Project design document form

(Version 11.0)

BASIC INFORMATION	
Title of the project activity	4.5MW grid-connected Sugur Mini Hydel Scheme at SLS Power Industries Ltd in Bellary District, Karnataka
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	04.1
Completion date of the PDD	21/11/2019
Project participants	M/s Bhoruka Power Corporation Limited
Host Party	India
Applied methodologies and standardized baselines	AMS-I.D. Version 18.0 - Grid connected renewable electricity generation Standardized baseline: Not Applicable
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources
Estimated amount of annual average GHG emission reductions	9806 tCO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project activity is generation of electricity using hydro potential available in Tungabhadra River and exporting the generated electricity to the state owned power utility company Karnataka Power Transmission Corporation Ltd. (KPTCL).

Tungabhadra is one of the major rivers in South India also one of the major tributaries of River Krishna. River Tungabhadra is formed by the union of Rivers Tunga & Bhadra originate in the Western Ghats in Chickmaglur district in Karnataka State at an elevation of 1,196m. River Tungabhadra flows for about 531 km in a generally northeasterly direction through Karnataka & Andhra Pradesh. It flows thorough Shimoga, Davanagere and Bellary Districts. From Tungabhadra dam two canals take-off one from left bank (Tungabhadra Left Bank Canal or TLBC) and the other from right bank (Tungabhadra Right Bank Canal or TRBC).

The site of the mini hydel scheme across Tungabhadra River is located about 2 km downstream of M. Sugur Village. The site can be reached by road from Bangalore via Bellary (NH13) and from there on with a deviation on State Highway leading to Siruguppa via Emmiganur to project site at M. Sugur Village. The project site is about 350 km from Bangalore.

Purpose of the project activity
The mini hydel scheme utilises the flows in Tungabhadra River and a Gross head of 6.1m available at the location of the project advantageous to generate power. The project activity exports electricity to INDIAN grid (erstwhile Southern grid) through Karnataka Power Transmission Corporation Ltd. (KPTCL), the local transmission utility. Total annual net generation from this project activity is estimated to be about 11,040 MWh.

The project falls under
Sectoral Scope: 01 - Energy industries (renewable / non-renewable sources)
Project Type: I - Renewable Energy Projects
Project Category: I.D. - Grid connected renewable electricity generation (Version 18, EB 81, Annex 24)[1]

Pre-project scenario: No Project Activity
The proposed project activity is a Greenfield project, which means no power generation facility existed at the project site in the pre-project scenario. In the pre-project scenario, this was an open hilly area. The electricity thus produced will be displacing the grid electricity which would have been otherwise generated through sources dominated by fossil fuel based power plants. The project activity thereby reduces the emission of greenhouse gases which would have been generated from such fossil fuel based power plants.

Baseline Scenario
The generated electricity by the project is planned to be supplied into INDIAN grid through Southern regional grid, which is dominated by fossil fuel-fired power plants, thereby precluding the emission of greenhouse gases (GHGs) that would resulted in the absence of this renewable energy-based power project activity. Hence, INDIAN grid has been considered for baseline emission calculations for the proposed project activity.

Technology
The project activity is a run-of-the-river hydroelectric project. The generating plant scheme comprises the following components:

[1] https://cdm.unfccc.int/filestorage/2/P/7/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC/EB81_repan24_AMS-I.D_ver18.pdf?t=aGp8cTE1eTNxfDDaX5X3AJBoT9lyYbX9m2ok

1. Strengthening of the existing anicut across river Tungabhadra about 2 km from Sugur Village
2. A power house with three TG units
3. A tailrace channel of 700 m length from the power house discharging back into the same river without any consumption

.Details of the technical description and parameters are mentioned in section A.3 of this document.

Emission Reductions from anthropogenic sources

The hydroelectric power generated from the project site will be displacing the electricity generated from thermal power stations feeding into regional grid (during power surplus time) and will be replacing the usage of diesel generators for meeting the power demand during shortage periods. Since hydro power is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic greenhouse gases (GHGs) emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The project activity is estimated to result in an annual average GHG emission reduction of 9,806 tCO_2e and a total of 68,642 tCO_2e during a crediting period of 7 years.

View of project participants about the project activity's contribution to sustainable development:

The main purpose of the project activity is to generate electrical energy through sustainable means without causing any negative impact on the environment and to contribute to climate change mitigation efforts. Apart from the generation of electrical power, the project also contributes to the following.

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

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects.

Social well-being:

The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.

Economic well-being**:**

The CDM project activity should bring in additional investment consistent with the needs of the people.

Environmental well-being:
This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.

Technological well-being:

The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewable sector or energy efficiency projects that are comparable to best practices in order to assist in up gradation of technological base.

Each of the above criteria is studied in the context of the project activity to ensure that the project activity contributes to the sustainable development and meets the above criteria.

