

PROJECT TITLE: 86 MW Hydro Project in Himachal Pradesh

Document Prepared By Malana Power Company Limited

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Abbreviations

ISO	: International Organization for Standardization
CEA	: Central Electricity Authority
NEWNE	: Northern, Eastern, Western and North-Eastern regional grid
MPCL	: Malana Power Company Limited (Project participant)
EB	: Executive Board
PDD	: Project Design Document
CER	: Certified Emission Reduction
QA/QC	: Quality Assurance / Quality Control
CER	: Certified Emission Reduction
PCB	: Pollution Control Board
HPSEB	: Himachal Pradesh State Electricity Board
VCU	: Voluntary Carbon Units
JMR	: Joint Meter Reading
OM	: Operating Margin
BM	: Build Margin
CM	: Combined Margin
GEF	: Grid Emission Factor
IPP	: Independent Power Producer

1 PROJECT DETAILS

1.1 Summary Description of the Project

Project activity is 86 MW hydro power project located at Jari village in Malana town of Kullu district, Himachal Pradesh, India. Project activity is based on the Run-of-the River (ROR) scheme and has been developed by Malana Power Corporation Limited having registered office at Noida, India (herein after referred as MPCL). MPCL is a private organization, established with an objective of developing new hydro projects across the country. Electricity generated from the project activity is being transmitted to Bajaura substation. From Bajaura substation, generated electricity is exported to NEWNE grid which is synchronised grid comprised of Northern, Eastern, Western and North-Eastern grid.

1.2 Sectoral Scope and Project Type

According to the categorisation system of the Clean Development Mechanism, which is part of Green House Gas (GHG) program that has been approved by the VCS board, the project is categorised as:

- **Type I** : Renewable energy projects
- **Category ACM0002:** Consolidated baseline methodology for grid-connected electricity generation from renewable sources
- **Reference** : Consolidated baseline methodology for grid-connected electricity generation from renewable sources ACM-0002, Version: 12.1.0, 26th November 2010, EB 58
- **Sectoral Scope** : 01, Energy industries (renewable-/ non-renewable sources)

The specified project is not a part of a grouped project

1.3 Project Proponent

Roles and Responsibilities:

The project proponent is responsible for installation, commissioning and subsequent operation and maintenance of the project. The project proponent is also responsible for monitoring and keeping the records as required for the project activity.

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1.4 Other Entities Involved in the Project

No other entities involved in the project activity.

1.5 Project Start Date

5th July 2001 (commissioning date of the project activity)

1.6 Project Crediting Period

- **Project Start date:** 5th July 2001
- **1st Crediting Period start date¹:** 5th July 2001 – 4th July 2011
- **2nd Crediting Period start date:** 5th July 2011 – 4th July 2021
- **Credit Period:** 10 years and 0 month

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

As per VCS Standard Version 3.2, projects are categorized by size according to their estimated average annual GHG emission reductions or removals, as follows:

Project	Less than or equal to 1,000,000 tCO ₂ e per year; Project activity falls under same category as estimated GHG emission reduction are below 1,000,000 as shown in Table 1.
Mega-project	Greater than 1,000,000 tCO ₂ e per year

Table 1: Estimated GHG emission reductions or removals (tCO₂e)

Years	Estimated GHG emission reductions or removals (tCO ₂ e)
2011-2012	275532
2012-2013	275532
2013-2014	275532
2014-2015	275532
2015-2016	275532
2016-2017	275532
2017-2018	275532
2018-2019	275532
2019-2020	275532

¹ As per VCS-2007.1 guidelines

2011-2012	275532
Total estimated ERs	2755320
Total number of crediting years	10
Average annual ERs	275532

Since the emission reductions from the project activity are below 1,000,000 tCO₂e per year so it falls under the category of project.

1.8 Description of the Project Activity

The electricity generation facility is installed on Malana Nallah, a tributary of Parbati River. The project activity entails installation of two turbine of capacity 43 MW each along with other auxiliary devices implemented at village Jari, Kullu District, Himachal Pradesh. The project activity has the capacity to generate about 370 million KWh per annum and this estimation is based on 95% power plant availability for a 90% dependable year based on the hydrological data for the last 24 years provided by the Government of Himachal Pradesh. And average power generation based on actual data of last 10 year is about 320 million KWh per annum. The generated power, after meeting the auxiliary power requirements, the net billable power will be injected to Bajaura Substation which is the part of NEWNE grid.

The purpose of the project activity is to generate electricity by using the renewable energy sources (water) for a grid system in the state of Himachal Pradesh, India. In the absence of the project activity, equivalent power would have been generated based on the fossil fuel intensive grid. The project activity displaces electricity and green house gases (GHG) emissions currently produced by thermal fossil fuel-burning facilities from the NEWNE grid.

This whole process will support climate change mitigation as it would lead to an emission reduction of 2755320 tonnes of CO₂e over the chosen crediting period.

Lifetime of the project activity is expected to be 40 years.

1.9 Project Location

The project is located at Jari village in district Kullu of Himachal Pradesh around 25 Km from Bhunter. The Project activity is uniquely identified as Malana Hydro Project in the region. The nearest railway station from the project site is Kiratpur Sahib, about 198 Km from Bhunter. Bhunter has airport and is well connected to Delhi.

Coordinates of the Barrage:

Latitude: 32° 2' 24" N ; Longitude - 77° 15' 4" E

Coordinates of Power House:

Latitude - 32° 0' 12" N ; Longitude - 77° 14' 30" E

For the project activity the project boundary is from the diversion site to the point of power supply to nearest substation where the project proponent has full control.

