. Since they were associated with hydroelectric projects, they were closely following the discussions and negotiations of the Kyoto Protocol as they had direct implications on their business. The project participants had considered approximate CDM incentives in the financial calculations. Proof of the same has been provided to DOE.

Therefore in the light of above, the project activity is additional and not a baseline scenario.

[13] http://www.mnes.nic.in/

[14] http://www.powermin.nic.in/

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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According to the para 43 of AMS-I.D. (version 18), the Emission Reductions for the project activity will be calculated using the following formula:

$\mathbf{ER_y = BE_y - PE_y - LE_y}$……………………………………………..…………………(2)

Where,
ER_y = Emission Reductions during the year y in tCO_2e
BE_y = Baseline Emissions during the year y in tCO_2e
PE_y = Project Emissions during the year y in tCO_2e
LE_y = Leakage Emissions during the year y in tCO_2e

Calculation of Baseline Emissions

As per para 22 of AMS-I.D. (version 18), baseline emissions (BE_y in tCO_2e) are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor ($EF_{CO2,grid,y}$).

$\mathbf{BE_y = EG_{PJ,y} * EF_{grid,y}}$……………………………………………………………………(3)

Where,
$\mathbf{BE_y}$ = Baseline Emissions in year y (tCO_2)

As per para 26 of AMS-I D ver 18, $\mathbf{EG_{PJ,y}}$ = $EG_{PJ,facility,y}$ = Quantity of net electricity supplied by the project plant/unit to the grid in year y(MWh).

(The net electricity export to the grid is the difference between the quantities of the grid electricity export and the import.)

$\mathbf{EF_{grid,y}}$= CO2 emission factor of the grid in year *y* (t CO2/MWh)

(Baseline emission factor for the grid (considering Combined Margin approach). NEWNE regional grid has been considered for this project activity.)

Calculation of Project Emissions

According to para 39 of AMS-I.D. (version 18), *for most renewable energy project activities, PEy = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002.*

- *Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption)*
- *Emissions from water reservoirs of hydro power plants"*

The project activity is not a biomass project, neither a geothermal application and nor it is a water reservoir based hydro power project. This is a first of its kind small hydro project; therefore no project emissions are applicable to the proposed project activity.

However, as per paragraph 40 of AMS-I.D. (version 18), CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[15]".

As there is a small capacity DG set available at the site as backup arrangement during start up or as a failsafe option. Therefore, the emission due to on-site consumption of fossil fuel shall be

[15]http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

calculated as per the "Tool to Calculate project or leakage CO_2 emissions from fossil fuel combustion, Version 02" a project emission; (calculated in the section B.6.3 of the PDD),

Thus,

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	- Are the CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr);
$FC_{i,j,y}$	- Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
$COEF_{i,y}$	- Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)
I	- Are the fuel types combusted in process j during the year y

The CO_2 emission coefficient $COEF_{i,,y}$ will be calculated based on net calorific value and CO_2 emission factor of fuel type i, as mentioned in option B (equation 4) of 'Tool to calculate project or leakage CO2 emissions from fossil fuel combustion' (version 2).

Leakage
According to the AMS-I.D, para 42, guidance on leakage is provided for biomass project only but the project activity is first of its kind small hydro project. Hence, no leakage emission from this project activity has been considered.

Emission Reductions:

According to equation no 9 as per paragraph 43 of AMS I.D. (version 18), the Emission Reduction is calculated by subtracting the project emissions from the baseline emissions

Thus $ER_y = BE_y – PE_y - LE_y$

According to the methodology, leakage emissions have not been considered for the project activity.

Therefore, **$ER_y = BE_y - PE_y$**

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**CO_2 Emission Factor of grid (EF_y)** = $EF_{CO2,grid,y}$
Unit	tCO_2 / MWh
Description	Combined Margin CO_2 Emission Factor of the NEWNE regional grid
Source of data	Central Electricity Authority (CEA), CO2 baseline database for the Indian Power Sector, Version 10 ,Dated 16 December 2014 (Combined Margin Emission Factor for Northern Regional Grid) published by Central Electric Authority (CEA), India http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf
Value(s) applied	0.6890
Choice of data or Measurement methods and procedures	CEA has estimated the simple operating margin and build margin emission factors for the Western regional grid. For calculating the CO_2 emission factor as per combined margin method for the second crediting period, the weights of 0.25 for operating margin and 0.75 for build margin are considered as per 'Tool to calculate the emission factor for an electricity system (Version 05.0)
Purpose of data	Calculation of baseline emission.
Additional comment	Details given in Appendix- 4.The emission factor has been fixed for the third crediting period.. The emission factor has been fixed for the third crediting period.