Environmental well-being:

- The project utilizes environmentally safe and sound technologies of small-scale hydroelectric power generation and demonstrates harnessing of hydro potential thus encouraging setting up of similar projects.
- The project does not create any negative impact on the environment, as there is no submergence or stagnation of water.
- The project will not have any negative impact on public health scenario or natural resources of the region.
- The project activity reduces GHG emissions which would have taken place in the absence of the project due to generation of the similar proportion of electricity generated by the project from fossil fuel based generating stations.

Social well-being:

- The project involves no displacement of people living near the project area and hence no rehabilitation and resettlement.
- The project is implemented in a rural area that does not have proper roads and other infrastructure facilities. Project proponents had constructed a road for approach and other infrastructure facilities in the village as a part of the project construction.
- The project has led to direct and indirect employment for the local population as the construction and maintenance staff has been drawn from the nearby local areas.
- More and more rural industries will be set up and new opportunities for development will be created as a consequence to the hydroelectric project in the area. This will result in infrastructure development, which ultimately lead to the rural development and prevent the migration of rural poor to cities.
- The project may promote eco-tourism in due course.

Economic well-being:

- The project proponent has invested approximately INR. 551.637 Million in the project, which is a considerable additional investment in rural area, which would not have happened otherwise, in the absence of the project activity.
- The project activity leads to alleviation of poverty by generating direct and indirect employment during construction and operation of the CDM project. Mini Hydel scheme created direct employment opportunities totally for about more than 200 persons during the construction amounting to about 90,000 man-days. The project provides additional source of income for the local poor people by providing employment amounting to an investment of INR 90,00,000 during construction period as salaries / wages for construction workers, mostly rural poor people, which otherwise would not happen in the absence of the project. In addition, the project creates direct permanent employment for about 20 persons during operation of the plant. This translates into an investment of about INR.6,00,000 per year.
- The project will bring in additional investment to the region due to increased earnings of residents creating increased demand.

Technological well-being:

- The generation of electricity from the project leads to strengthening of the grid, increasing the energy availability and quality of power in the nearby rural areas thereby meeting the energy demand to a certain extent leading to technological well-being.
- The project makes use of efficient environmentally safe technology for power generation.

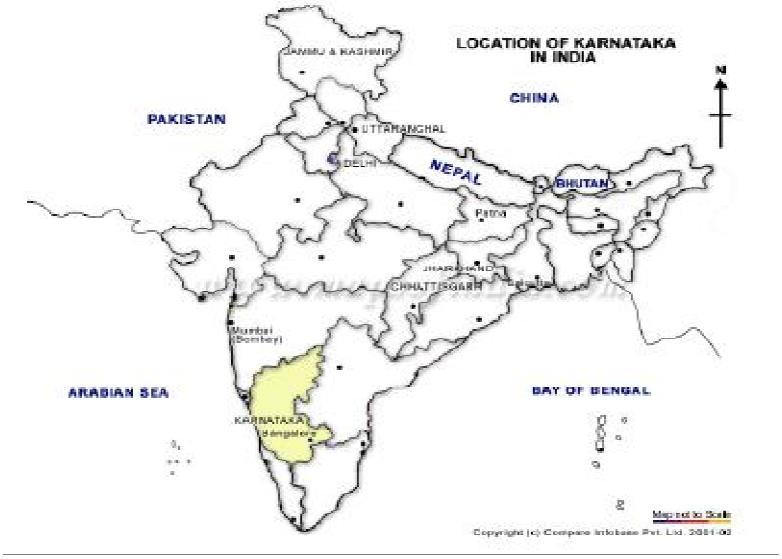
In view of the above, proposed project activity strongly contributes to the sustainable development.

A.2. Location of project activity

Project site location:

Village - M. Sugur
Taluka – Siruguppa
District – Bellary

The project site is located in M. Sugur village in Bellary district of Karnataka State. The project is commissioned on right side of Tunga Bhadra River 4 km after the Ullanaur Central Water Commission (CWC) gauging station. Total area of land acquired for the project is 11.85 acres of which 3.65 Acres is owned by BPCL and the remaining is leased from Government. The site is located about 2 km downstream of M. Sugur Village. The plant approximate co-ordinates are as follows 15°38'57"N & 76°52'58"E. The physical location of the Karnataka state in India and project site in Karnataka state is shown in the maps given below:



A.3. Technologies/measures

The project activity has three hydroelectric generating units of 1.5 MW capacities each. Based on the availability of water in the river the project proponents anticipated a net generation of 24.4

GWh[2] per year, which reflects a PLF of 61.9%. However, the actual PLF achieved during the year 2005-06 was only about 28% and the achieved generation was around 11,037.4 MWh. The GHGs emissions reductions calculations in this crediting period has also been done based on this generation data. (i.e. 11,037.4 MWh).

The project is established on the Right bank of Tunga Bhadra River. The daily flows where gauged and measured at Ullanur Central Water Commission (CWC) gauging station, about 3 to 4 km upstream of the project site. Based on the data available during the recent 10-year period, the daily flow in the river varies from an average monthly minimum of 15.17 m3/sec in May to a maximum of 786.5 m3/sec in August. The flows in the river are predominant during the months of July to November. The post monsoon flow during the months from December to May varies from 15 m^3/sec to 100 m3/sec. Also based on the flow data, it is seen that the flow exceeds 80m3/sec for 30% duration and 200 m3/sec for 12% duration in a year.