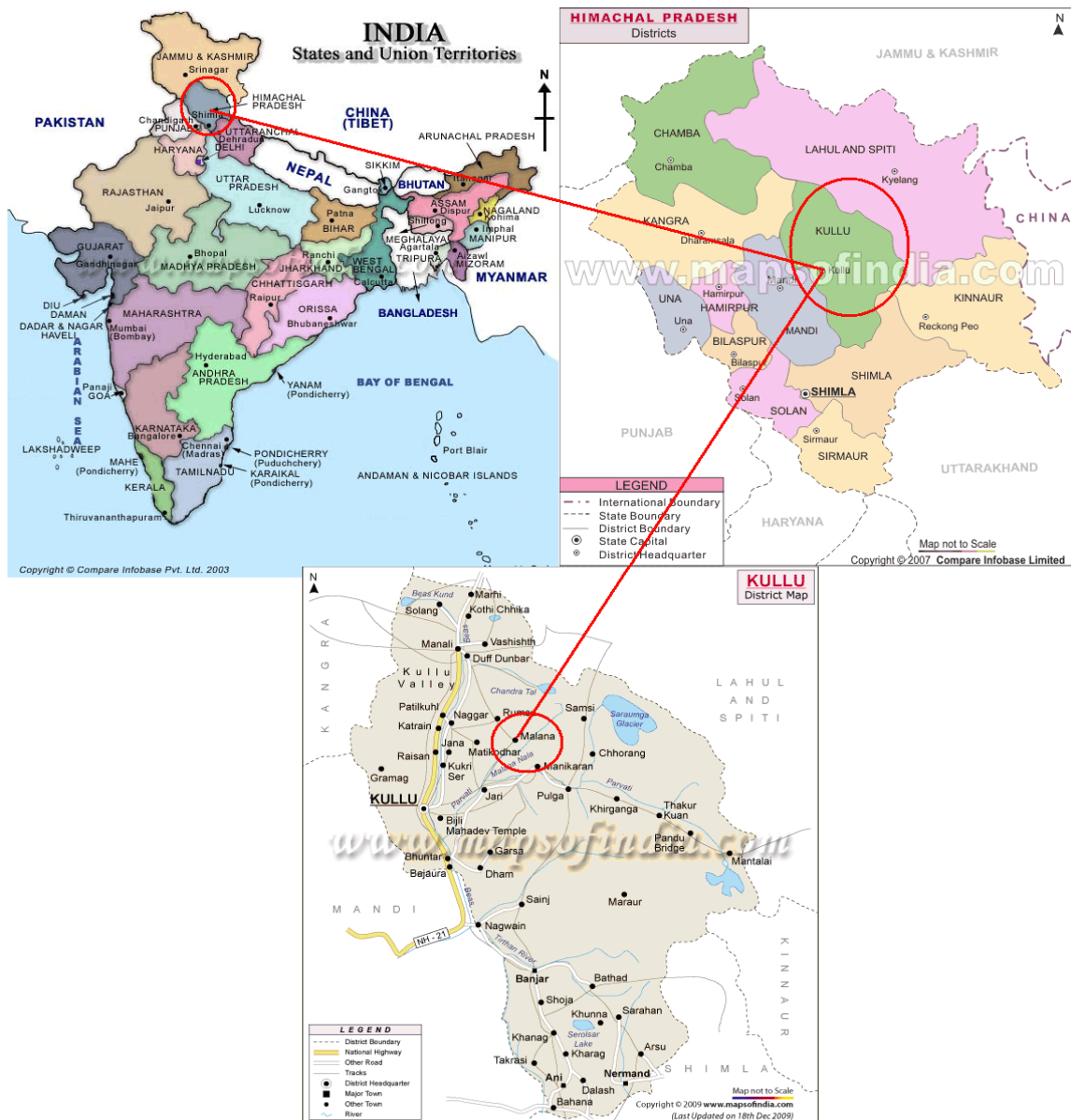


Figure 1: Location of project activity

1.10 Conditions Prior to Project Initiation

The project is a renewable energy project which generates electricity. In the absence of the project activity the electricity delivered to the NEWNE grid would have been generated by the operation of grid-connected power plants which are mainly thermal based power stations². Hence, it would have led to increased GHG emissions thereby, further accelerating climate change.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity is not mandated by any local or national laws. The project proponent has obtained all required approvals as given below.

Approval Name	Approval date	Law under which it is applicable
Renewable of consent to operate	11/03/2011	Water (Prevention & Control of Pollution) Act, 1974 & Air (Prevention & Control of Pollution) Act, 1981
Implementation agreement	13/03/1997	Government of Himachal Pradesh Agreement with Project Developer

1.12 Ownership and Other Programs

1.12.1 Proof of Title

For the ownership details of the Malana Hydro power project following may be referred:

- PCB clearance
- Commissioning certificates
- Letter of Intent dated April 26, 1999

1.12.2 Emissions Trading Programs and Other Binding Limits

The net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions.

1.12.3 Participation under Other GHG Programs

Not Applicable

1.12.4 Other Forms of Environmental Credit

PP is not getting any other form of environmental credit and undertaking for the same is provided from PP end.

² http://cea.nic.in/reports/planning/cdm_co2/user_guide_ver6.pdf

1.12.5 Projects Rejected by Other GHG Programs

Project has not been rejected under any GHG programs. Undertaking for the same is provided from PP.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project hence the criteria is not applicable.

Leakage Management

NA

Commercially Sensitive Information

There is no such information which is deemed as commercially sensitive

Further Information

NA

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Title: Consolidated baseline methodology for grid-connected electricity generation from renewable sources

Reference: Approved consolidated baseline methodology ACM-0002, Version: 12.1.0; EB 58, 26 November 2010

2.2 Applicability of Methodology

The justification of the CDM project activity vis-à-vis applicability conditions in the ACM0002 Version 12.1.0 is described in the following Table 2. This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:

Table 2: CDM project activity vis-à-vis applicability conditions in the ACM0002

Applicability Conditions in the ACM0002, Version 12.1.0	Project activity vis-à-vis applicability conditions
<i>The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or</i>	The project activity is installation of a new grid connected run-of-the river hydro power project

an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	
<i>In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;</i>	The project is a green-field project and does not involve capacity additions, retrofits or replacements.
<i>In case of hydro power plants:</i> <i>- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir.</i> <i>- 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/m².</i> <i>- 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/m².</i>	This is a run of the river hydro power project which does not involve construction of any reservoir. Since the power density of the project activity is greater than 4 W/m² so as per applied methodology for the project activity, there would not be any project emission. Calculation of the power density is shown in section 3.2 of the PD.
Methodology is not applicable to the following Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m². Biomass fired power plants	The Project activity is installation of a new grid connected run-of-the river hydro power project and does not involve switching from fossil fuel to renewable energy This is a run of the river hydro power project which does not involve construction of any reservoir. This is a run of the river hydro power project and not a biomass plant