Data / Parameter	**Net calorific value of diesel (NCV_{diesel})**
Unit	GJ per mass unit (GJ/ ton)
Description	Net calorific value of diesel
Source of data	IPCC default values
Value(s) applied	43.3
Choice of data or Measurement methods and procedures	IPCC default values at the upper limit of uncertainty at a 95% confidence intervals as provided in Table 1.2 of Chapter 1 of Vol 2 (Energy) of the 2006 IPCC guidelines on National GHG inventories, indicates that the NCV of diesel oil is 43.3 TJ/Gg which is equivalent to 43.3 GJ/ton
Purpose of data	Calculation of baseline emission.
Additional comment	Future revision of the IPCC guidelines would be taken into account in case revisions occur during the current crediting period

Data / Parameter	**CO2 Emission Factor of diesel (EF_{CO2_diesel})**
Unit	tCO2 /GJ
Description	CO2 emission factor of diesel
Source of data	IPCC default values
Value(s) applied	0.0748
Choice of data or Measurement methods and procedures	IPCC default values at the upper limit of uncertainty at a 95% confidence intervals as provided in Table 1.4 of Chapter 1 of Vol 2 (Energy) of the 2006 IPCC guidelines on National GHG inventories indicates that CO2 emission factor for diesel is 74,800 kg/TJ which is equivalent to 0.0748 tons/ GJ
Purpose of data	Calculation of baseline emission.
Additional comment	Future revision of the IPCC guidelines would be taken into account in case revision occur during the current crediting period

B.6.3. Ex ante calculation of emission reductions

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<u>Formula used to determine Emission Reduction:</u>

CO2 emission reduction due to project activity = BEy– PEy – LEy

Calculation of Baseline Emissions

$$BE_y = EG_{PJ,y} * EF_{CO2,grid,\ y}$$

For the third crediting period, the total net electricity delivered to the grid would be monitored & calculated as per the monitoring plan provided in section B.7.3. However, for the estimation of total net electricity delivered by the project activity per annum, verified data from the 2nd crediting period for the issued emission reduction period (i.e. from 27th July 2008 to 26th July 2015) has been considered below:

Quantity of net electricity to be supplied to the grid ($EG_{BL,y}$) per annum = 50,857 MWh

Thus, the Baseline Emissions are

$BE_y = EG_{PJ,y} * EF_{CO2,grid,\ y}$

= 50,857 * 0.6890

= 35,042 $tCO2_e$/annum

Hence, the expected baseline emissions for the project activity will be 35,042 tCO_2e/annum. Thus, the total emission reductions across the third crediting period (27th July 2015 to 26th July 2022) is 245,294 tCO_2e.

Calculation of Project Emissions:

Average Diesel Consumption per year	= 62	Lit/annum
EF CO_{2_diesel}	= 0.0726	tCO_2e/GJ
NCV_{diesel}	= 41.76	GJ/Ton
Density of diesel (IPCC 2006 default value)	= 0.00086	ton/liter
Project Emission (Less than 1% of total ER. Hence, considered zero for estimation. However, will be considered during the second crediting period on actual.	= (62*0.0726*41.76*0.00086) = 0.16	tCO_2/annum

Leakage:

According to the AMS-I.D, para 42, guidance on leakage is provided for biomass project only but the project activity is z small hydro project. Also, there is no transfer of energy generating equipment and therefore the leakage no leakage emission from this project activity has been considered.

Hence, $LE_y = 0$

Emission Reductions:

The Emission Reduction is calculated by subtracting the project emissions from the baseline emissions

Thus,

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$
$$= 35{,}042 - 0 - 0\ tCO_2e$$
$$= 35{,}042\ tCO_2e$$

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1[16]	35,042	0	0	35,042
Year 2	35,042	0	0	35,042
Year 3	35,042	0	0	35,042
Year 4	35,042	0	0	35,042
Year 5	35,042	0	0	35,042
Year 6	35,042	0	0	35,042
Year 7	35,042	0	0	35,042
Total	**245,294**	**0**	**0**	**245,294**
Total number of crediting years	7			
Annual average over the crediting period	35,042	0	0	35,042

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**Electricity Exported (**EG_y)
Unit	kWh
Description	Electricity Exported to the grid by the project activity
Source of data	Joint Meter Readings (JMRs) taken and signed by authorised officials of MSEDCL
Value(s) applied	44,000,000 kWh during first year and 52,000,000 kWh during subsequent years of the crediting period
Measurement methods and procedures	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.
Monitoring frequency	Continuous monitoring, hourly measurement and at least monthly recording

[16] Here ‘Year 1’ would be started from the date of start of the renewal crediting period.