The existing anicut across the Tungabhadra River is utilised to divert the river flows for the power generation. The anicut is very old and leaking profusely. Leakage through body of anicut is visible at many locations. The crest level of the existing anicut is at EL 375.00m.

Based on the head water level at the intake to be maintained and the tailrace-rating curve (based on existing bed slope and cross section of Tungabhadra river about 0.7 km downstream of the power house), the gross head available for power generation has been worked out as 6.1 m.

The power potential studies shows, the power potential exceeds 17 MW for 10% duration, 4.5 MW for 31% duration and 2 MW for 67% duration in a year. Based on this study capacity of the power plant is decided as 4.5 MW which consists of three numbers of 1.5 MW TG sets (3x1.5 MW).

The total generation from three 3.3 kV generators of rating 1.5 MW each is stepped up to 33 kV by means of two numbers of transformers each of 6 MVA capacity. The generated power is evacuated from the powerhouse through a double circuit 33 kV transmission line approximately for a length of 25 km till the substation at Tekkalkota. There is a diesel generator, which is used at the time of construction and the present use of the same is negligible (since the project is run of river and not canal based) compared to the amount of CO_2 displacement of the project activity

The brief technical particulars of the project activity are given below in the table:

Hydrology

Design Flow	29 m^3/sec
Gross head	6.1metre
Net rated head	5.7 metre
Runner Diameter	3000 mm
Rate Speed	750 rpm

Energy

Expected annual gross generation	24.40 GWh
Expected net annual export	11.04 GWh
Generation voltage level	3.3kV
Grid interfacing voltage	33 kV

Plant Equipment

Hydro Turbine	Vertical Shaft Full Kaplan.
Rated Flow	32.2 m^3/sec
Rated Net Head	5.7 m
Rated Speed	132 RPM
Type of generator	Vertical Shaft Synchronous.

[2] As per DPR

No. of generating units	3 Nos.
Rated capacity of generating unit	1765 kVA
Power Factor	0.85 (lag)
Installed Capacity	4500 kW

Expected operational lifetime of the project is 30 years as per normal industry standard and specification by manufacturer. The present age of the project equipment is 15 years.

The detail of monitoring equipment's and their location in the systems have been provided under Section B.3 - Project boundary and B.7.1. & B.7.3. The technology used for the project activity is well established and available within the country hence, there is no transfer of technology involved. Also, there is no significant impact on air, water, and land due to the project activity. Thus, an environmentally safe technology is being employed for this project activity.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host Party)	Bhoruka Power Corporation Limited (Private entity)	No

A.5. Public funding of project activity

Total funding required for the project is around INR.310.0 Millions, which has been met through debt financing and equity capital. Debt portion, which is around 70% of the total investment, which has been funded by Andhra bank & Punjab National bank and does not include any public funding from Annex I countries. The equity capital was mobilised by the project proponents at their own risk out of their resources. Apart from the above, no other funding is involved.

Hence, the project proponents hereby confirm that public funding from parties included in Annex -I is not involved in the project activity.

A.6. History of project activity

(a) The proposed CDM project activity is registered as CDM project having UNFCCC reference number as UN 0921;
(b) The proposed CDM project activity is not a project activity that has been deregistered.
(c) The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA;

A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) doesn't exist in the same geographical location as the proposed CDM project activity

A.7. Debundling

According to Appendix C of Simplified Modalities & Procedures[3] for small-scale CDM project activities, „Debundling" is defined as the fragmentation of a large project activity into smaller parts.

The mini hydel power project is not a de-bundled component of a large project activity as the project proponents:

[3] https://cdm.unfccc.int/Reference/COPMOP/08a01_abbr.pdf

- Do not propose another Hydel power plant with higher capacity;
- Have not registered within the previous two years; and
- Project boundary is not within 1 km radius of any other proposed small-scale activity.
- Though the project participant propose another small scale hydro project at Sattegala, Karnataka it is about 350 km from this project

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The methodology followed will be AMS – I. D. Version 18, Approved methodology for small-scale projects under sectoral scope "Grid connected renewable electricity generation" which is the most appropriate for this Project and is listed as per the UNFCCC norms.

Title of the methodology: Grid connected renewable electricity generation
Reference: AMS-I.D. Version 18[4] EB 81, Annex 24

Project Type : Renewable energy project

Project category: AMS –I.D. Grid connected renewable electricity generation
(AMS I.D. Version 18)

Methodology AMS I.D. also refers to:-

Tool to calculate the emission factor for an electrical system EB 100, Version 07[5]

Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period EB 66, version 03.0.1[6]

Reference: Appendix B of simplified M&P for small scale project activities (UNFCCC, Recent norms)

B.2. Applicability of methodologies and standardized baselines

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project is categorized as Type I.D. Version 18, Scope 1; Grid connected renewable electricity generation. Category I.D. is applicable to projects generating electricity from renewable energy technologies and supplying the electricity to grid.