2.3 Project Boundary

Table 3: GHG gases considered for the emission reduction estimation within project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
		Other	No	-
Project	For hydro power plants, emissions of CH ₄ from the reservoir	CO ₂	No	Minor emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
		Other	No	-

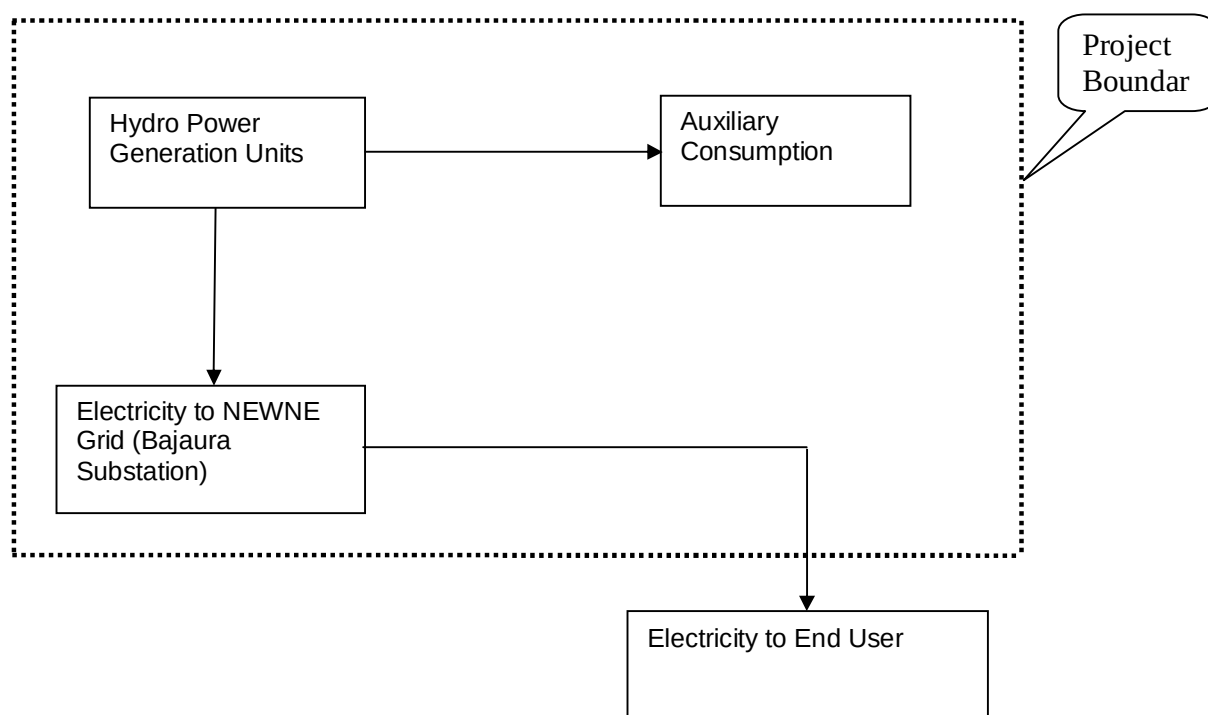


Figure 2: Project Boundary

2.4 Baseline Scenario

As per the approved consolidated methodology ACM0002, version 12.1.0 since the project activity involves the installation of a new grid-connected hydro power plant, the baseline scenario is the following: 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, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

Since the project activity is the installation of a new grid-connected hydroelectric power plant hence the baseline scenario is the same as described above. In the following section Combined Margin for the grid has been calculated as per “Tool to calculate the emission factor for an electricity system”

Baseline Methodology procedure for the calculation of the Emission Factor:

Step 1. Identify the relevant electricity systems:

A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints. The Baseline Carbon Dioxide Emissions database, Version 6, published by the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into two regional grids as shown in Table 4³.

Table 4: Regional grid distribution in India

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

³ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

The dam considered in the project activity lies in the state of Maharashtra. The state forms a part of the NEWNE grid. Hence, relevant Operating margins and Build margins shall be used for calculations.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional):

For calculating the grid emission factor for the project activity, “*Option 1 (only grid power plants are included in the calculation)*” of this step has been chosen. PP has chosen not to include off-grid power plants in the project electricity system, as there is no data available for off-grid power generation for the NEWNE grid. Moreover, the contribution from any such off-grid power plants is expected to be insignificant.

Step 3. Select a method to determine the Operating Margin (OM):

For the purpose of this project activity, the simple OM method has been used. However, as per the tool, *the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.*

Table 5 below⁴ analyses whether simple OM can be used in the project case or not:

Table 5: Percentage of low cost/ must run sources in NEWNE grid

NEWNE Grid						
Generation source	2005-06	2006-07	2007-08	2008-09	2009-10	Average (last five years)
Net Generation (GWh)	437,877.22	465,361.32	496,119.03	510,692.73	544,915.16	490,993.09
% of Low cost/ Must run sources	17.95%	18.46%	19.04%	17.41%	15.94%	17.76%

⁴Central Electricity Authority, March 2011, “Baseline Carbon Dioxide Database Version 6.0”
http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

The above table clearly shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for all three regional grids is much less than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

Step 4. Calculate the operating margin emission factor according to the selected method,($EF_{OM,grid}$)

The simple OM emission factor is calculated as the generation-weighted average CO₂ 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.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the Designated Operating Entity (DOE) for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

OR

- Ex post option: 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.

The simple OM emission factor is calculated as the generation-weighted average CO₂ 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.

Method adopted for Simple OM in the project activity

In the project activity, (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission has been considered.

The data is published annually by the Central Electricity Authority.

It is confirmed that ex-ante vintage is considered in the project activity and cannot be changed during the crediting period.

For the project activity, the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission has been considered. The data is published annually by the Central Electricity Authority.

Simple OM	NEWNE Grid (tCO ₂ /MWh)	Generation (GWh)
2007-08	0.9999	401,641
2008-09	1.0065	421,802
2009-10	0.9777	458,043

Weighted average $EF_{OM,grid} = 0.994$ (tCO₂/MWh)

Step 5. Calculate the build margin emission factor ($EF_{grid, BM,y}$)

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.

For the project activity, the *Option 1* has been used and the build margin emission factor has been fixed *ex-ante* by using the most recent information available. The calculation of the same has been shown below.

