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

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	•The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. •As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	•The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Lodhama Hydro Power Project at Darjeeling in West Bengal, India

Version – 01

Date – 27/04/2008

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

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The project activity promoted by Nippon Power Limited, referred to as the project proponent, involves the setting up of a run of the river small[1] hydro power (SHP) project that uses water from the rivers Ritukhola and Kalpokhri, both tributaries of the Lodhama River. The present capacity of the SHP is 3MW and the project proponent plans to add another 1.5MW by mid-2009. The project envisages generating 14.2GWh of electrical energy in the first year and 17.8GWh annually subsequently to be exported to the nearest grid sub-station at Bijanbari of the West Bengal State Electricity Board (WBSEB), a part of the Eastern Regional Grid[2] of India. Nippon Power Limited (NPL) is a company with a broad vision for development of power projects with a major emphasis on tapping the renewable and pollution-free resources of energy in the country. It is the second private sector company to set up a SHP plant in the state of West Bengal and the first company to have executed a turnkey SHP project in Bihar.

The purpose of the project is to generate clean power by utilising the renewable natural resource – hydro power potential and supply the generated power to the grid. The hilly regions in the Northern part of the West Bengal state at the foot-hills of the Himalayas have hydro power potential, much of which has not

[1] As per the Ministry of Non Conventional Energy Sources (under Government of India) guidelines, hydro projects with station capacity from 2MW up to 25MW are classified as Small hydro projects

[2] From the view point of electricity generation, India is demarcated into five regional grids:

- Northern Regional Grid
- Western Regional Grid
- Southern Regional Grid
- Eastern Regional Grid
- North-Eastern Regional Grid

Eastern Region that the project activity is a part of comprises the states of Bihar, Jharkhand, Orissa, West Bengal and Sikkim. It has an area of 4,25,432 sq. km, which is about 13% of the total area of the country
Please refer to http://www.eastrpc.org/ for details

been brought into use till date. The power generated by the project activity displaces an equal amount of power in the grid that would have otherwise been generated by the combustion of fossil fuels. Furthermore, the project activity contributes to the causes of conservation of fossil-fuels: the non-renewable sources of energy and mitigation of climate change.

Contribution of the Project Activity to Sustainable Development

The contribution of the project activity to the sustainable development of the host country India is surmised as follows:

Social Well Being	The project activity generates clean power without adverse effects on the surroundings. As the project activity is a SHP project without the construction of a dam, there is no human displacement due to it and hence no requirement of relocation. Also, the project contributes to the stability of grid power that is a major cause of concern in the hilly areas that are regularly hit by power shortage. The project proponent provides various scopes of employment to the local inhabitants during its constructional and operational phases and has also constructed recreational facilities for them. As the local population will be employed in the project, proper training imparted to the people involved ensures better operation of the unit and it also results in the skill development of the local inhabitants.
Economic Well being	The project activity has created business opportunities for local stakeholders like the contractors, suppliers, manufacturers and small shop owners. The project activity will help the local industries currently suffering from power shortage and support those coming up in the future. Hence the project activity is an effort on the part of the project proponent to contribute towards bridging the demand-supply gap in the region directly at a local level and indirectly at a national level. Moreover, the project activity also contributes to the economic development of the local people and industries by providing employment and business opportunities.
Technological Well being	The project activity generates power using environmentally safe technology to generate hydroelectric power. Its success would encourage other entrepreneurs to replicate such eco-friendly technologies in hilly regions of not only West Bengal but also in entire India. The power generated by the project will contribute towards the grid stability directly in the local level and indirectly at the national level. Moreover, it also helps in

	reducing the losses due to power transmission and distribution from the existing generating stations of the grid to such remote areas.
Environmental Well being	The project activity does not cause environmental disturbance or ecological imbalance to the surroundings. It does not hamper the natural beauty of the hilly regions neither does it disturb the flora and fauna around the site. The project activity generates clean power by harnessing hydro-electric potential, a renewable source of energy. Hence it avoids the generation of an equivalent amount of power using non-renewable energy sources: fossil fuel like coal, natural gas, *etc.* It would thus lead to reduction in GHG emissions at the thermal power plants connected to grid. Also the project activity would also contribute to the cause of natural resource conservation by cutting down on the consumption of fossil fuels for the purpose of power generation and hence making them available for other purposes where their use is indispensable.

A.3. Project participants:

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Name of Party involved ((Host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	Nippon Power Limited (Private Entity, Project participant)	No

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

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

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A.4.1.1. Host Party(ies):

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India

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

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West Bengal

A.4.1.3. City/Town/Community etc:

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Fedikhola and Fenchitar Villages, Darjeeling District

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

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The SHP project site is located on the upper reaches of the Lodhama (Ritukhola) river and uses water from the Ritukhola and Kalpokhri, both tributaries of the river Lodhama. The rivers originate from the Deorali Danda – Tonglu – Phatke – Danda range with altitudes ranging from 2590 m to 3322 m that is covered by snow in winter. The catchment area (13.77 sq mile or 35.25 sq km) is covered with deep forest, which ensures high intensity of base flow. The Lodhama meanders through deep gorges and thick forests in lower reaches before joining the river Rammam. The project site lies within 88°00' E to 88°07' E and 27°00' N to 27°05' N and is located 70 km from Darjeeling.

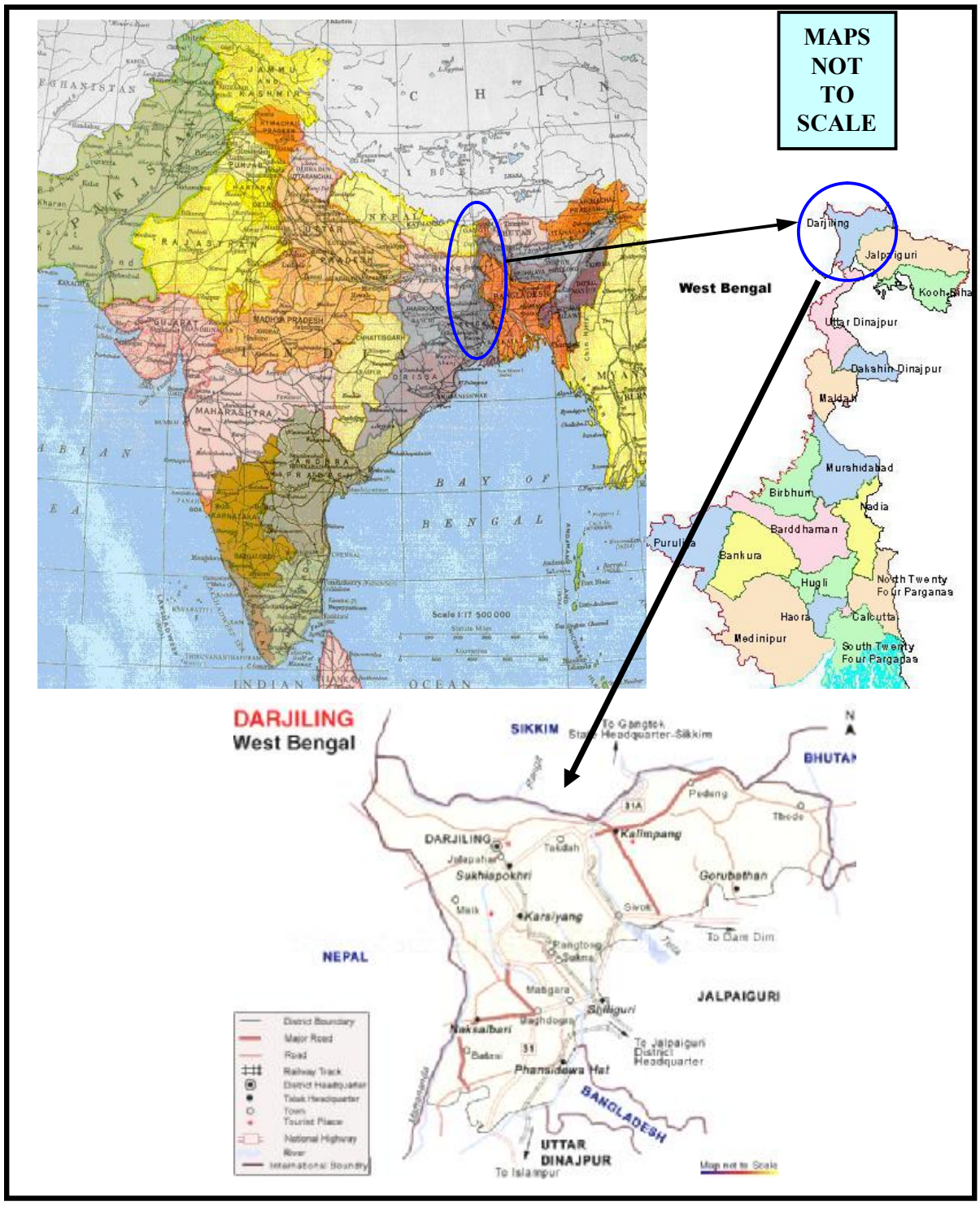
There are two railway stations to access the place:

(i) Ghoom Railway Station on the narrow gauge, at a distance of 55 km from the project activity site, and

(ii) New Jalpaiguri Railway Station on the broad gauge, at a distance of 135 km from the project activity site.