QA/QC procedures	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 Main Energy Meter and Check Energy Meters accuracy is 0.2s. 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.
Purpose of data	Calculation of baseline emission
Additional 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.

Data / Parameter	**Electricity Imported (E_{Import})**
Unit	kWh
Description	Electricity Imported from the grid by the project activity
Source of data	Monthly billing records of MSEDCL
Value(s) applied	-
Measurement methods and procedures	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 when on a monthly basis the electricity imported is equal to or more than 0.5 % of the electricity exported.
Monitoring frequency	Continuous monitoring, monthly recording
QA/QC procedures	Import meter is under the custody of MSEDCL, and DLHPPL has no access to meter and therefore the calibration details pertaining to the same. Hence calibration records are not maintained by DLHPPL for the import meter. The Import meter Energy Meter accuracy is 0.5s.
Purpose of data	Calculation of baseline emission
Additional comment	-

Data / Parameter	**Gross Electricity Generation (E_{Gen})**
Unit	kWh
Description	Gross electricity generated by the project activity
Source of data	Joint Meter Readings (JMRs) taken and signed by authorised officials of MSEDCL
Value(s) applied	44,806,520 kWh in year first year and 52,953,160 kWh in the subsequent years of the crediting period.

Measurement methods and procedures	The generation meter measures the units generated. The Monthly joint meter reading (JMR) of the generation meter shall be taken and signed by authorized 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.
Monitoring frequency	Continuous monitoring, monthly recording
QA/QC procedures	The data will be directly measured and monitored at the project site. The Gross Main Energy Meter accuracy is 0.2s. 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
Purpose of data	Calculation of baseline emission
Additional 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.

Data / Parameter	**Auxiliary Consumption**
Unit	kWh
Description	Unit consumed by the project activity
Source of data	Joint Meter Readings (JMRs) taken and signed by authorised officials of MSEDCL
Value(s) applied	806,520 kWh during first year and 953,160 kWh during the subsequent years of the crediting period
Measurement methods and procedures	The difference between the gross electricity generation (E**Gen**) and electricity exported to the grid (EGy) 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
Monitoring frequency	Continuous monitoring, monthly recording
QA/QC procedures	The data is calculated using the gross electricity generation and electricity exported as per the JMRs.
Purpose of data	Calculation of baseline emission
Additional 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	**Diesel consumption (DC_y)**
Unit	Tons
Description	Diesel consumed by the standby DG set
Source of data	Daily records of levels in the diesel storage tanks as per the plant log book.
Value(s) applied	-

Measurement methods and procedures	The diesel quantity available in the diesel storage tanks is recorded daily by DLHPPL in the plant log book. The diesel consumption would be recorded in the logbook in litres. However, based on the density of diesel of about 0.88[17] kg/litre, the diesel consumption in tons would be calculated for use in the equation to compute project emissions (PE) as per section B.6.3.
Monitoring frequency	Continuously
QA/QC procedures	The measured data will be cross checked with diesel procurement.
Purpose of data	Calculation of project emission
Additional comment	Project emissions due to diesel consumption will be calculated as below: $PE_{DC,y} = \_DC_y \times NCV_{diesel} \times EF_{CO2\_diesel}$ The data would be archived upto two years after the end of crediting period.

Data / Parameter	**Hourly Electricity Export ($HEE_{main\ meter}$)**
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	Log book records for the main meter.
Value(s) applied	-
Measurement methods and procedures	This data is recorded on an hourly basis by DLHPPL based on data recorded at the main meter.
Monitoring frequency	Continuously
QA/QC procedures	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 Main Energy Meter and Check Energy Meters accuracy is 0.2s. 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.
Purpose of data	Calculation of project emission
Additional 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. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

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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.