Option 1 as described above is chosen in the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

As per the CEA CO₂ Baseline Database, the BM for the 2009-10 has been calculated to be EF_{grid, BM,y}

BM	NEWNE Grid
2009-10	0.812

STEP 6. Calculate the combined margin (CM) emissions factor (EF_{grid, CM, y})

The combined margin emission factor is calculated as follows:

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

Where:

EF_{grid, OM,y} = Build Margin CO₂ emission factor in the year y (tCO₂/GWh)

EF_{grid, BM,y} = Operating Margin CO₂ emission factor in the year y (tCO₂/GWh)

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

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

As per the EB 63 annex 19 step 6, to calculate the combined margin emissions factor weighting of the operating margin and builds margin emission factor need consider w_{OM} = 25% and w_{BM} = 75% respectively for second crediting period⁵.

In the project activity, **combined margin has been chosen as the baseline emission factor** for grid emission factor. The value chosen is taken from relevant official sources and is publicly available⁶.

⁵http://cdm.unfccc.int/filestorage/Z/U/L/ZULY095DAFBVKQ2IEXSM6HRT7NOG1C/eb63_repan19.pdf?t=RGx8bHRjcHM1fDDawKiifSmS7KCmnEMMo9vC

⁶http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Table 6: Combined margin of the NEWNE grid

Parameter	NEWNE grid
OM, Operating Margin – Generation weighted	0.994
BM, Build Margin	0.812
CM, Combined Margin (tCO₂/ MWh)	0.858

The combined margin thus obtained shall be fixed *ex-ante* for the entire crediting period of the project activity. The combined margin has been denoted by EF_{CM,grid,y} later in the VCS- PD for the calculation of emission reductions. The OM and BM have been fixed *ex-ante* for the entire crediting period of the project activity.

2.5 Additionality

The project proponents have used VCS to analyze the additionality argument vis-à-vis project activity.

The project has selected the appropriate baseline and its project emissions are found to be below the selected baseline. In order to determine the baseline the project will use either of the following criteria

- *Determine the baseline based on existing or historical emissions*
- *Determine the baseline based on its industry benchmark under similar social, economic, environmental and technological circumstances*
- *Determine the baseline by identifying the most likely new project activity providing the same level of services as the proposed project*

The Project activity is a run-of-the-river hydel project which supply power through the NR Grid (Now synchronised with NEWNE grid). The power generated by the project activity displaces the power that would have otherwise been generated using fossil-fuel as in the current supply mix of the grid. NR grid was operating with a mix of hydro, nuclear (Total 28%) and fossil fuel (Total 72%) power plants⁷.

The GEF as discussed in section B.2 is taken from publically available source and is based on historical data of power plant performances. CEA has access to all the required data and has

⁷ The composition is based on excel sheet provided by CEA, for calculation of GEF.
http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

done the calculation in a transparent and conservative manner based on guidelines as per ACM0002 Version 12.1.0

This clearly demonstrates that baseline has been determined based on genuine historical data and project activity being a renewable source power shall add to greenhouse gas reductions in real sense.

The VCU (Voluntary Carbon Units) criteria require that project from which emission reductions are created pass an additionality test. Through the additionality test the project proponent shall show that mitigation measures result in real reduction in greenhouse gases against a transparent emission baseline. Project additionality shall be done based on one of the criteria prescribed in VCS. The following logic has been used by project proponents:

Test 1 - The project test:

Step 1: Regulatory Surplus

- The project activity is not mandated by any enforced law, statute or other regulatory framework. And project activity is in compliance with applicable laws and regulations. For power generation, the Indian Electricity Act of 2003 does not restrict or empower any authority to limit the fuel choice.
- There is no regulation in India that imposes either formal or voluntary targets, to be met by such project activity
- The applicable environmental regulations do not restrict the use of hydro energy
- There is no legal requirement on the choice of a particular technology

Also there were not any policies before 11 November 2001 that gives comparative advantage to less emission intensive i.e. hydro power project thus project activity is regulatory surplus.

Step 2: Implementation Barriers

There is minimal private sector participation in hydro power generation in India. Nearly 98% of installed capacity is with Government owned utilities. Lack of private sector participation in hydro power sector is due to difficulties in arranging finance for the projects. Further, most hydro projects in India have run up high capital costs, faced considerable implementation delays, run into geological related problems and faced significant rehabilitation & resettlement related problems, which have contributed to the high financial risk now associated with hydropower projects. In addition, private power generation in India has a chequered past, since state utilities are the usual off takers and the financial standing of most state owned utilities is in a perilous state. Given this background, most private investors are wary of venturing into hydro power development in India.

Step 3: Common Practice analysis

The project activity is the first hydro Independent Power Producers (IPPs) in Himachal Pradesh, India. It is also the first Merchant power plant in the country. An analysis of total power generated in northern region shows that there are not many large scale hydro power projects promoted by private players, hence it is one of its kind in the region.

Fossil fuel based power plant have been considered most popular power generation alternatives in India since they give high return on investment and availability of easy project finance. Installed capacity of fossil fuel based thermal power plants are increasing year by year very rapidly. The encouraged development of thermal power project is illustrated through a consideration of five-year plans over the last 50 years (as shown below in the Table 7). Five year plans are developed by the Planning Commission to identify the planned capacity addition to the national and regional grid.

Table 7: Contribution of different major sources of power sector in five year plans

<i>Plan and Year</i>	<i>Hydro (%)</i>	<i>Thermal (%)</i>	<i>Nuclear and Wind (%)</i>
1 st Plan 1956	35	65	0
3 rd Plan 1966	46	54	0
5 th Plan 1979	41	57	2
7 th Plan 1990	29	69	2
9 th Plan 2002	25	71	4 ⁸

Project activity is the first large scale hydro project in state and an example for the other project developers in the state. It is also first IPP (Independent Power Producer) in India.

The above analysis clearly and strongly demonstrates that project activity has led to greenhouse gas reduction over an above a transparent and conservative baseline.