The nearest national airport from the project activity site is Bagdogra and the nearest international airport is the Netaji Subhas Chandra Bose International airport in Kolkata, the state capital.

The physical location of the site is shown in the following figure:



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

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As per the categorization of Appendix B of Indicative Simplified Monitoring and Baseline Methodologies[3], *"renewable energy generating 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"* come under:

Type: *Type I – Renewable Energy Projects*

Category: *I.D. 'Grid Connected Renewable Energy Generation'/ Version 13*

The project activity under consideration would harness the naturally available hydro power potential for generation of power that would be exported to the thermal power dominated Eastern Regional Electricity Grid of India. Hence it can be classified as under Type I, Category I.D. of small scale CDM project activities.

Technology:

The technological scheme for the project activity has been designed to generate power in an environment-friendly manner by setting up a run off the river SHP plant. The plant uses surplus discharge of the river Lodhama's tributaries: Ritukhola and Kalpokhri, covering a total catchment area 13.77 sq miles (35.25 sq km). The Kalpokhri stream, a tributary of the Lodhama river, has been diverted to join the Ritukhola river, another tributary of Lodhama. In order to obtain the rated power generation at 90% dependability, a discharge of around 1.5 cumecs is required out of which 1.3 cumecs is available from Ritukhola river and 0.2 cumecs is available from Kalpokhri. The diversion structure is a drop inlet type weir, designed for a maximum discharge capacity of 2.4 cumecs for Ritukhola and 0.4 cumecs for Kalpokhri. The water conductor system that leads the water to the forebay includes a reinforced cement concrete (RCC) duct (section 1m x 1 m) and a trapezoidal flume. There is a de-silting chamber to remove the solid particles in the river water. The forebay (590 m^3 capacity) of depth 5.3 m and free board 0.3 m is circular in shape. The penstock that leads the water into the power house has an internal diameter of 0.914m in the initial part, 0.864m in the middle part and it then bifurcates into parts of 0.6m each. The same has a length of 2500 m and is designed for a discharge of 1.46 cumecs. Its invert level at the indoor type pump house end is 1490 m in length. The power house comprises two Impulse type (Pelton Wheel) turbines of 1500 kW capacity each and rated speed 750rpm. The two synchronous generators of 1500kW capacity each associated with them are self-excited and self-regulated and will generate electricity at 6.6kV. They have a rated speed of 750rpm, frequency 50Hz and a power factor of 0.9. Another similar 1.5MW turbine-

generator set would be implemented by mid-2009 to enhance the net power potential to 4.5MW. A transformer of 4000kVA steps up the electricity generated from 6.6kV to 33kV to be transmitted to the nearest grid substation Bijanbari at a distance of 22km.

The project activity envisages the generation of an average of 17.4GWh of electrical energy per annum. Therefore with the implementation of the project activity, there will be a replacement of the same quantum of electrical energy per annum from the Eastern Regional Grid. The same will lead to a reduction of 17,920tonnes of CO_2 per annum on an average as per the carbon intensity of the Eastern Regional Grid. Therefore over the entire credit period of 10years, the project activity will result in emission reductions to the tune of 179,202tonnes of CO_2.

Technology transfer:

There is no technology transfer from other countries involved in the project activity.

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

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Years	Estimation of annual emission reductions in tones of CO_2 e
July 2008-June 2009	14,629
July 2009-June 2010	18,286
July 2010-June 2011	18,286
July 2011-June 2012	18,286
July 2012-June 2013	18,286
July 2013-June 2014	18,286
July 2014-June 2015	18,286
July 2015-June 2016	18,286
July 2016-June 2017	18,286
July 2017-June 2018	18,286
Total estimated reductions CO_2 e	**179,202**
Total number of crediting years	**10**
Annual average of the estimated reductions over	**17,920**

[3] http://cdm.unfccc.int/methodologies/SSCmethodologies

the crediting period (tCO_2e)	

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

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There is no public funding available from any Annex I party for the project activity.

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

As mentioned in the Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities: *"Debundling is the fragmentation of a large project activity into smaller parts. A small scale project activity that is a part of large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.*

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a 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 and technology/measure; and*
- *Registered within the previous 2 years; and*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point"*

No similar project activity has been implemented by NPL that falls under the Category-I.D. of "Appendix B of the simplified modalities and procedures for small scale CDM project activities" and deals with the same technology/measure, with the same project category and whose boundary is within 1km of the project boundary of the proposed small-scale project activity at its closest point at a registered or advanced stage of registration with the UNFCCC in the last two years.

With the above explanation, the project proponent hereby confirms that the proposed project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of Approved baseline and monitoring Methodology: 'Grid Connected Renewable Electricity Generation'

Reference of the Approved baseline and monitoring Methodology: Category I.D - Renewable Energy Projects – AMS–I.D. / Version 13 of the Appendix B of Simplified Modalities and Procedures (M & P) of Small Scale CDM Project Activities

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

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As per the provisions of Paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities[4], to use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall:

1. Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 28 of Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its second session, held at Nairobi from 6 to 17 November 2006 [FCCC/KP/CMP/2006/10/Add.1, English, Page 08][5] ; Point i. [Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent)]

The proposed project activity primarily aims at the reduction of emissions of GHGs by setting up a run off the river hydro power plant. In the process, a renewable source of energy is being harnessed and the

[4] Refer to: FCCC/CP/2002/7/Add.3, English, Page 21

[5] In accordance with decision 17/CP.7 (contained in document FCCC/CP/2001/13/Add.2), paragraph 6 (c), simplified modalities and procedures have been developed for the following types of small-scale CDM project actives the revised definitions of which is provided in paragraph 28 of decision -/CMP.2:
Type I: Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent);
Type II: Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, limited to those with a maximum output of 60 GWh per year (or an appropriate equivalent);
Type III: Other project activities limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually;

electricity generated by the activity will displace from the grid an equivalent amount of electricity generated by fossil fuel combustion. Thus the GHGs that would have been emitted by the grid connected thermal power plants are avoided. The total capacity of the hydro power plant is 3MW presently and as already mentioned, another 1.5MW would be added by mid-2009. Hence the net capacity of the small hydro power plant falls well within the requisite Type I small scale cap of 15MW.

2. Conform to one of the project categories in Appendix B;

The project activity conforms to "Category I.D." project category in Appendix B. The justification of the same has been provided in Section A.4.2

3. Not be a debundled component of a larger project activity, as determined through Appendix C

The project activity is not a debundled component of a larger project activity as determined through Appendix C of Simplified Modalities and Procedures for Small Scale CDM Project Activities[6]. The justification of the same has been provided in Section A.4.5

Therefore the project activity meets the 'Small Scale CDM Project Activities' applicability criteria.

The applicability criteria of the methodology and their relevance with respect to the project activity are addressed as follows:

1. "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 project activity involves a renewable energy generation unit: SHP plant that supplies electricity to the fossil fuel dominated Eastern Regional Grid, an electricity generation and distribution system. In the process, it displaces an equivalent amount of electricity that would have been generated by the grid connected fossil fuel fired thermal power plants.

Hence the project activity complies with this criterion.

2. "If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW".

[6] [FCCC/CP/2002/7/Add.3, English, Page 21]

The capacity of hydro power generation through a SHP plant in the project activity is 3MW with a further envisaged implementation of 1.5MW, the cumulative sum of which is much less than the stipulated 15 MW. As the project proponent has planned to carry out the project activity with 4.5MW total capacity and have no further plans of capacity expansion, the activity would continue to remain within the requisite cap of 15 MW throughout the crediting period. More over it involves no other mode of electrical energy generation like co-firing fossil fuels.