The project activity involves generation of grid connected electricity from a 4.5 MW hydro power project. The project activity has an installed capacity of 4.5 MW which will remain less than the maximum qualifying capacity of 15 MW for a small scale CDM project activity under Type-I of the small scale methodologies. The installed capacity will not increase throughout and even after the crediting period therefore the project activity will remain within the limit of small scale in each year of the crediting period. The project status is corresponding to the methodology AMS-I.D and applicability of methodology AMS-I.D are discussed below:

[4] https://cdm.unfccc.int/filestorage/2/P/7/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC/EB81_repan24_AMS-I.D_ver18.pdf?t=Z1B8cTIweWQwfDCwHiHZBIovuiYfmLkCSfDb

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

Applicability Criterion (with para no. reference)	Project case
1.This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid. (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The project activity is a Renewable Energy Project i.e. hydroelectric power project which falls under applicability criteria option 1 (a) i.e., "Supplying electricity to a national or a regional grid". Hence the project activity meets the given applicability criterion.
2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included in Table [7]	The project is installation of new hydroelectric energy based electricity generation plants (not addition to existing system). Option (a) is applicable.

[7]

	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

3, This methodology is applicable to project activities that (a) install a Greenfield plant (b) involve a capacity addition in (an) existing plant(s); (c) involve a retrofit[8] of (an) existing plant(s); or (d) involve a rehabilitation[9] of (an) existing plant(s)/unit(s); (e) involve replacement[10] of (an) existing plant(s).	The project is installation of Greenfield hydropower plant. Hence Option (a) is applicable.
4.Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; •The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The project activity is a run of river hydroelectric power project, hence no reservoir is required for this project activity; thus the criterion is not applicable to this project activity.
5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The project activity is a 4.5 MW hydroelectric energy based electricity generation. Generation facility does not involve using of co- fire fossil fuels. Hence the criterion is not applicable to the project activity.
6. Combined heat and power (co-generation) systems are not eligible under this category.	The Project activity is a small hydro power project and is not a combined heat and power system. Hence the criteria is not applicable to the project Activity

[8] Retrofit (or rehabilitation or refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level.

[9] Rehabilitation (or refurbishment) - is an investment to restore existing power plants/units that was severely damaged or destroyed due to foundation failure, excessive seepage, earthquake, liquefaction, or flood. The primary objective of rehabilitation or refurbishment is to restore the performances of the facilities. Rehabilitation may also lead to increase in efficiency, performance or power generation capacity of the power plants/units with/without adding new power plants/units

[10] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.

7. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[11] from the existing units.	The project activity is Greenfield and there is no existing power generation facility at the site. Hence the criteria is not applicable to the project activity
8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable, the hydro power project is a Green field project activity and this project activity does not involve any retrofit or replacement.
9. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	Not applicable, the project activity is a Greenfield hydro power project and does not involve any landfill gas, waste gas, waste water treatment or agro-industries projects.
10. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	Not applicable; the project activity is a Greenfield hydro power project and does not involve any use of biomass

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

B.3. Project boundary, sources and greenhouse gases (GHGs)

As per AMS-I.D Version 18, EB 81 - "*The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.*"

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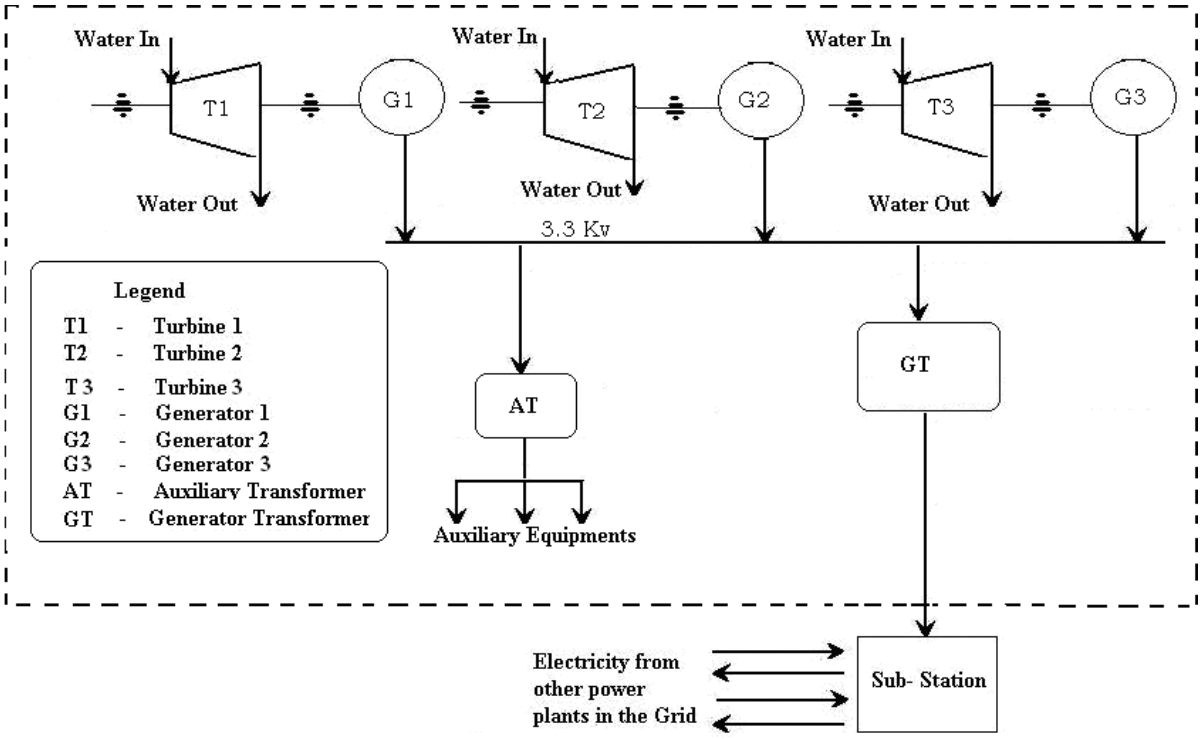
For the project activity under consideration, the project boundary considered encompasses the diversion structure, power canal, penstock, powerhouse, power evacuation system and tailrace canal. Details of the process diagram and major plant equipment details are furnished below:



Gases and Sources considered in the project activity:

The table provided below shows the gases and sources considered in the project activity

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_2O	No	Minor emission source
Project	For dry or flash steam geothermal power plants,	CO_2	No	Not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable.

Source		Gas	Included?	Justification/Explanation
	emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam			
	For binary geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable
		CH_4	No	Not applicable.
		N_2O	No	Not applicable.
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	CO_2	No	Not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable.
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable
		CH_4	No	Not applicable.
		N_2O	No	Not applicable
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable as this project activity is a run-of-the river hydro power project and does not include any reservoir.
		CH_4	No	Not applicable as this project activity is a run-of-the river hydro power project and does not include any reservoir
		N_2O	No	Not applicable as this project activity is a run-of-the river hydro power project and does not include any reservoir

B.4. Establishment and description of baseline scenario

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

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 278 to 291 of Project Standard version 02.0.

The tool stipulates the following steps to be carried out.

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

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

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

Step 1.2: Assess the impact of circumstances

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

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 344,002.39 MW as on 31.03.2018, consisting of 222,906.59 MW Thermal, 69,022.39 MW Renew and 6,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1[12] that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO_2 emissions in the country by increased use of renewable energy sources.

Furthermore, project participant has considered the latest available CO_2 Baseline Database (CEA database, version 14) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission. As per below table, the fossil fuel based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original.

Table 1: Sector- wise installed capacity (MW) as on 31/03/2018 (CEA Database version 14)[13]

Sector	Thermal				Nuclear	Hydro	RES	Total
	Coal	Gas	Diesel	Total				
State	64670.50	7078.95	363.93	72113.38	0.00	29858.00	2003.37	103974.75
Central	56955.00	7237.91	0.00	64192.91	6780.00	12041.42	1502.30	84516.63
Private	75546.00	10580.60	473.70	86600.30	0.00	3394.00	65516.72	155511.02
All India	197171.50	24897.46	837.63	222906.59	6780.00	45293.42	69022.39	344002.39

Thus current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period.

[12] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

[13] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

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

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. The project activity in green field project and there is no any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

This sub-step is applicable here because the baseline scenario identified at the validation of the project activity is the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

If the baseline scenario of the project activity is the continuation of use of the current equipment(s) without any investment and the projects proponents or third party (ies) will undertake an investment later, but before the end of a crediting period, then the current baseline needs to be updated for that crediting period or the crediting of emission reductions should be limited to the period before the baseline equipment would cease its operation.

Determination of remaining lifetime of the project activity is done by using "Tool to determine the remaining lifetime of equipment" version 01, EB 50, Annex 14 and option (a) is used here i.e. using manufacturer's information for the technical lifetime of equipment and compare to the date of first commissioning for the major equipment like turbine. Manufacturer of the hydro turbine of this project activity has certified that the present age of turbine is 15 (commissioned in December 2004) and it has another 20 years of remaining lifetime.

Step 1.4: Assessment of the validity of the data and parameters

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

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

Step 2: Update the current baseline and the data and parameters

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version of CEA database available at the time of PDD submission for renewal.

In line with the project standard version 02.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

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

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the existing laws. The Act consolidated the laws relating to generation,

transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy[14] on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

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

The state electricity regulatory commission issues tariff order in respect of procurement of power generated from small and mini hydro power plants and there is no mandatory national and/or sectoral policies have come into effect that would affect the compliance of the current baseline. Hence, it can be concluded the current baseline complies with all relevant mandatory national and/or sectoral policies that have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

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

The approved consolidated baseline methodology, AMS-I. D. (Version 18), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "*Tool to calculate the emission factor for an electricity system*" *(version 07.0)* has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

As per CEA database version 14, the fossil fuel dominated electricity is more than renewable sector and is continuing with same pattern. In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the Project Standard version 02.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario .Hence the baseline scenario as applied for the present project activity remains justified.