2.6 Methodology Deviations

NA

⁸ : <http://powermin.nic.in> (see Plan to augment power generation; Accelerating the Development of hydro projects)

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

- Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net quantity of electricity supplied to the grid and emission factor of the NEWNE grid. The calculation approach is explained below:

Table 8: Emission Reduction Estimation

Parameters	UoM	Value	Source
Capacity	MW	86	Purchase order
Running hours	per day	24	-
Working days	per year	365	-
PLF	%	43.1%	Based on actual data since operation of project activity
Auxiliary consumption	%	0.33%	Based on actual data since operation of project activity
Transmission losses	%	0.76%	Based on actual data since operation of project activity
Gross power generation	MWh	324678.99	Calculated
Auxiliary power consumption	MWh	1079.37	Calculated
Power loss due to transmission	MWh	2466.06	Calculated
Net power supplied to grid	MWh	321133.56	Calculated

Gross power generation in a year by the project activity: $86 \times 24 \times 365 \times 0.431 = 324678.99$ MWh

Auxiliary power generation in a year by the project activity: $324678.99 \times 0.33\% = 1079.37$ MWh

Transmission losses in a year by the project activity: $324678.99 \times 0.76\% = 2466.06$ MWh

Therefore,

Net power supplied to the grid in a year by the project activity: $324678.99 - 1079.37 - 2466.06 = 321133.56$ MWh

Combined Margin/ Grid Emission Factor = $0.858 \text{ tCO}_2/\text{MWh}$

The baseline emission for the project activity is calculated as follows:

$$BE_y = 321133.56 \text{ MWh} \times 0.858 \text{ tCO}_2/\text{MWh} = 275532 \text{ tCO}_2/\text{year}$$

3.2 Project Emissions

The project emission in case of hydro projects includes the CH₄ emission from the reservoir and emission due to fossil fuel combustion. Since the project activity is a ROR project without any reservoir, so CH₄ emission would be zero.

As per methodology ACM0002 Version 12.1.0, for hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH₄ and CO₂ emissions from the reservoir, estimated as follows:

- (a) If the power density of the project activity (*PD*) is greater than 4 W/m² and less than or equal to 10 W/m²:

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000} \quad (1)$$

$PE_{HP,y}$: Project emissions from water reservoirs (tCO₂e/yr)

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO₂e/MWh)

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

- (b) If the power density of the project activity (*PD*) is greater than 10 W/m²:

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$):

The power density of the project activity (*PD*) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (2)$$

Where:

PD = Power density of the project activity (W/m²)

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

For the project is a new hydro power plant, so the Cap_{BL} and A_{BL} are both zero.

For the project activity:

$$Cap_{PJ} = 86000000W$$

$$Cap_{BL} = 0 W$$

$$A_{PJ} = 18250 m^2$$

$$A_{BL} = 0$$

$$\begin{aligned} \text{Power density of the project activity, PD} &= (86000000-0) / (18250-0) \\ &= 4712.32 W/m^2 \end{aligned}$$

Since Power density is greater than $4 W/M^2$; therefore,

$$P_{EHP,y} = 0$$

Since during previous crediting period, fossil fuel has never been used for the project activity and it is expected not to be used in the project activity during the current crediting period so project emission due to fossil fuel combustion ($P_{EFF,y}$) is considered zero.

So

$$\text{Total project emissions (PEy)} = P_{EHP,y} + P_{EFF,y}$$

$$= 0 + 0$$

$$= 0 tCO_2$$

3.3 Leakage

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

Therefore, as specified in ACM0002, project participants do not need to consider leakage. Hence, $LE_y=0$.

3.4 Summary of GHG Emission Reductions and Removals

Years	Estimated baseline emissions or removals (tCO ₂ e), BEy	Estimated project emissions or removals (tCO ₂ e), PEy	Estimated leakage emissions (tCO ₂ e), LEy	Estimated net GHG emission reductions or removals (tCO ₂ e), ERy
2011-12	275532	0	0	275532
2012-13	275532	0	0	275532
2013-14	275532	0	0	275532
2014-15	275532	0	0	275532
2015-16	275532	0	0	275532
2016-17	275532	0	0	275532
2017-18	275532	0	0	275532
2018-19	275532	0	0	275532
2019-20	275532	0	0	275532
2020-21	275532	0	0	275532
Total	2755320			2755320

4 MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF _{BM,grid, y}
Data unit:	tCO ₂ /MWh
Description:	The Build Margin emission factor for year 2009-10 of NEWNE grid
Source of data:	CEA CO ₂ Baseline Database, version 06
Value applied:	0.812
Justification of choice of data or description of measurement methods and procedures applied:	The value is taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 6.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.
Any comment:	Latest available value for 2009-10 is used.

Data Unit / Parameter:	EF _{OM,grid, y}
Data unit:	tCO ₂ /MWh
Description:	The Operating Margin emission factor of NEWNE grid

Source of data:	CEA CO ₂ Baseline Database, version 06
Value applied:	0.994
Justification of choice of data or description of measurement methods and procedures applied:	The value is taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 6.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.
Any comment:	CEA CO ₂ Baseline Database for most recent three years

Data Unit / Parameter:	EF _{CM,grid, y}				
Data unit:	tCO ₂ /MWh				
Description:	The Emission factor of the NEWNE grid				
Source of data:	Calculated as the weighted average of the build margin emission factor and operating margin emission factor (with 50/50 weights to OM and BM)				
Value applied:	0.858				
Justification of choice of data or description of measurement methods and procedures applied:	The values are taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 6.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.				
Any comment:	<table border="1"> <tr> <td>BM</td><td>0.812</td></tr> <tr> <td>OM</td><td>0.994</td></tr> </table>	BM	0.812	OM	0.994
BM	0.812				
OM	0.994				

4.2 Data and Parameters Monitored

Data Unit / Parameter:	EG _y
Data unit:	MWh
Description:	Net Electricity supplied to the NEWNE grid by the project activity during the year y
Source of data:	Meters installed at three locations, at generation point, plant sent out point and at Bajaura Substation, accurately monitors electricity supplied to the grid. Joint Meter readings taken at all three stations have been used to achieve the parameter EG _y .
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording:	-
Value applied:	321133.56

Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$EG_y = [EG_{Malana} - EG_{Aux,Malana} - L_{Malana}]$
Any comment:	-

Data Unit / Parameter:	EG _{Gen,Malana}
Data unit:	MWh
Description:	Energy generated by Malana Hydro Power project at the Generation point.
Source of data:	Joint Meter Reading (JMR) by State Electricity Board (SEB)
Description of measurement methods and procedures to be applied:	Meter installed at the generation point shall be used to record this parameter. SEB take the reading on monthly basis and issue the JMR.
Frequency of monitoring/recording:	Monitoring Frequency : Continuous Recording Frequency : Monthly
Value applied:	As per actual data
Monitoring equipment:	Type : Electricity Meter Accuracy Class of meters : 0.2 % Serial Number : As per available at site during verification period
QA/QC procedures to be applied:	Meters are maintained by state electricity board. These meters are calibrated once in three year and the records maintained by state electricity department.
Calculation method:	
Any comment:	-

Data Unit / Parameter:	EG _{Malana}
Data unit:	MWh
Description:	Energy supplied by the Malana Hydro Power Project to the Malana transmission line at Malana Yard.
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.