[17] Reference: Requirement of High Speed Diesel (HSD) fuel as per IS 1460: 1995 as specified under Motor spirit and High Speed Diesel Control Orders by the Ministry and Petroleum and Natural Gas (MoPNG) dated 28 December 1998 available at http://petroleum.nic.in/newgazette/GN%20No.511%20dtd%2029-12-98.pdf

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 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 whichever 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.

<u>**Procedures for handling data uncertainties:**</u>

In the event when verification period dates and JMR dates in the project activity, do 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 application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Date: 22/01/2015
Dodson Lindblom Hydro Power Private Limited, along with CDM consultant.
(Contact information as given in the Appendix 1)

The entity determining the baseline is not a project participant.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
10/04/2000

C.1.2. Expected operational lifetime of project activity

>>
30 y-0m

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
The project activity will use a renewable crediting period. This period pertains to the third 7 years crediting period for the project activity.

C.2.2. Start date of crediting period

>>
27/07/2015.
This pertains to the starting date of the third crediting period.

C.2.3. Length of crediting period

>>
7 y-0 m.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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The environmental monitoring and compliance of the projects implemented in India come under the purview of Environment (Protection) Act. Ministry of Environment and Forests (MoEF), Government of India has been vested with powers to administer and ensure compliance under the Act. Under the act, a Central Pollution Control Board (CPCB) has been formed at the federal level and separate pollution control boards (PCBs) have been formed for each state for monitoring and ensuring the compliance of the environmental norms fixed by MoEF. In some cases more stringent norms have been fixed by the state pollution control board depending upon the situations and sensitivity. MoEF frames policies, guidelines and standards for environmental norms. MoEF has exempted small hydro power projects with project cost less than Rs. 500 Million (US $ 11.415 Million) from environmental clearance vide Notification dated 27 th January, 1994. http://envfor.nic.in/divisions/iass/eia/Annex1.htm. (Subsequently amended to exempt projects with project cost less than Rs.1000 million (US$22.830 Million)) from environmental clearance. This notification also exempted carrying out environmental impact assessment (EIA) studies for hydro power plants with investment less than Rs.500 Million, which otherwise is mandatory for new projects.
However, DLHPPL had carried out an environmental review of the project activity and other new proposed projects. A brief of the same applicable for the project activity is discussed below; complete environmental social review shall be made available during validation.
The following potential environment, health and safety and social aspect 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 land acquisition due to the project activity. Since the project activity does not increase the reservoir size and does not cause any land inundation, there are no land submerging issues and hence no resettlement and rehabilitation was involved.

National and local government permitting requirements

As per a communication[18] from Government of Maharashtra (GOM), the project activity has been exempted from clearance from pollution control authorities.

Potential impacts on downstream users

The water discharge levels are controlled by the GOM irrigation authorities who release water at Bhandardara dam in accordance with agricultural demands downstream. 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

[18] Letter no. PVT-1096/(130/96)LB 5/HP dated 18 th April, 1998

DLHPPL has constructed a housing facility for its staff with adequate water, sanitary facilities. Good potable water is available in the power house for drinking purposes and good water for washing and cleaning purposes.

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. This is a foot of a dam hydropower project where size of the reservoir was not increased and hence there was no inundation of land due to the project activity.

There are no known endangered species in the vicinity of the project activity. Hence, there are no significant impacts on the ecology due to the project activity.

Social and economy issues

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

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
Since the project activity was a rehabilitation of the damaged project, formal comments from stakeholders were not invited.

An advertisement was given in local newspaper in vernacular language (Marathi) in Dainik Lokmat of Ahmednagar on 20th June 2005 informing about the availability of environmental social review (ERS) report and inviting public and local stakeholders to avail a copy of the document. ERS was kept for public inspection at BH-1.

A register was maintained to make the entries of the issue of ERS. A scanned version of the newspaper advertisement and its translation in English is attached as Annex 4.

E.2. Summary of comments received

>>
There was no request from the stakeholders to review the environmental social review till the prescribed period of availability (20th July 2005) and there was no comment from anybody and no entry was made in the register maintained at BH-1.

E.3. Report on consideration of comments received

>>
Since there were no comments, no action taken report is available.