Hence the project activity complies with this criterion.

3. *"Combined heat and power (co-generation) systems are not eligible under this category"*

The project activity being a run off the river SHP plant generates only electrical energy by harnessing the potential energy available from the water of the perennial rivers Ritukhola and Kalipokhri that are tributaries of the river Lodhama. There is no co-generation involved in the project activity.

Hence the project activity complies with this criterion.

4. *"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 from the existing units."*

The run off the river SHP plant set up by the project is a green-field activity and hence there is no addition of renewable energy generation units at an existing renewable power generation facility.

Hence the project activity complies with this criterion.

5. *"Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW"*

The renewable energy generating hydro power plant employed by the project activity is newly constructed and set up and are not any means to retrofit or modify any existing facility for renewable energy generation.

Hence the project activity complies with this criterion.

The project activity thus meets all the applicability criteria of the Baseline Methodology of AMS-I.D./ Version 13 and hence falls under the small scale CDM project activity as per Appendix B of the simplified modalities and procedures for small–scale CDM project activities of UNFCCC.

The Methodology is applied in the context of the project activity as follows:

I. Baseline Emissions: The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient measured in kg CO_2 equivalent/kWh. Two methods are provided for category I.D for estimating the emission coefficient in a transparent and conservative manner. They are

a. The average of 'approximate operating margin' and the 'build margin', or

b. The weighted average emissions in kg CO_2/kWh of the current generation mix.

Since the project activity affects both the present and the future generation mix of the grid, as per the guidance of the methodology, the project proponent decides to use Option a. - the average of 'approximate operating margin' and the 'build margin', for estimating the emission coefficient of the electricity distribution system. Details of baseline calculations are provided in Section B.4. of the PDD.

II. Project Boundary: The project boundary encompasses the physical, geographical site of the renewable generation source. The details are provided in Section B.3. of the PDD.

III. Additionality: The additionality aspects for the project activity have been discussed in accordance with Attachment A to Appendix B in Section B.5. of the PDD.

IV. Monitoring: The detailed Monitoring plan for the project activity is provided in Section D of the PDD.

V. Emission Reductions: As outlined in section B.3 of the PDD, there are no project emissions or leakage associated with the project activity, the Emission Reductions are equivalent to the baseline emissions avoided for that particular year by generating power from renewable source instead of a non – renewable source. The detailed emission reduction calculations are provided in Section B.6. of the PDD.

B.3. Description of the project boundary:

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As per paragraph 6 of AMS I.D of Appendix B, the project boundary encompasses the physical and geographical site of the renewable generation source.

Hence for the project activity, the project boundary consists of the following:

(A) The following river channels and power generating equipment:

(i) Diversion weir

(ii) Water conductor system (RCC duct and open flume)

(iii) Forebay

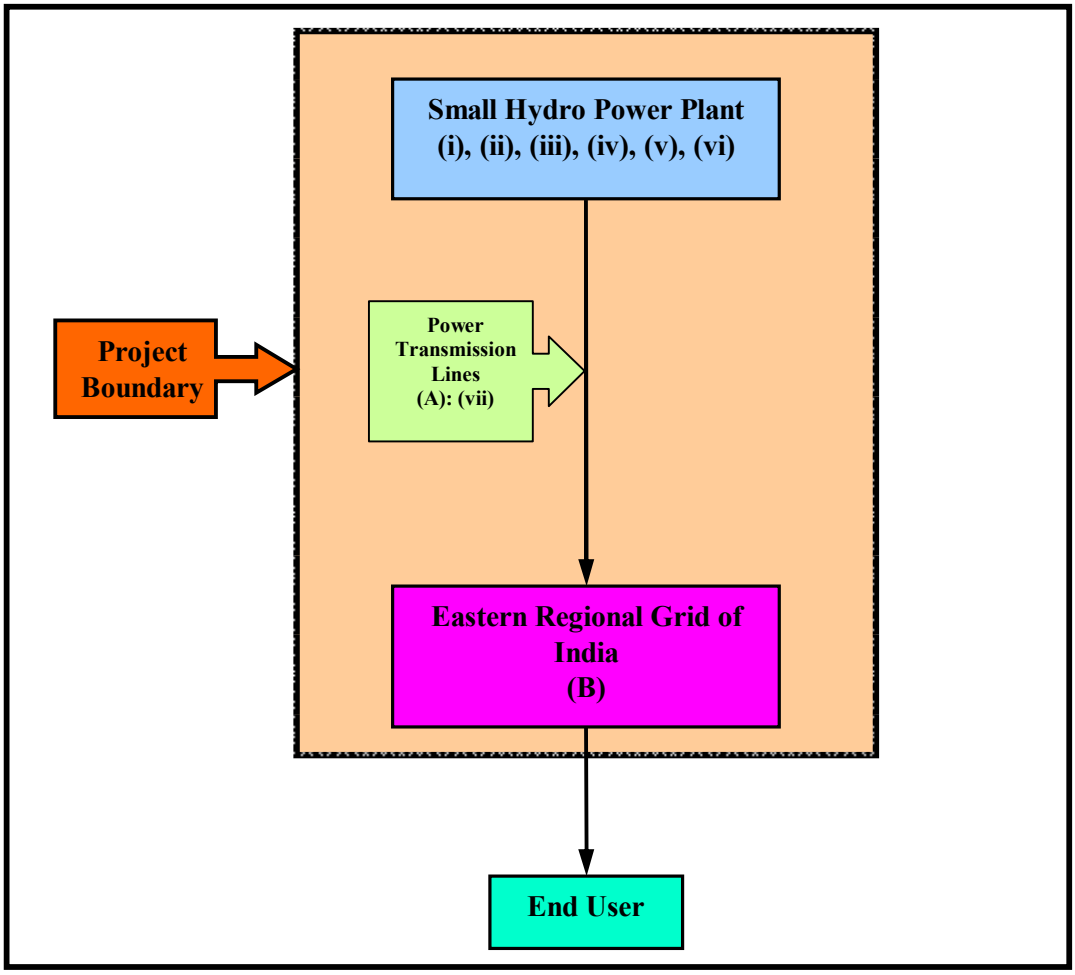
(iv) Penstock

(v) Power generation house (containing the turbines, generators and transformers)

(vi) Tail race canal

(vii) Power evacuation or transport system up to the grid substation.

(B) Further, for the purpose of estimation of baseline emissions, the Eastern Regional Grid[7] of India has been considered within the system boundary. The project boundary is demonstrated by the following block diagram:



[7] The Electricity Grid of India has been sub – divided into five Regional Grids:
(i) The Northern Regional Grid
(ii) The Eastern Regional Grid
(iii) The Western Regional Grid
(iv) The Southern Regional Grid
(v) The North – Eastern Regional Grid

B.4. Description of baseline and its development:

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NPL identified the following alternatives to the proposed project activity that are available to any green-field hydro power project in general:

Alternative 1 – Continuation of existing scenario: no project activity and electricity generated by the present fossil fuel fired grid connected thermal power plants

Alternative 2 - The project activity not undertaken as a CDM project activity

They are analysed as follows:

Explanation	Conclusion
Alternative 1 – Continuation of existing scenario: no project activity and electricity generated by the present fossil fuel fired grid connected thermal power plants	
In absence of the CDM project activity, the project proponent does not set up the SHP plant and no electricity generated by the project activity. In such a situation, the electricity equivalent to the quantum of 4.5MW will be generated by the grid connected fossil fuel fired thermal power plants. Also, the process will result in GHG emissions as per the carbon intensity of the grid (Eastern Regional Electricity Grid of India). This alternative is in compliance with all applicable legal and regulatory requirements. Therefore, this alternative may be a part of the baseline.	Therefore the Alternative 1 is **considered** further for arriving at the baseline scenario.
Alternative 2 - The project activity not undertaken as a CDM project activity	
The project activity involves the setting up of one SHP plant on the rivers Ritukhola and Kalpokhri, which are tributaries of the river Lodhama. The electricity generated would be exported to the Eastern Regional Electricity Grid at the nearest sub-station Bijanbari. This alternative speaks of implementing the project but not as a CDM project activity. This alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative has associated barriers to its implementation which prevented NPL to implement the project activity (Please refer to the analysis under Barrier and Additionality in Section B.5. below for details). The consideration of the CDM benefits (GHG abatement and financial benefits) played a key role in NPL's decision to proceed with the project activity. Therefore the alternative 2 would not be a credible and realistic alternative option for NPL to implement.	Therefore the Alternative 2 is **not considered** further for arriving at the baseline scenario.