Frequency of monitoring/recording:	As per actual data
Value applied:	
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$EG_{Malana} = (EG_{Gen,Malana} - EG_{Aux,Malana})$
Any comment:	-

Data Unit / Parameter:	EG _{Toss}
Data unit:	MWh
Description:	The units/ Energy supplied by the Toss Hydro Power Project to the Malana transmission line at Malana Yard.
Source of data:	Monthly meter readings issued by HPSEB
Description of measurement methods and procedures to be applied:	Meter installed at the Malana yard shall be used to record this parameter
Frequency of monitoring/recording:	Monitoring Frequency : Continuous Recording Frequency : Monthly
Value applied:	As per actual data
Monitoring equipment:	Type : Electricity Meter Accuracy Class of meters : 0.2 % Serial Number : As per available at site during verification period
QA/QC procedures to be applied:	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	EG _{M&T}
Data unit:	MWh
Description:	Total Energy sent out both Malana and Toss hydro power project to the Malana transmission line at Malana yard.
Source of data:	Joint Meter Reading (JMR) by SEB

Description of measurement methods and procedures to be applied:	Meter installed at the Malana yard shall be used to record this parameter.
Frequency of monitoring/recording:	Monitoring Frequency : Continuous Recording Frequency : Monthly
Value applied:	As per actual data
Monitoring equipment:	Type : Electricity Meter Accuracy Class of meters : 0.2 % Serial Number : As per available at site during verification period
QA/QC procedures to be applied:	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Calculation method:	-
Any comment:	-
Data Unit / Parameter:	EG _{Aux, Malana}
Data unit:	MWh
Description:	Auxiliary consumption by Malana hydro power project
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording:	-
Value applied:	As per actual data
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$EG_{Aux, Malana} = [EG_{Gen, Malana} + EG_{Toss} - EG_{M\&T}]$
Any comment:	-

Data Unit / Parameter:	EG _{Bajoura, M&T}
Data unit:	MWh
Description:	Energy injected at Bajoura substation by both Malana and Toss hydro power project
Source of data:	Joint Meter Reading issued by SEB

Description of measurement methods and procedures to be applied:	Meter installed at the Bajaura Substation shall be used to record this parameter.
Frequency of monitoring/recording:	Monitoring Frequency : Continuous Recording Frequency : Monthly
Value applied:	As per actual data
Monitoring equipment:	Type : Electricity Meter Accuracy Class of meters : 0.2 % Serial Number : As per available at site during verification period
QA/QC procedures to be applied:	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	$L_{\text{Transmission}}$
Data unit:	MWh
Description:	Total transmission losses between Malana yard and Bajaura substation
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording:	-
Value applied:	As per actual data
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$L_{\text{Transmission}} = (EG_{\text{M\&T}} - EG_{\text{Bajaura, M\&T}})$
Any comment:	-

Data Unit / Parameter:	L_{Malana}
Data unit:	MWh

Description:	Share of losses of Malana hydro power project
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording:	-
Value applied:	As per actual data
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$L_{Malana} = \frac{L_{Transmission} * EG_{Malana}}{EG_{MT}}$
Any comment:	-

Data Unit / Parameter:	L _{Toss}
Data unit:	MWh
Description:	Share of losses of Toss hydro power project
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording:	-
Value applied:	As per actual data
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	$L_{Toss} = \frac{L_{Transmission} * EG_{Toss}}{EG_{MT}}$
Any comment:	-

Data Unit / Parameter:	A _{PJ}
Data unit:	m ²
Description:	Area of the reservoir measured in the surface of the water,

	after the implementation of the project activity, when the reservoir is full
Source of data:	Project site
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc
Frequency of monitoring/recording:	Yearly
Value applied:	18250
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	Cap _{PJ}
Data unit:	W (Watt)
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Project site
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards
Frequency of monitoring/recording:	Yearly
Value applied:	86,000,000
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

4.3 Description of the Monitoring Plan

Project Management Plan:

A team is constituted with participation from relevant departments. People are trained on CDM concept and monitoring plan. This team is responsible for data collection and archiving. This team meet periodically to review CDM project activity check data collected, emissions reduced etc. On a weekly basis, the monitoring reports is checked and discussed by the seniors and team members/managers. In case of any irregularity observed, it shall be informed to the concerned person for necessary actions. On monthly basis, these reports shall be forwarded at the management level.

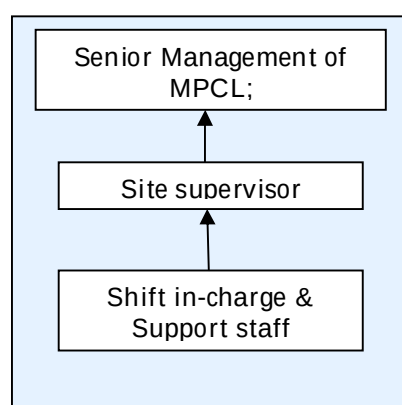


Figure 3: Project Management Plan

Senior Management of MPCL/Technical Head: Overall responsibility of compliance with the CDM monitoring plan.

Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation

Shift In-charge: Responsibility of daily report generation

Data Monitoring:

The methodology requires monitoring of the following:

- Electricity generation from the project activity;

Energy supplied to Grid

The energy supplied to grid is measured using electricity meters located at Bajaura substation. The net electricity supplied is measured as

$EG_y = \text{Total Generation} - \text{Auxiliary Consumption} - \text{Transmission Losses}$

In the current practice another hydro electric power project (Toss) was allowed to utilise the Malana –Bus for sending out the generated electricity. A common meter is now being used to measure the electricity being sent out by Malana and Toss collectively at Malana Yard.