SECTION F. Approval and authorization

>>
The letter of approval from the host country for the project activity has already available at UNFCCC website.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	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
Postcode	400057
Country	India
Telephone	+91 22 2682 6819/ 2682 6718 / 2682 6594
Fax	+91 22 2683 4658
E-mail	dlhppl@dlz.com
Website	-
Contact person	-
Title	Director (Maharashtra Projects)
Salutation	Mr.
Last name	Samant
Middle name	-
First name	Uday
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	asamant@dlz.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Statkarft Markets GmbH
Street/P.O. Box	Derendorfer Allee 2a,
Building	-
City	Dusseldorf
State/Region	Germany
Postcode	40476
Country	Switzerland
Telephone	-
Fax	-
E-mail	-
Website	-
Contact person	-

Title	-
Salutation	Mr.
Last name	Peters
Middle name	-
First name	Stef
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	-

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Dodson Lindblom Hydro Power Private Limited
Street/P.O. Box	Tejpal Scheme Road 5, Vile Parle
Building	6, Shiv Vastu,
City	Mumbai
State/Region	Maharashtra
Postcode	400 057
Country	India
Telephone	+91 Ph: 022 26826819
Fax	+91 20 25885234
E-mail	dlhppl@dlz.com
Website	-
Contact person	-
Title	CDM Consultant
Salutation	Mr.
Last name	Borah
Middle name	-
First name	Deep J
Department	CDM
Mobile	+91 7738067988
Direct fax	-
Direct tel.	-
Personal e-mail	borah.deep@gmail.com

Appendix 2. Affirmation regarding public funding

There is no public funding of the project activity from Annex 1 Parties.

Appendix 3. Applicability of methodology and standardized baseline

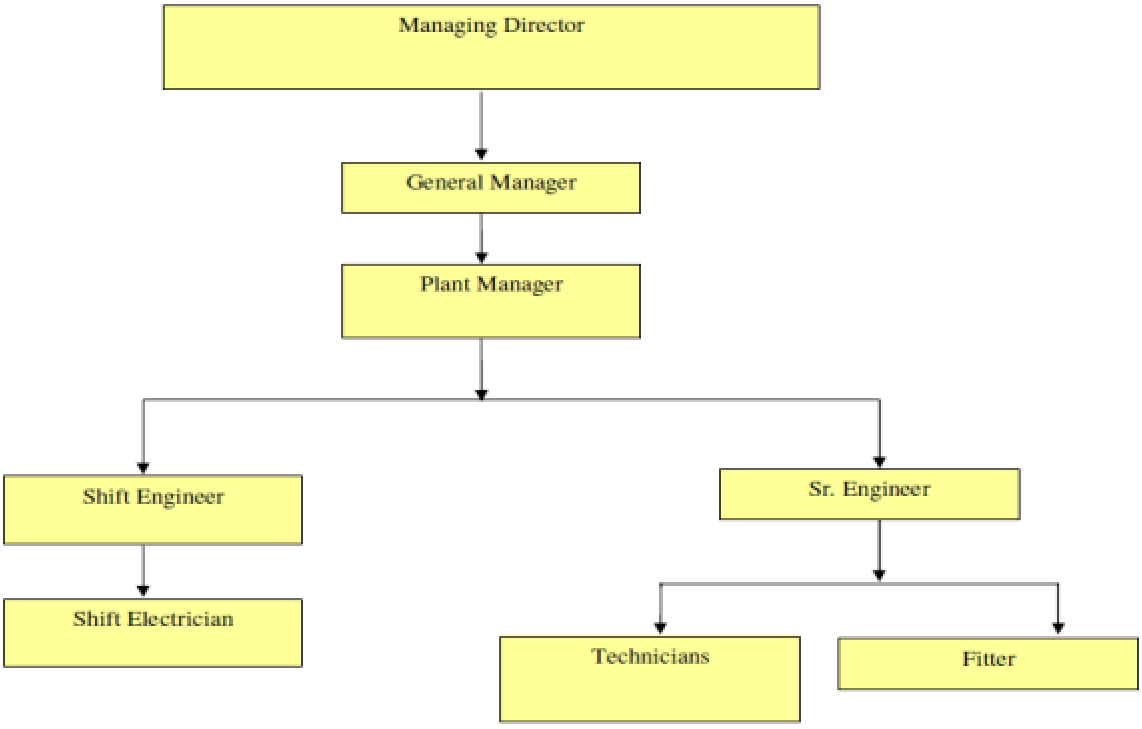
Refer Section B.2.

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

Refer Section B.6.3

Appendix 5. Further background information on monitoring plan

The operational and management structure and procedure to monitor the project activity is discussed below:



Managing Director of DLHPPL is based in their Mumbai office and makes a periodical visit to the Bhandardara plant. The Plant Manager is in charge of day to day operations of the plant. Shift engineers, assisted by a fitter and a technician would be responsible for onsite maintenance of the equipment, preventive maintenance etc.