Considering the points mentioned above, "Alternative 1: Continuation of existing scenario" can be concluded to be the viable option available to NPL in absence of the project activity and therefore, as per the methodology, this alternative option is the baseline scenario. This is further substantiated by the fact that this scenario was the prevailing scenario before CDM project implementation.

As per paragraph 9 of the methodology AMS-I.D. / Version 13, the baseline is given by

"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as:

(a) 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 kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available."

According to paragraph 9 of the small scale methodology AMS I.D./ Version 13,

"the baseline of the project activity is the kWh generated by the project activity multiplied by the emission factor of the regional grid in which it displaces the electricity."

The emission factor of the grid, according to the outlines of the methodology, is calculated in a transparent and conservative manner as a combined margin which is calculated as the average of the operating margin and the build margin. The detailed calculations of the operating and build margins have been provided in Central Electric Authority (CEA) CO_2 Baseline Database, Version 3.0, dated December 2007 developed in accordance to the guidance of 'Tool to calculate the emission factor for an electricity system'/ Version 01. Please refer to Annex 3 for details. The baseline emissions are calculated according to the equation (7) as provided in section B.6.1.

Parameters required for calculation of baseline emissions:

Serial number	Variable	Parameters	Data sources
1	EF_y	Electricity baseline emission factor	Calculated according to the guidelines of Tool to calculate the emission factor for an

			electricity system/.Version 01. The value for the emission factor has been sourced from the CEA CO_2 Baseline Database, Version 3.0 dated December 2007[8].
2	EG_y	Total energy exported to grid	Power export bills

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

As per the decision 17/cp.7 paragraph 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

Barriers and Additionality

The additionality aspects of the project are discussed below in accordance with Attachment A of appendix B of the simplified M & P for small scale CDM project activities that states:

"Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

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

[8] Available at: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

The barriers encountered by the project activity at several stages of planning, implementation and operation are as follows:

(a) Investment Barriers:

1. *Poor returns from the project activity:*

The tariff for power sale from the project to the WBSEB is as per the Agreement signed around ten years prior to the actual commencement of the project and power export to the grid. Hence the tariff of INR. 2.25 / kWh (with an escalation of INR. 0.04 / kWh per annum) is unviable for the project proponent considering the increase in the construction cost and the operation and maintenance cost in these years during which the project has been delayed owing to several reasons. In fact, the rate of sale of power for the project proponent of is much below the capping tariff rate prescribed by the West Bengal Electricity Regulatory Commission Guidelines for electricity purchase from small hydro power plants[9] of INR. 3.60 / kWh. Hence the project proponent is at a huge loss with respect to the current power sale rates and is compelled to sell the power at the lower rate due to the PPA signed. The project proponent has applied to the WBSEB[10] to increase the rate of sale of power but received no response till date despite repeated reminders and follow-ups. In such a scenario, it is a financially unviable for the project proponent to sustain operations and the only respite for sustained operations is the assurance of CDM revenue being looked up to.

2. *Financial strain on the company in procuring capital upfront:*

Till 1995 there was a 'capital subsidy' for renewable energy projects in the private sector by the Ministry of Non–Conventional Energy Sources (MNES)[11]. Keeping that in mind the project proponent had considered setting up a SHP in Darjeeling in the year of 1994. Subsequently they also intimated The Alternate Hydro Energy Centre about their intent to set up the above mentioned project. The Alternate Hydro Energy Centre had also appreciated the project proponent's interests in developing a SHP in Darjeeling and informed the project proponent about the incentives offered by MNES for such projects that can be availed by them[12]. This capital subsidy had enabled the project promoter to expect a financially attractive return from the project activity due to lesser debt component and was the driving factor behind the project proponent's plan of the implementation of the project activity. However this capital subsidy was

[9] Please refer to: http://www.wberc.net/wberc/regulation/under_2003_Act/regulation39/Regulation_39.PDF

[10] Reference: Letters from Nippon Power Limited to WBSEB reporting the various problems at various intervals

[11] Government of India, Ministry of Non-Conventional Energy Sources Power Group (Small Hydro Power Division) Circular dated November 11, 1993

unexpectedly replaced by an 'interest subsidy' for such projects[13]. Under the new policy of 'interest subsidy', the project proponent could no longer avail of capital subsidy from MNES and had to finance the entire project cost upfront by debt or internal accruals. Capital subsidy for any project provides upfront support and hence results in a relatively lower one time investment. On the other hand, an interest subsidy implies a higher one time investment and hence a greater burden has to be borne by the project proponent upfront. The subsidy element here comes into the picture only in the repayment phase, when the project is operational and revenue generation has already commenced. Considering the financial status of Nippon Power Limited, it was not possible to finance the project through internal accruals only and the project proponent was forced to investigate the mode of financing through loans. This clearly implied additional cash outflow as payments against interest on loans provided by agencies like Indian Renewable Energy Development Agency Ltd (IREDA) The amendment affected the viability of the project activity due to the unavailability of the capital subsidy and forced the project proponent to seriously reconsider its decision of the implementation of the project activity. This meant that the 3MW of power that would have otherwise been generated by the project activity would continue to be generated by the grid connected fossil-fuel fired thermal power plants, thus emitting GHGs. Thus, a financially more viable alternative of the project activity would have resulted in a higher emission of GHGs.

But in 2001-02, Nippon Power Limited decided to take up the implementation of the SHP project again with the consideration of CDM benefits to provide a cover against the shortfall in the project financing to make it feasible. Hence, the consideration of CDM revenues played a crucial part in the project proponent's decision to implement the SHP.

3. *Cost and time overrun:*

The project proponent faced cost overrun to the tune of one-third of the initially estimated total project cost. Several factors contributed to the cost overrun and delay (time overrun) in the project implementation, resulting in additional cash outflow from the project proponent in the form of interest during construction (IDC) to three times the amount originally estimated. This implicates further constrains on the already strained financial situation of the company. The factors contributing to the same are highlighted below:

- The cost estimate of construction and other materials initially determined by the project proponent received a major setback in 2002-03. The price escalation of the materials like cement, steel and other

[12] Letter from Alternate Hydro Energy Centre to Surya Domestic Appliances (former name of Nippon Power Limited) dated 11 July 1994

[13] Government of India, Ministry of Non-Conventional Energy Sources Power Group (Small Hydro Power Division) Circular dated October 23, 1998

construction materials resulted in the rise to the tune of 10% of the initially estimated total project cost forcing additional cash inflows for the project proponent.

- The construction activity for the project was delayed due to three landslides resulting from torrential rains in 2003, 2004, and 2006. Each landslide caused damages and the destroyed structures had to be reconstructed, resulting in delay of the construction of the project and further increment of the project costs. Hence Nippon Power Limited has not only incurred severe loses in terms of cash outflow due to the impact left behind by the landslides but also suffered from a time overrun in the reconstruction of the damaged parts which has delayed the commissioning and hence also the onset of revenue generation phase of the project activity.
- Initially WBSEB planned to construct a sub-station at Rammam that is just 4km away from the power-house site. But later WBSEB changed its plans and set up the proposed grid sub-station at Bijanbari that is 22km away from the power-house site. This increased the cost of the construction of transmission lines from INR. 25 lakhs to INR. 120 lakhs. The project promoter then had to negotiate with WBSEB to get partial funding for this enhanced cost of construction for the transmission line. Although WBSEB agreed to pay half of this increased amount, the resultant expenditure the project proponent had to bear to set up the transmission line increased from INR 25 lakhs to INR 60 lakhs. The project was delayed by a substantial period of around two years owing to this issue. .

In light of the above 3 barriers, it is evident that it would have made more financial sense not to implement the project activity in absence of CDM revenue, the result of which would lead to higher GHG emissions from the thermal dominated Eastern Regional Electricity Grid of India.

(b) Prevailing Practice Barrier:

The prevailing practice in the Indian Power sector is an inclination towards fossil fuel fired power generation activities. Compared to that, renewable energy source applications and especially SHP projects are not that preferable for institutions venturing into the power sector. This is because of the assured return on investments and easy financing options available for other ventures, compared to the SHP projects. Even though the operating cost is low for hydropower projects, getting finances for the project is difficult due to the risks associated with hydropower projects such as low plant load factor, irregular monsoons, uncertainty with regard to the availability of water in the canal, etc. This is evident from the following figures:

- Out of the 112683.47MW[14] of installed capacity of electrical energy generation in India, only 1905MW[15] is constituted by SHPs whose contribution is not even 2% of the total figure.
- In the state of West Bengal, the contribution of SHPs is only 98.04MW[16] which is again a meager 2% of the total 4700MW installed capacity of power generation.