As per the approved consolidated methodology AMS-I. D Version 18

If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is 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 "TOOL07: Tool to calculate the emission factor for an electricity system".

[14] http://www.cercind.gov.in/Act-with-amendment.pdf

The project activity involved setting up of a small hydroelectric power generation plant to harness the kinetic energy of water resources to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the state grid (part of Indian grid), which is fed mainly by fossil fuel fired plants.

In the absence of the project activity, the equivalent amount of power would have been drawn from the state grid. Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 14 is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

The combined margin of the Indian grid used for the project activity is as follows

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.8885 tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) values, sourced from Baseline CO_2 Emission Database, Version 14.0, Dec 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9610 tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2015-16, 2016-17, 2017-18) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 14.0, Dec 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8644 tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 14.0, Dec 2018 published by Central Electricity Authority (CEA), Government of India

B.5. Demonstration of additionality

Evidence for CDM revenues in project planning

Construction of the Sugur Mini Hydel Scheme commenced in Jan 2004. Additional revenues under the CDM of Kyoto Protocol from sale of emissions reductions were considered during the p planning stage of the project. Events leading to the development of the project under CDM are furnished below, which will show that CDM revenues are considered before start of the construction activities of the project.

During negotiations on power purchase tariff with the state owned power utility company Karnataka Power Transmission Corporation Ltd. (KPTCL) for evacuation of the generated power to the KPTCL grid, project proponents had to agree in principle to share the benefits accruing on account of the carbon credits at the ratio 30:70 between the project proponents and the KPTCL. Subsequently, a Power Purchase Agreement was signed on 9th January 2004 for Sugur MHS

between the project proponent and KPTCL, which contains a clause on sharing of CDM revenues. Power Purchase Agreement will be provided for verification.

Approval and registration of the project as a CDM activity enable the project proponents to access additional revenues by selling CO2e emission reductions. It is estimated that the project would generate around 8,242 CERs per year. Assuming a sale price of 5Euros per CER, additional gross revenues from the sale of CERs account for EURO 41,212 or INR. 2.27 Millions per year. All the barriers described below are of perceived risks associated with the project activity and the additional revenue would only alleviate risk factors and act as margin money in the event of occurring any unexpected breakdowns. For instance, additional revenue could compensate financial losses arising out of lack of water resources for power generation or breakdown of the power canal due to silting or reduction of power purchase price by KPTCL etc.

Justification for additionality of the project:

UNFCCC simplified modalities seek to establish additionality of the project activity as per Attachment A to Appendix B, which listed various barriers, out of which, at least one barrier shall be identified due to which the project would not have occurred any way. Project participants identified the following barriers for the proposed project activity.

1. Other barriers

The project activity faces the following perceived risks and barriers that prevent project proponents investing in the proposed project activity if it were not registered under the CDM.

Hydrology risks. Uncertainty with respect to the availability of water in the river on which the proposed project is constructed is a major concern. Requirement / consumption of water for irrigation crops is not uniform. During the path of Tungabhadra River and upstream of the project site there are several branch canals which divert water for irrigation purposes in the region. In case irrigation pattern at the upstream side of the proposed project changes due to local pressures then the water availability at the project site for power generation will be affected. Though sufficient head is available for power generation, due to uncertainty in the hydrology as explained above, the power projections may not represent the true situation, which is a barrier for private investments.

Geology risks: There is a possibility of water carrying a lot of silt. This will block the flow of water into the channel and choke intake pipes. Hence, the project operation demands frequent periodical maintenance at a remote place to remove the accumulated silt, reducing the plant availability for power generation. This will damage the power channel, which in turn will effect power generation and unexpected plant outages. The project will generate power only during 5 to 6 months duration in a year. Any breakdown within this period will affect operation of the power plant and power generation, since bringing back the plant in operation may take considerable time during monsoon season.

Transmission risks. The nearest electrical sub-station of the KPTCL grid is at Tekkalkota which is located at a distance of 25km from the project site of Sugur Mini Hydel Scheme, which requires a long transmission system. The long distance and low transmission voltage level results in transmission and distribution losses. Further, long transmission system demands more attention for maintenance. This aspect makes a barrier for conceiving the small-scale hydroelectric project.

Lack of infrastructure: The area of the project of the mini hydel scheme is an underdeveloped area. No infrastructure such as roads, electricity, communication, transportation and proper civic amenities etc. are available. The project proponents developed these facilities before implementation of the project. This adds to the project cost and makes a burden for private investors in the hydroelectric sector.

Institutional barriers: Often government policies keep changing from time to time in the Karnataka state. As for instance before 2 years the power purchase price was at Rs.3.20 per kWh (in the year

2004-05) with 5% annual escalation. The same has been revised twice since then; even a legally valid power purchase agreement is in place. Now the price stands at Rs.2.90 per kWh with 2% annual escalation. This indicates inconsistency in government policies and no guarantee that the project receives the same tariff in future for the power fed to grid. This makes a significant barrier for the private sector investments in the power sector in the Karnataka state.