The technicians will record the readings from main and check meters daily and these readings will be counter checked by the Plant Manager. Daily records at the storage tanks are maintained in the log book to derive the quantity of diesel consumed.

Daily reports are sent to head office electronically and Monthly reports are generated and maintained at the plant and head office. Plant managers would maintain records of joint meter reading.

In house training will also be provided on need basis. The Plant Manager will be responsible for identifying the training needs and maintaining the undergone training records. The records of training undergone are kept at the site.

Calibration /testing records will be maintained by Plant Manager.

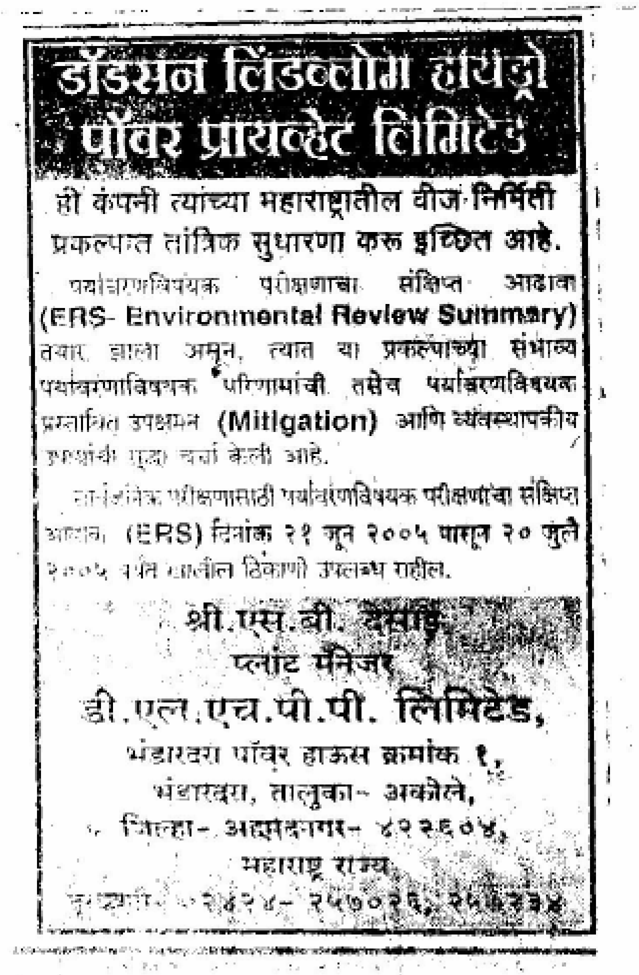
In order to ensure that the project emissions are being regularly monitored and to ensure the function of the monitoring system, the Managing Director or his representative would carry out an audit on regular basis and maintain necessary records of the same. Necessary corrective and preventive action based on the audit findings would be carried out. All the internal audit records would be kept at the corporate office and a copy of the same would be maintained at the site.

Appendix 6. Summary of post registration changes

There is no post registration change involved to this project.

Appendix 1

Image of newspaper advertisement (Marathi -local language)



डॉडसन लिंडब्लोम हायड्रो पॉवर प्रायव्हेट लिमिटेड

हो 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, २५७२३४

<u>Translation of the newspaper advertisement</u>

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

Appendix 2 –Abbreviations

AMS	Approved small scale methodology
BH-1	Bhandardara power house –1
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 social review
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&P	Modalities and Procedures
m^3	Cubic meter
m^3 /s	Cubic meter per second
MCM	Million cubic meter
MNES	Ministry of Non conventional Energy Sources, Government of India
MoEF	Ministry of Environment &Forests, Government of India
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSTCL	Maharashtra State Transmission Corporation Limited
MSEB	Maharashtra State Electricity Board
MSPGCL	Maharashtra State Power Generation Company Ltd
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	Overhead Overhead
OM	Operating margin
PCB	Pollution Control Board
RCC	Reinforced cement concrete
Rs.	Indian Rupees
tCO_2e	tonnes carbon di oxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollars

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Document information

Version	*Date*	*Description*
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-SSC-PDD-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities”
03.0	15 December 2006	EB 28, Annex 34 • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02.0	08 July 2005	EB 20, Annex 14 • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

Version	*Date*	*Description*

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