(c) Other Barriers and Risks:

The project is also facing a number other barriers and risks in addition to the ones already explained above. These are explained below in detail.

1. *Barriers due to unstable local grid:*

The 33kV WBSEB state grid is unstable in the hilly regions of Darjeeling and it suffers from regular occurrences of line outages and frequency fluctuations and hence results in complete blackout of the entire area. The project proponent has been facing several problems associated with line outage of the local grid, which are highlighted below:

- This damages the equipment relays and causes terminal sparks in the various components and poses the threat of the breakdown of the power generating equipment
- This results in mechanical shocks to the power generating equipment like the turbines and generators, thus shortening their life.
- This reduces the efficiency of the power plant
- The plant remains in shut down mode during the restoration period of the transmission lines resulting in revenue loss of the generation during the same period

This is substantiated by the fact that during the first 11 months of operation of the plant, more than 70% of the days (Refer to the table below) have involved stoppages of the plant due to grid-related problems. Hence the project proponent faces the risk of potential damages to the major plant equipments as mentioned above and hence substantial amount of cash outflow due to the same. Moreover the project proponent has also been subjected to revenue loss due to stoppages in generation due to regular stoppages owing to problems with the local grid.

Plant stoppage due to problems with the grid

[14] Source: http://www.cea.nic.in/power_sec_reports/general_review/0304/chap-2.pdf
[15] Source: http://mnes.nic.in/annualreport/2006_2007_English/HTML/ch2_pg1.htm
[16] Source: http://mnes.nic.in/annualreport/2006_2007_English/HTML/ch3_pg7.htm

Month	No. of days of Plant Operation	No. of days of operation with stoppages	% of days with operational stoppages
May-07	31	26	83.87
Jun-07	-[17]	-	-
Jul-07	16[18]	13	81.25
Aug-07	30	29	96.67
Sep-07	30	27	90.00
Oct-07	31	18	58.06
Nov-07	30	18	60.00
Dec-07	31	19	61.29
Jan-08	31	16	51.61
Feb-08	19[18]	5	26.32
Mar-08	31	29	93.55
Total	**280**	**200**	**71.43**
Source: Statements of Generation of Nippon Power Limited			

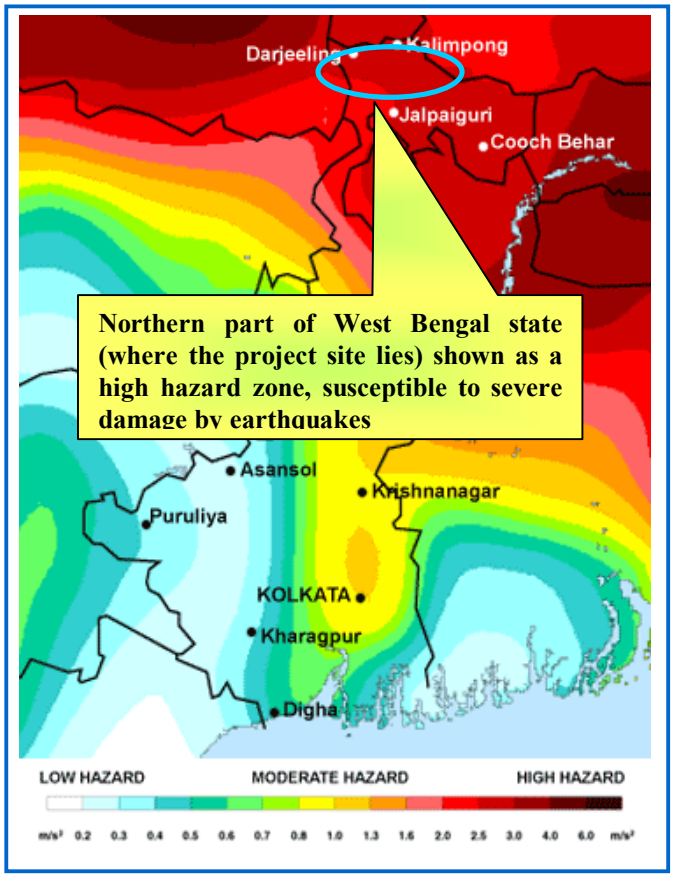
2. *Geological Risks:*

The Darjeeling district of West Bengal falls in the seismic zone IV as per the 2002 Bureau of Indian Standards (BIS)[19] map shown below. Furthermore, the project activity is in the close proximity of the highly hazardous earthquake prone zones of Nepal in the North West and Meghalaya and Assam in South-East. Thus the project activity is under a continuous risk of being exposed to potential damages that may be inflicted by earthquakes in the future.

[17] The plant was shutdown for a period of 45 days due to the damages caused due to a landslide

[18] The plant was shutdown for a period of 10 days due to problems in the Darjiling region

[19] Refer to: http://asc-india.org/seismi/seis-west-bengal.htm
and http://asc-india.org/maps/hazard/haz-west-bengal.htm



3. *Locational Barriers:*

The project activity is situated in a difficult and mountainous terrain. There are following barriers associated with the same:

- Topographical Barriers:

  The location of the plant is in a mountainous and rugged terrain and the plant is exposed to potentially dangerous landslides and flash floods striking the plant and damaging the equipment. There have been such occurrences in the past both during the construction as well as during operational phase[20] of the plant, which led to loss of properties and stoppage of plant operation. This has resulted in cost overrun during construction phase as well as revenue loss due to no generation from the power plant during the shut down period.

- Long lead time in procurement of spare parts:

[20] A landslide during June 2007 resulted in loss of properties and plant shutdown for a period of one and a half months

The absence of any engineering equipment vendor in the nearby locality leads to long lead time in procuring the replacement and disruption in plant operation in case of any equipment failure.

- Shortage of Skilled Manpower:

The plant suffers from shortage of skilled manpower due to its remote location. The project proponent is constantly facing problems both in retaining and recruiting skilled manpower at the plant location.

- Barrier due to inadequate infrastructure:

The project proponent has faced barriers due to inadequate roads in the project location. To overcome this barrier, they have constructed an approach road to make the remote location accessible and facilitate the construction as well as operation of the project activity. Further the poor telecommunications facilities posed problems during the construction phase and are currently a major barrier for day to day operation of the power plant.

- Substantial Transmission and Distribution Loss:

The plant is located 22km away from the nearest grid substation and hence the electricity has to be transmitted over long distances by 33kV lines. This results in a substantial transmission and distribution losses that have to be borne solely by the project proponent as the billing occurs as per the readings of the sub-station meter.

As discussed above, the project proponent had to face a number of investment, operational and locational barriers during project construction and operational phases leading to increased capital costs and time delay. To continue with the project activity and make it successful, the project proponent has to continuously incur expenses of continuous maintenance and overcome the hurdles posed by the remote location of the plant, more so if a natural calamity strikes. Thus, it is established that the project activity would not have occurred in the absence of the CDM revenue aid due to the associated investment risks and barriers faced by the project activity.

Hence the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The Methodology is applied in the context of the project activity in order to calculate the baseline emissions, project emissions, leakages and emission reductions as follows:

I. Baseline Emissions: According to the methodology,

"the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient measured in kg CO_2 equivalent/kWh. Two methods are provided for category I.D for estimating the emission coefficient 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 kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available."

Since the project activity affects both current and future generation mix of the grid, the project proponent opts to use Option a. - the average of 'operating margin' and the 'build margin', for estimating the emission coefficient of the electricity distribution system.

Emission Factor of the Grid (EF_y)

Electricity baseline emission factor of Eastern regional grid (EF_y) has been calculated by the Central Electric Authority (CEA) of India (Central Electric Authority: CO_2 Baseline Database, version 3.0 dated December 2007) as per the guidelines of 'Tool to calculate the emission factor for an electricity system'/ Version 01. The same emission factor for the grid has been used for calculation of emission reductions. For details please refer to Annex 3 of this document.