Another critical issue is that the project proponents have to back down the generation whenever required by the utility company, KPTCL. A clear clause is built into the Power Purchase Agreement to this effect. Accordingly, a significant risk is existing for the project activity that demands shut down of the project in situations such as an emergency, surplus power situation, off-peak duration etc. This risk is already felt recently by some of the power developers in Karnataka when KPTCL issued orders to some of the power plant operators to stop generating power due to low demand for power across the state at the time of grid synchronization of the project (at the end of financial year 2004-05). For seasonally operating small hydroelectric projects, risk associated with this PPA clause makes a significant barrier.

2. Prevailing practice

According to the annual report of Ministry of New and Renewable Energy (MNRE) (erstwhile MNES) 2000-01, India has an estimated small hydro potential of about 15,000 MW[15]. The total installed capacity (1423 MW) of small hydro projects is only 9.48 % of the total potential, which indicates that there exists some barrier due to which the potential could not be fully exploited.

The share of electricity from small hydroelectric projects in India‟s total installed capacity is very small. According to the latest statistics published by the Ministry of Power, the total installed capacity of small hydroelectric projects is 1,705 MW whereas the India's s total installed capacity is around 123,667[16] MW as on 31 December 2005. This translates into a very small share of 1.4% from small hydro sector.

As per the Annual report 2005-06 of Ministry of Power, the total installed capacity in Karnataka is 7,766 MW in which Small Hydro Project is 275 MW. The share of SHP (less than 25MW) is only 3.5% of the total installed capacity in the state.

As per published data in KREDL website

Progress of non-conventional energy power projects in Karnataka till 30.09.2005

Sl. No	Sector	Potential available	Projects allotted by Government		Projects commissioned	
			No	MW	No	MW
1	Wind	7000.00	295.00	4112.17	217.00	467.99
2	Small Hydro	1500.00	239.00	1398.80	44.00	252.94
3	Cogeneration	1000.00	46.00	815.10	15.00	293.80
4	Biomass	650.00	64.00	465.70	8.00	58.00
	Total	10150.00	644.00	6791.77	284.00	1072.73

From the above table it could be seen that though the potential to the tune of 1500 MW exists for small hydro projects in Karnataka only the capacity to the extent of 252.9 MW has been harnessed though the Govt of Karnataka has allotted 1398.8MW. This clearly indicates existence of barriers to harness the small hydro units as proposed by the project proponent.

[15] http://www.mnes.nic.in/annualreport/2001_2002_English/ch5_pg20.htm

[16] https://powermin.nic.in/sites/default/files/uploads/ar05_06.pdf

Annual Report 2005-06 of Ministry of Power, Govt. of India

Further the Independent Power Producers (IPP) instead opt for medium scale thermal units (based on coal/diesel/naptha/natural gas), because of the prevailing conditions in India which are conducive for setting up pro-conventional fuel based generating stations for the following reasons:

- Easy availability of coal/diesel/naptha/natural gas as a fuel
- Small gestation period of the plant.
- Less debatable as compared to storage type multipurpose hydropower projects.
- Ease of expansion of generating capacity.

In the light of above arguments under other barriers and prevailing practice barriers the project is not a business – as – usual project

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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As per the small-scale Methodology AMS-I.D. (Version 18.0) section 5.5 5.6:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows:

$$\mathbf{BE_y = EG_{PJ,y} \times EF_{grid,\,y}}$$

Where:

BE_y = Baseline emissions in year y (t CO_2/yr)

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

$EF_{grid,\,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

In case of Greenfield project activity, $EG_{PJ,\,y} = EG_{PJ,\,facility,y}$

Where $EG_{PJ,\,facility,\,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

The proposed project activity being a Greenfield project, $EG_{PJ,\,y} = EG_{PJ,\,facility,\,y}$

As per methodology, combined grid emission factor as per the "Tool to calculate the emission factor for an electricity system" version 07 is calculated as below:

CO_2 Baseline Database for the Indian Power Sector, Version 14, Dec 2018[17] published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4), following six steps have been followed:

(a) **Step 1:** Identify the relevant electricity systems;

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

(c) **Step 3:** Select a method to determine the operating margin (OM);

[17] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

(e) **Step 5:** Calculate the build margin (BM) emission factor;

(f) **Step 6:** Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

As described in tool "For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity systems". It also states that "If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used". Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern.

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO_2 Baseline Database. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Table: Geographical Scope of Indian Electricity 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	Telangana
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Puducherry
Rajasthan		Goa	Tripura	Lakshadweep
Uttar Pradesh				
Uttarakhand				

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

The Project Participant has chosen only grid power plants in the calculation.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2013-14	2014-15	2015-16	2016-17	2017-18
India	18.6%	16.8%	15.1%	14.6%	14.3%

The above data 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 the Indian grid is less than 50 % of the total generation. Thus the Average OM method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/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:

(a) **Ex-ante option:** if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

OR

(b) **Ex-post option:** if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

(c) PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PD to the DOE for validation.

(d) OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the crediting period.