Since there is a common meter for measuring the electricity sent out from Malana Bus Bar hence now the calculation of auxiliary consumption and transmission losses are based on combined energy sent out & combined energy injected at Bajaura Sub Station. The calculation for auxiliary consumption and transmission losses for Malana HEP is described in the section 4.2 of the VCS-PD. Calculation is based on the authenticated Letter issued by HPSEB, 12 October, 2009.

Gross generation at Malana is being measured by meter at generation point. The source of values taken for this parameter is the Joint Meter Reading (JMR). Energy sent out by Toss is measured by meter at the Toss incoming line, the meter readings are recorded and maintained by HPSEB. The total energy sent out by Malana and Toss combined is measured by meter at Malana Bus, the source for these values is the JMR. The total energy injected at Bajoura substation by Malana and Toss combined is measured by meter at Bajoura substation. Auxiliary consumption and the share of transmission loss by Malana are calculated as per formula given in section 4.2. The total energy injected by Malana at Bajaura substation is calculated by subtracting the auxiliary consumption and Malana's share of transmission loss from the Gross generation by Malana.

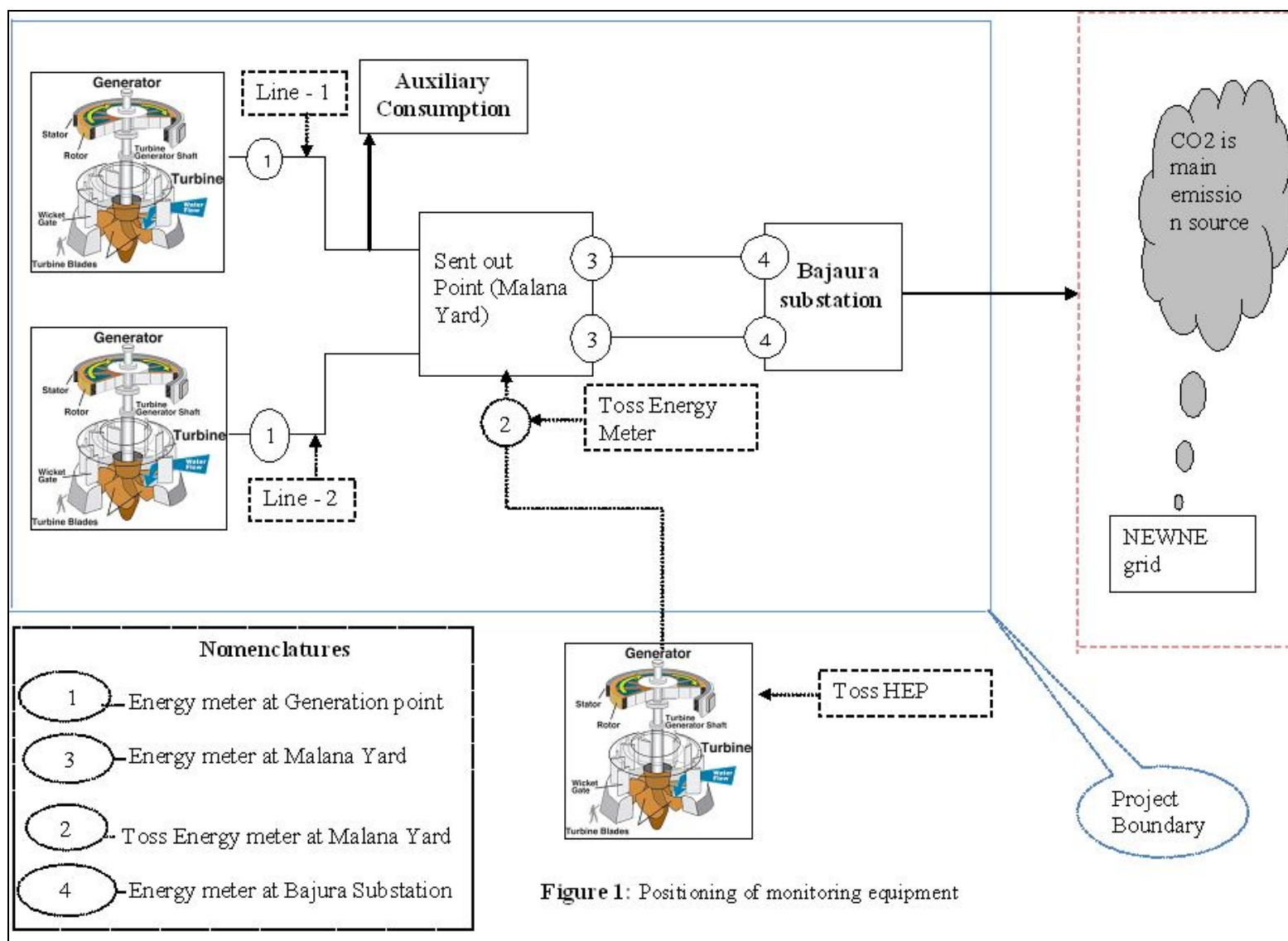
Completeness-

For Electricity generation data: The project activity will install the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection will happen using these control systems. An hourly log of data will also be prepared by the shift in-charge. A daily report of aggregation of these data will also be prepared. Parameters monitored are the total power generated, power exported to the grid and auxiliary power consumed (other parameters like head availability, grid issues, frequency etc will also be maintained hourly in the log).

Reliability-

For electricity generation data: automatic control meters for power generation and exports will be regularly maintained. The regular plant operating & maintenance procedures will also include process of regular meter testing, calibration & maintenance. All these meters are calibrated & tested before installation and the calibration of meters is done once in three year at Government of India Lab

Actual power generation data will also be metered using power output meter at the substation. The billing invoices for the power sold and meter readings could be used to validate the data accuracy.



Frequency-

The measurement is recorded and monitored on a continuous basis. An hourly log is prepared by the shift in-charge. At the end of the day, hourly data is aggregated in a daily report. The meters to be provided shall be of 0.2 accuracy class.

Training-

Training needs have been identified in project document; however the group is already operating a plant in Manikaran valley & experienced staff will be available for plant O&M.