Baseline Emission Calculations

The Baseline Emission is calculated as,

$$BE_y = EG_y \times EF_{GRID} \text{ ..... (7)}$$

Where,

BE_y Baseline Emissions due to displacement of electricity during the year y (in tCO_2)

EG_y Net units of electricity substituted in the grid during the year y (in MWh)

EF_{GRID} Emission Factor of the grid (in tCO_2/ MWh) and y is any year within the crediting period of the

project activity

II. Project Emissions: The project activity is a run-of-river hydroelectric project. There are no anthropogenic emissions by sources of GHGs in the project boundary as a result of the project activity.

Hence,

$$PE_y = 0$$

Where,

PE_y Project emissions for the year y

III. Leakage Emissions: As per the methodology AMS-I.D./ Version 13, "*If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered*".

There are no anthropogenic emissions identified by sources outside the project boundary attributable to the project activity. Further, the project proponent confirms that the equipments used by the project activity are newly procured and hence not transferred from another project. Thus, there is no leakage calculations required for the project activity.

IV. Emission Reductions: The emission reductions of the project activity are calculated as the difference between the baseline emissions and the project emissions.

$$ER_y = BE_y - PE_y \quad \ldots\ldots\ldots \textbf{(8)}$$

Where,

ER_y emission reductions for the project activity in tonnes of CO_2e

BE_y Baseline emissions in tonnes of CO_2e

PE_y Project emissions in tonnes of CO_2e

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

Data/Parameter which is kept fixed for the entire crediting period.

Data / Parameter:	EF_{GRID}
Data unit:	tCO_2/ MWh
Description:	CO_2 emission factor of the grid
Source of data used:	CO_2 Baseline Database Version 3.0, Dated December 2007 (Combined Margin Emission Factor for Eastern Regional Grid) published by Central Electric Authority (CEA), India

Value applied:	1.03
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines of 'Tool to calculate the emission factor for an electricity system'/ Version 01.
Any comment:	Please refer Annex 3 of PDD for details.

B.6.3 Ex-ante calculation of emission reductions:

>>

The run off the river SHP set up by the project activity generates electricity and then exports the same to the grid after accounting for the minor auxiliary consumption. Also, some amount of electricity is lost as transmission and distribution loses by the time it reaches the nearest grid substation at Bijanbari. The following table shows the values of the electricity the project envisages generating and exporting.

EMISSION REDUCTION COMPUTATION (Year 1)			
Parameters	**Unit**	**Value**	**Remarks**
Power generation capacity	MW	3.00	Given
Auxiliary power consumption @1%	MW	0.03	Assumed
Transmission & Distribution Loss @9%	MW	0.27	Assumed
Net power generation	MW	2.70	Calculated
Plant Load Factor	%	60.00	Assumed
Annual electrical energy generated	MWh	14205.39	Calculated
Eastern Regional Grid Emission Factor	tCO_2/MWh	1.03	CEA Value
Emission Reductions	**tCO_2/annum**	**14629**	

EMISSION REDUCTION COMPUTATION (Years 2 - 10)			
Parameters	**Unit**	**Value**	**Remarks**
Power generation capacity	MW	4.50	Given
Auxiliary power consumption @1%	MW	0.05	Assumed
Transmission & Distribution Loss @9%	MW	0.40	Assumed
Net power generation	MW	4.05	Calculated
Plant Load Factor	%	50.00	Assumed
Annual electrical energy generated	MWh	17756.74	Calculated
Eastern Regional Grid Emission Factor	tCO_2/MWh	1.03	CEA Value
Emission Reductions	**tCO_2/annum**	**18286**	
Emission Reductions over 9 years	tCO_2	164573	

1. Estimation of GHG emission by sources within the project boundary:

Sl. No.	Operating Year	Emissions within project boundary (tonnes of CO_2 e)
1.	July 2008- June 2009	0
2.	July 2009- June 2010	0
3.	July 2010- June 2011	0
4.	July 2011- June 2012	0
5.	July 2012- June 2013	0
6.	July 2013- June 2014	0
7.	July 2014- June 2015	0
8.	July 2015- June 2016	0
9.	July 2016- June 2017	0
10.	July 2017- June 2018	0
Total		**0**

2. Estimation of Leakage:

As mentioned earlier, no leakage is associated with the project activity.

3. Estimation of Project Activity Emissions:

Now, Project Activity Emissions (1+2)

= GHG emissions by sources within the project boundary + Leakage emissions

Thus, the net project activity emissions during the crediting period are as follows:

Sl. No.	Operating Year	Project Emissions (tones of CO_2 e)
1.	July 2008-June 2009	0
2.	July 2009-June 2010	0
3.	July 2010-June 2011	0
4.	July 2011-June 2012	0
5.	July 2012-June 2013	0
6.	July 2013-June 2014	0
7.	July 2014-June 2015	0

8.	July 2015-June 2016	0
9.	July 2016-June 2017	0
10.	July 2017-June 2018	0
Total		**0**

4. Estimation of Baseline Emissions:

Sl. No.	Operating Year	Baseline Emissions (tones of CO_2 e)
1.	July 2008-June 2009	14,629
2.	July 2009-June 2010	18,286
3.	July 2010-June 2011	18,286
4.	July 2011-June 2012	18,286
5.	July 2012-June 2013	18,286
6.	July 2013-June 2014	18,286
7.	July 2014-June 2015	18,286
8.	July 2015-June 2016	18,286
9.	July 2016-June 2017	18,286
10.	July 2017-June 2018	18,286
Total		**179,202**

5. Estimation of emission reductions:

Difference between 4 and 3 representing project activity emission reductions:

Sl. No.	Operating Year	Emission Reductions (tones of CO_2 e)
1.	July 2008-June 2009	14,629
2.	July 2009-June 2010	18,286
3.	July 2010-June 2011	18,286
4.	July 2011-June 2012	18,286
5.	July 2012-June 2013	18,286
6.	July 2013-June 2014	18,286
7.	July 2014-June 2015	18,286

8.	July 2015-June 2016	18,286
9.	July 2016-June 2017	18,286
10.	July 2017-June 2018	18,286
Total		**179,202**

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

>>

Years	Estimation of project activity Emissions (tonnes of CO_2 e)	Estimation of baseline Emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions in tonnes of CO_2 e
July 2008-June 2009	0	14,629	0	14,629
July 2009-June 2010	0	18,286	0	18,286
July 2010-June 2011	0	18,286	0	18,286
July 2011-June 2012	0	18,286	0	18,286
July 2012-June 2013	0	18,286	0	18,286
July 2013-June 2014	0	18,286	0	18,286
July 2014-June 2015	0	18,286	0	18,286
July 2015-June 2016	0	18,286	0	18,286
July 2016-June 2017	0	18,286	0	18,286
July 2017-June 2018	0	18,286	0	18,286
Total (tones of CO_2 e)	**0**	**179,202**	**0**	**179,202**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	KWh
Description:	Power Exported to grid from the project activity
Source of data to be used:	Power Export Bills
Value of data	14.2×10^6 for year y = 1

	17.8 x 10^6 for years y = 2 to 10
Description of measurement methods and procedures to be applied:	The data will be recorded by a main meter at the West Bengal State Electricity Board (WBSEB) grid substation Bijanbari. The meter will be calibrated and maintained by WBSEB. Also there is a check meter at the grid substation to cross-check and verify the value. Records of sales bills will be used as evidence for power exported to WBSEB grid.
QA/QC procedures to be applied:	Energy meter used for measurement will be regularly calibrated.
Any comment:	Please refer Annex 3 of PDD for details.

B.7.2 Description of the monitoring plan:

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As per the Indicative simplified baseline and monitoring methodology AMS-I.D./ version 13,

"Monitoring shall consist of metering the electricity generated by the renewable technology"

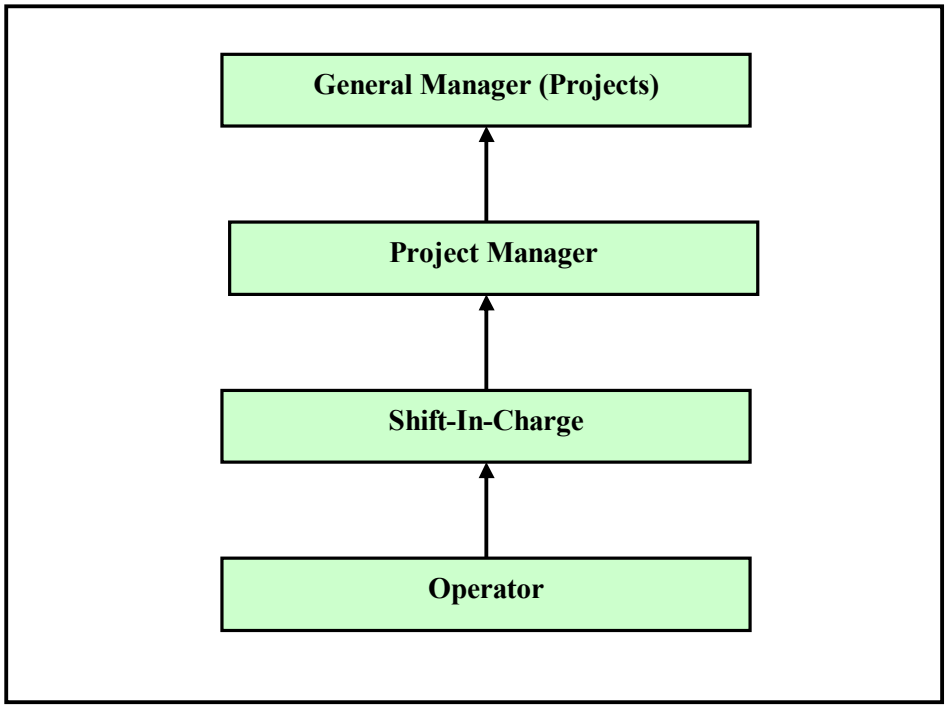
In addition please also mention the paragraph 13 of the monitoring section of I.D

Organization structure for data monitoring

The organization structure in the plant is as follows:

The Operator is concerned with the operation and maintenance of the equipment. The Electrical Engineer working as Shift-In-Charge is concerned with the recording of data in the plant log books from the meters installed in the plant and checking it for any anomalies. The data recorded by him is finally verified by the Project Manager. He then sends the data to the General Manager (Projects) in the Head Office.

The organization data structure of the plant is shown in the following flow-chart:



Refer to Annex 4: Monitoring Plan for details

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

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Date of completion of the application of the baseline and monitoring methodology: 27/04/2008

Name of person responsible: Nippon Power Limited (as outlined in Annex I of the PDD)

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

February 2002

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

>>

20 years 0 months

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

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

Not Applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/07/2008.

C.2.2.2. Length:

>>

10 years 0 months

SECTION D. Environmental impacts

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

>>

As per the Environmental Impact Assessment (EIA) Notification of the Ministry of Environment and Forests, Government of India[21], the river valley projects with investment of less than Rs. 500 million do not require EIA submission. The project cost in case of the project activity is Rs. 142 million and hence it is not required of the project proponent to get an EIA done. The project proponent however has got an EIA conducted and its report states about no adverse effects to the environment by the project activity. The report is available with the project proponent as and when required. The project has obtained the Consent to Establish (*i.e.* the No Objection Certificate) from the West Bengal Pollution Control Board. The scheme being run-of-the- river type, it will not adversely affect the ecological characteristics of the area. No human displacement is involved in the project as it does not involve any dam construction and hence no problem of resettlement is envisaged. Unlike a few other SHPs in hilly areas, the project activity does not involve clearance of forest land to erect the plant. The 2.5 km long penstock used by the project activity actually reduces some of the space the project activity would have been occupied for the setting up the plant. The hydro-electric scheme on the other hand will improve the socio-economic condition of the nearby locality. The project activity is thus completely eco-friendly and on the other hand will contribute towards the maintenance of the natural beauty of the region in which the hydro power scheme is situated.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

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Not Applicable

[21] Refer to http://envfor.nic.in/divisions/iass/notif/eia.htm

SECTION E. Stakeholders' comments

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

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For any project activity, stake-holders are identified as the people who are directly or indirectly affected by the project activity. Also in case of the run of the river SHP project on the Lodhama River, the stake-holders' opinions play a very crucial role in justifying the project proponent's initiative of harnessing the renewable sources of energy for power generation and at the other hand contributing to the sustainable development of the host country India. The project proponent Nippon Power Limited has identified the following stakeholders for the project activity.

- Elected body of representatives administering the local area (village *Panchayat*)
- Local clubs
- Equipment Suppliers
- West Bengal Renewable Energy Development Agency (WBREDA)
- West Bengal State Electricity Board (WBSEB)
- Indian Renewable Energy Development Agency (IREDA)
- Ministry of Non Conventional Energy Sources (MNES)

In order to impart a clear understanding of the project to the local stake-holders, NPL wrote a letter to the Village *Panchayat* (elected body of representatives administering the local area) explaining all the environmental, social, economic issues of the project. A local club was also approached by means of a letter written to them for their comments and its feedback was obtained. The project proponent

E.2. Summary of the comments received:

>>

NPL has received the following comments and feedback from the above mentioned stake-holders:

Serial No.	Stake-Holders Identified	Mode of Communication	Comments Received

Serial No.	Stake-Holders Identified	Mode of Communication	Comments Received
1	Elected body of representatives administering the local area (village *Panchayat*)	NPL wrote a letter to the village *Panchayat* informing them about the project and invited their comments and feedback on the project.	The local people acknowledged the contribution of the project towards the environment, social and economic well being of the region and appreciated the initiative undertaken by NPL for the well-being of the environment. Moreover they also expressed their thankfulness to the project proponent for generation of employment in the region and devising a solution to the power shortage and frequent power-cuts plaguing the area.
2	Local Club	NPL approached a local club through a letter written to them inviting their comments and feedback on the project undertaken by them.	The local club appreciated the contribution of NPL towards the sustainable development of the region and generation of employment in the region. They also expressed their gratitude to NPL for constructing a football stadium for them and sponsoring a football tournament.
3	West Bengal Pollution Control Board (WBPCB)	The details of the run of the river small hydro power plant were communicated to the WBPCB by NPL and requested for their consent on the same.	WBPCB found that the project activity complies with all the statutory requirements for such projects and is in the process of issuing a No–Objection Certificate (Consent to Establish)
4	Equipment Suppliers	The project proponent NPL approached the equipment suppliers of the project activity through a letter and	The equipment suppliers of the project activity acknowledged that the project activity will result in reduction of green house gases and fossil fuel conservation,

CDM – Executive Board

Serial No.	Stake-Holders Identified	Mode of Communication	Comments Received
		asked for their views and opinions on the matter	thus resulting in the sustainable development of the host country.

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

>>

Nippon Power Limited has received encouraging and positive feedbacks from the identified stake-holders as the project will neither cause any displacement of the local population nor will it affect the ecological characteristics of the area. Those comments along with other documents like the Detailed Project Report (DPR), environmental clearances, other clearances obtained from Governmental Organisations *etc.* were considered while preparing this CDM Project Design Document.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Nippon Power Ltd.
Street/P.O.Box:	10A, Jackson Lane,
Building:	
City:	Kolkata
State/Region:	West Bengal
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Country:	India
Telephone:	+91 33 2242 3325
FAX:	+91 33 22131725
E-Mail:	nipponpower@satyam.net.in
URL:	-
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Saraogi
Middle Name:	C
First Name:	P
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

THERE IS NO PUBLIC FUNDING FOR THE PROJECT ACTIVITY.

Annex 3

BASELINE INFORMATION

The baseline scenario for the project activity involves the generation of electricity by the grid connected fossil fuel fired thermal power plants, which would result in GHG emissions according to the carbon intensity of the grid. As per the small scale methodology AMS-I.D./ Version 13, baseline of the project activity is the electricity in kWh generated by the project activity multiplied by the emission factor of the Eastern Regional Grid in which it displaces the electricity generated by the majority of fossil fuel based units. The emission factor for the electricity displaced in the grid due to the project activity is calculated as per 'Tool to calculate the emission factor for an electricity system'/ Version 01. The emission factor will be determined for the grid to which the electricity generated by the project activity will be transmitted *i.e.,* the Eastern Regional Grid of India for baseline emission calculations over the proposed project activity's crediting period.