Report generation on monitoring-

After verification of the data and due diligence on correctness if required an annual report on monitoring and estimations shall be maintained and record to this effect shall be maintained for verification.

Internal audits of CDM project compliance-

CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

5 ENVIRONMENTAL IMPACT

- **Documentation on the analysis of the environmental impacts, including trans boundary impacts:**

For a hydroelectric power project the major concern is at the point of project implementation in regard to social, economic and environmental issues. Under the regulatory frame work, Environment Impact Assessment (EIA) study is mandatory for the project activity as clarified by the Host party namely Ministry of Environment and Forests, Government of India. In this regard MPCL has addressed and resolve the key issues which are necessary part of Environment Impact Assessment. The environmental impacts associated with the project activity are as follows:

Impact on Flora and Fauna

Project activity don not involve storage of large amount of river water hence there is no issue regards to the submergence of the forests, fertile land or of the inhabited areas. The structure of project (including reservoir, barrage and other facilities) is not very big in size to cause any significant disturbance to the eco-system. No significant deforestation is required at the weir side location. Implementation of the scheme would help in conservation of forest by replacing the firewood for cooking and heating purposes with electricity.

Socio-Economic Impact

There is no rehabilitation and resettlement has been taken place by the project activity. No relocation of the human population occurred around the project activity. Project activity acquires small pieces of land for which adequate compensation was paid to the local villages; this compensation would help the local population to start new business in the nearby area.

15% of the generated electricity is being delivered to the state grid as royalty which will improve the power scene in the nearby area.

Environment Pollution

Since it is hydro project so there is no issue regarding air pollution. On the other hand power generation from the project will result in air quality improvement and emission reductions caused by burning of fossil fuels and firewood.

Impact of Noise Quality

Equipments which are being used in project activity has the ability to keep the noise level below 90 db for an exposure time of 8 hours as enforced by OSHA (Occupational Safety and Health Administration). During the construction phase, the personnel operating and stationed near the Heavy Earth Moving Vehicles and Concrete Mixing Machines provided with adequate Personal Protective Equipment (PPEs) to avoid damage to the health. The noise generated in the construction process did not have any significant impact on the ambient noise levels. Hence there is no significant noise impact has been observed.

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

The MPCL is an environmentally benign 'clean energy' and cost effective solution to meet the region's growing energy demands. Efforts have been made to enhance the existing resources and minimize the

adverse impact on the ecosystem through suitable planning. Environmental Impact Assessment for the project has been carried out and the clearance for the project has been obtained.

6 STAKEHOLDER COMMENTS

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

MPCL identified the people, groups and organisations that were interested or have got involved with this project implementation as stakeholder. MPCL sent a communication to all the identified stakeholders about the project activity. They conducted open consultation where all the stakeholders were given an opportunity to present their views and opinions regarding the MPCL project. All these communication process were aimed at

- Transparency
- Accountability
- Flexibility
- Increased stakeholder awareness of project related issues
- Broad stakeholder input and involvement
- Efficiency and effectiveness
- Promotion of stakeholder confidence
- Understanding of stakeholder perspective

The following are the identified stakeholders for the project activity

1. Government Parties

- HPSEB (Himachal Pradesh State Electricity Board)
- Pollution Control Board of Himachal Pradesh & Environmental Department of Himachal Pradesh
- Ground Water Department
- MNES (Ministry of Non Conventional Energy Sources)

2. Non- Government Parties

- Gram Panchayat of Jari Village
- Land Owner
- Non-Government Organisation(NGOs)
- Consultants
- Equipment suppliers

Stakeholder list includes various government and non-government parties, which are involved with the Project activity at various stages of its implementation.

Summary of the comments received:**Government Parties**Himachal Pradesh State Electricity Board (HPSEB)

As an importer of the power, the HPSEB is a major stakeholder in the MPCL project activity. They hold the key to the commercial success of the MPCL project. HPSEB has already cleared the MPCL project and MPCL signed Power Purchase Agreement (PPA) with HPSEB.

Himachal Pradesh Pollution Control Board (HPPCB), Environment Department of Himachal Pradesh

Himachal Pradesh Pollution Control Board (HPPCB) and Environmental Department of Government of Himachal Pradesh have prescribed standards of environmental compliance and monitor the adherence to the standards. The MPCL project received No Objection Certificate (NOC) from Himachal Pradesh Pollution Control Board for commissioning of the project. Project proponent has also taken consent from Environmental Department of Himachal Pradesh.

Ministry of Non Conventional Sources and Ground Water Department

Ministry of Non Conventional Sources, Government of India has been promoting the energy renewable project such as wind, solar, hydro, mini hydro, biomass based projects to conserve available sources (such as fossil fuel, diesel and natural gas) for future uses. Effort implementing this hydro project was appreciated by the MNES.

Consent of Ground water department is mandatory in the implementation of the hydro projects, since this project does not affect the quality and quantity of the ground water in the region, so project activity has been given the approval to implement and operate the hydro power plant in the region

Non-government partiesVillage panchayat and Local Populace

The village Panchayat / local elected body of representative administering the local area are a true representative of local population in a democracy like India. Hence, their consent / permissions to set this project were necessary. MPCL has completed the necessary consultation and documented their approval for this project.

Local population comprises of the local people in and around the MPCL project area. The roles of the local people are as a beneficiary of the MPCL project. The construction of MPCL project and continuous operation included local manpower working at the same plant site. Since, the MPCL project provided good direct and indirect employment opportunities the local populace is encouraging and providing complete support to the MPCL project.

The MPCL project does not require any major displacement of local population. The Project activity has acquired land from local population and local population have been given compensation for this thing. So project activity has not received any adverse comment from their side.

Non-Government Organisations (NGOs), Consultants, Equipment Suppliers

The NGOs got involved with the MPCL project during various stages of its implementation. They have provided complete support to the MPCL project activity.

Project consultants were involved in the MPCL project to take care of various pre contracts and post contract project related activities like preparation of detailed project report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment supplier delivered all the equipment as per specification within the schedule and MPCL successfully commissioned the plant.

Land Owner

Project activity acquired land from few local land owners. Acquisition process has been done after taking consent of the land owners and land owners have been compensated for losing their land by the project activity. Land owners have not shown any adverse reply against this process.