The net electricity exported to the grid sub-station by the project activity is the gross generation reduced by an amount equal to the sum of the auxiliary consumption and transmission & distribution loses in the small hydro power plant. The values of these parameters in are as follows:

CALCULATION OF ELECTRICITY EXPORTED TO THE GRID				
Parameters	**Unit**	**Value (Year 1)**	**Value (Years 2 to 10)**	**Remarks**
Power generation capacity	MW	3.00	4.50	Given
Auxiliary power consumption @1%	MW	0.03	0.05	Assumed
Transmission & Distribution Loss @9%	MW	0.27	0.40	Assumed
Net power generation	MW	2.70	4.05	Calculated
Plant Load Factor	%	60.00	50.00	Assumed
Annual electrical energy generated	MWh	14205.39	17756.74	Calculated
Eastern Regional Grid Emission Factor	tCO_2/MWh	1.03	1.03	CEA Value
Emission Reductions	**tCO_2/annum**	**14629**	**18286**	
Emission Reductions over 10 years	**tCO_2/annum**	**179202**		
Average Emission Reductions per annum	tCO_2/MWh	17920		

A) Choice of the grid that will be affected by the project activity

Indian power grid system (or the National Grid) is divided into five regional grids namely Northern, North Eastern, Eastern, Southern and Western Region Grids. These regional grids have independent state Load Dispatch Centres (LDCs) that manage the flow of power in their jurisdiction. Power generated by state owned generation units and private owned generation units is consumed by the respective states. The power

generated by central sector generation plants is shared by all states forming part of the grid in a fixed proportion. The Eastern Regional Grid consists of state grids of Bihar, Jharkhand, Orissa (GRIDCO), West Bengal, and Sikkim. The project activity under consideration is connected to the WBSEB which falls under Eastern Regional Grid network of India, in which majority of power is supplied by thermal power plants like coal and gas (please refer to Central Electric Authority (CEA) CO_2 Baseline Database[22], Version 3.0 Dated December 2007

Furthermore, the as per 'Tool to calculate the emission factor for an electricity system'/ Version 01;

"In large countries with layered dispatch systems (e.g. state/provincial/regional/national) the regional grid definition should be used. A state/provincial grid definition may indeed in many cases be too narrow given significant electricity trade among states/provinces that might be affected, directly or indirectly, by a CDM project activity."

Taking into consideration the points mentioned above (i.e. the relevant grid displaced by the project activity and the guidelines for selection of the appropriate grid in large countries with layered dispatch systems like India as given in 'Tool to calculate the emission factor for an electricity system'/ Version 01), the Eastern Regional Grid has been considered as the most representative system boundary (i.e. project electricity system) where an equivalent amount of electricity would be replaced by the implementation of the proposed project activity. The carbon intensity of the Eastern Regional Grid would be determined to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period.

B) Determination of the Carbon Intensity of the chosen Grid

Complete analysis of the system boundary's electricity generation mix has been carried out for calculating the emission factor of Eastern Regional Grid by Central Electric Authority (CEA) of India in its CO_2 Baseline Database Version 3.0 dated December 2007. The project proponent has used this analysis for computation of the grid emission factor. The combined margin grid emission factor computed from the above analysis is thus 1.03 for the Eastern Regional Electricity Grid of India. This value of the grid emission factor will be fixed for the crediting period of the project activity.

The Eastern Regional Grid emission factor (EF_y) is calculated as a combined margin (CM), as a weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) as described below:

Step-I: Calculation of CO_2 Operating Margin emission factor of Eastern Regional Grid ($EF_{OM,y}$)

[22] Available at: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Operating Margin emission factor of Eastern Regional Grid as an average of the 3-years' (*i.e.* 2004-2005, 2005-2006 and 2006-2007) Simple Operating Margin emission factor of the Eastern Regional Grid. The Simple Operating Margin emission factors are calculated following the guidance of 'Tool to calculate the emission factor for an electricity system'/ Version 01. The following table gives the CO_2 Operating Margin emission factor of Eastern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector/ Version 3.0 dated December 2007'.

Operating Margin Emission Factor of the Eastern Regional Electricity Grid of India					
Parameter	**Unit**	**Value**			**Comments**
Simple Operating Margin Emission Factor	tCO2/ MWh	**2004-05**	**2005-06**	**2006-07**	CEA CO_2 Baseline Database/ Version 3.0 dated December 2007 available at: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%2website.htm
		1.17	1.13	1.09	
Operating Margin Emission Factor	tCO2/ MWh	1.13			3-years' average

Step-II: Calculation of CO_2 Build Margin emission factor of Eastern Regional Grid ($EF_{BM,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Build Margin emission factor of Eastern Regional Grid for the year 2006-2007 following the guidance of 'Tool to calculate the emission factor for an electricity system'/ Version 01. The following table gives the CO_2 Build Margin emission factor of Eastern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated December 2007'.

Build Margin Emission Factor of the Eastern Regional Electricity Grid of India			
Parameter	**Unit**	**Value**	**Comments**
Build Margin Emission Factor	tCO2/MWh	0.93	CEA CO_2 Baseline Database/ Version 3.0 dated December 2007 available at: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step-III: Calculation of CO_2 emission factor of Eastern Regional Grid (EF_y)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 emission factor of Eastern Regional Grid following the guidance of 'Tool to calculate the emission factor for an electricity system'/ Version 01 as a weighted average of the Operating Margin emission factor and Build Margin

emission factor of the Eastern Regional Grid. The following table gives the CO_2 emission factor of the Eastern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated December 2007.

Data used for CO_2 Emission Factor of Eastern regional Grid		
Parameters	**Values (tonnes CO_2/MWh)**	**Remarks**
Operating Margin Emission Factor, $EF_{OM,y}$	1.13	Please refer to Step-I above.
Build Margin Emision Factor, $EF_{BM,y}$	0.93	Please refer to Step-II above.
CO_2 Emission Factor of Eastern Regional Grid, EF_y	1.03	Calculated

The CO_2 Emission Factor of Eastern Regional Grid has been calculated at the start of the crediting period and will remain fixed for the entire crediting period of 10 years.

Annex 4

MONITORING INFORMATION

The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (*i.e.* GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on technical/ efficiency/ performance parameters. It also allows scope for review, scrutiny and benchmarking of all these information against reports pertaining to M & V protocols.

The M&V Protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

Monitoring:

CDM stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity would reduce the carbon dioxide whereas an appropriate monitoring system would ensure this reduction is quantified and helps maintaining the required level.

Also a monitoring system brings about the flaws in the system if any are identified and opens up the opportunities for improvement.

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and Reporting

Frequency of Monitoring

Since the emission reduction units from the project activity would be determined by the electrical energy exported to the grid sub-station by the project activity, it becomes important for the project activity to monitor the amount of electricity exported. The data will be recorded by a main meter at the West Bengal State Electricity Board (WBSEB) grid substation and also with a check meter at the responsibility of the project proponent. The meter will be provided with a totaliser from which cumulative readings can be taken.

Reliability

As the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result:

- All measuring instruments will be calibrated by third party/ government agency once in a year for ensuring reliability of the system.
- The Standard Testing Laboratory (under Central/State Government) will verify the reliability of the meter readings; thereby ensuring the monitored results are highly reliable.

Registration and Reporting:

Registration of data would be in the plant log-books. Monthly reports would be prepared stating the relevant parameters.

The parameters to be monitored for the project activity will be archived in the plant's internal recording system (plant log books).

The project proponent will also maintain a GHG performance procedure on a regular basis. All the monitored parameters will be recorded for crediting period plus two years.

The electricity exported to the grid will be calculated in the following manner:

$E_{GEN,y} - E_{AUX,y} = EG_y + E_{T\&DLOSS,y}$

Where,

$E_{GEN,y}$	Gross electricity generated by the project activity in the year y
$E_{AUX,y}$	Auxiliary consumption by the project activity in the year y
EG_y	Electricity exported by the project activity to the grid substation in the year y
$E_{T\&DLOSS,y}$	Transmission & distribution loses in the year y

This is how the above mentioned parameters will be tracked in the run off the river small hydro power plant:

Data	Uncertainty level of Data (High/Medium/Low)	Are QA/QC procedures planned For these data?	Outline explanation why QA/QC procedures are or are not being planned.
Electricity Exported (EG_y)	Low	Yes	This data is required for the calculation of emission reductions. It will be recorded by: The Main Meters that will be maintained and calibrated by WBSEB and the check meters at the responsibility of the project proponents
Electricity Generated ($E_{GEN,y}$)	Low	Yes	This data can be obtained from the meters on the power generating equipment (turbines) that keep a record of the amount of electricity generated
Auxiliary Consumption ($E_{AUX,y}$)	Low	Yes	This data will be recorded at the meters in the plant that keep a record of the electricity required for it to function
Transmission & Distribution Loses ($E_{T\&DLOSS,y}$)	Low	Yes	This data can be calculated as the difference between the electricity leaving the power house and that recorded at the grid sub-station

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