(e)

(f) **Step 4: Calculate the operating margin emission factor ($EF_{grid,OMSimple,y}$) according to the selected method**

(g) The operating margin emission factor has been calculated using a 3 year data vintage:

(h)

Net Generation in Operating Margin (GWh) (incl. Imports)			
	2015-16	2016-17	2017-18

INDIAN Grid	8,71,753	9,16,278	9,60,693

(i)

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2015-16	**2016-17**	**2017-18**
INDIAN Grid	0.9655	0.9636	0.9543

(j)

Weighted Generation Operating Margin	
INDIAN Grid	**0.9610**

(k)

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

(m) As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 72:

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

(o) (a) **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 PD 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.

(p) (b) **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.

(q) Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

(r)

Build Margin (tCO_2/MWh) (not adjusted for imports)	
	2017-18
INDIAN Grid	**0.8644**

Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (t CO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (t CO_2/MWh)
W_{OM} = Weighting of operating margin emissions factor (per cent)
W_{BM} = Weighting of build margin emissions factor (per cent)

The following default values should be used for W_{OM} and W_{BM}:

As per para 86(b) of the methodological tool "Tool to calculate the emission factor for an electricity system" version 07.0, in case of hydro power project, the default values of W_{OM} and W_{BM} for second crediting period are as below:: W_{OM} = 0.25 and W_{BM} = 0.75 Therefore, $EF_{grid,CM,y}$ = 0.9610 * 0.25 + 0.8644 * 0.75 = 0.8885 tCO_2e

Project activity emissions

According to the chosen baseline methodology AMS-I.D. Version 18.0, for hydro power projects without reservoir project emissions are not considered. Moreover, there is a diesel generator, which is used at the time of construction and the present use of the same is negligible (since the project is run of river and not canal based) compared to the amount of CO2 displacement of the project activity. Hence, no project emissions are applicable to this project activity. PE_y = 0.

Leakage

According to AMS-I.D., Version 18.0, leakage emissions are considered only for biomass projects to quantify leakages pertaining to the use of biomass residues. As this project activity is a run-of-the river hydro power project, no leakage emissions are considered. LE_y = 0.

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{grd, CM, y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 grid Emission factor for the INDIAN electricity grid
Source of data	Calculated from CEA database, Version 14, Dec 2018[18]
Value(s) applied	0.8885
Choice of data or measurement methods and procedures	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 25% W_{BM}= Weighting of build margin emissions factor (%) = 75%
Purpose of data	To calculate baseline emissions
Additional comment	The data will be archived 2 years after the end of the crediting period or the last issuance of CERs.

Data/Parameter	$EF_{grd, OM, y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor for INDIAN electricity grid (weighted average of 3 years 2015-16, 2016-17 and 2017-18
Source of data	Calculated from CEA database, Version 14, Dec 2018[19]
Value(s) applied	0.9610
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2015-16, 2016-17 & 2017-18. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14,December 2018, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	To calculate baseline emissions
Additional comment	The data will be archived 2 years after the end of the crediting period or the last issuance of CERs.

Data/Parameter	$EF_{grd, BM, y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor of the INDIAN electricity grid
Source of data	Calculated from CEA database, Version 14, Dec 2018[20]
Value(s) applied	0.8644

[18] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

[19] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

[20] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2017-18. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 14, December 2018 published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	To calculate baseline emissions
Additional comment	The data will be archived 2 years after the end of the crediting period or the last issuance of CERs.

B.6.3. Ex ante calculation of emission reductions

Annual net estimated electricity supplied to grid by the project activity($EG_{PJ,y}$) = 11,037.6 MWh
Combined Emission Factor of CO_2 for INDIAN Grid = 0.8885 tCO_2/MWh
Therefore,

Baseline Emissions(BE_y) = 11,0437.6 MWh x 0.885 tCO_2/MWh = 9806 tCO_2
Project Emissions(PE_y) = 0 tCO_2
Emission Reductions (ER_y) = BE_y - PE_y
= 9806 – 0 = 9806 tCO_2/year

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2014-15	9806	0	0	9806
2015-16	9806	0	0	9806
2016-17	9806	0	0	9806
2017-18	9806	0	0	9806
2018-19	9806	0	0	9806
2019-20	9806	0	0	9806
2020-21	9806	0	0	9806
Total	68,642	0	0	68,642
Total number of crediting years	7			
Annual average over the crediting period	9806	0	0	9806

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{export, y}$
Data unit	kWh
Description	Electricity exported to the grid by the project
Source of data	Import Export Meters installed
Value(s) applied	----

Measurement methods and procedures	Measured and recorded using calibrated meters at the KPTCL substation
Monitoring frequency	Monthly
QA/QC procedures	The data will be recorded both at the project site as well as at the grid substation, which is under the control of KPTCL. The energy will be measured and recorded using calibrated meters at the KPTCL substation. Records of measurements will be used for verification of emissions reductions. Sales bills / receipts may be compared as an alternative proof of the power exported to the grid. The energy meters are being periodically calibrated and the calibration certificates are being maintained. The project proponents also have the provision of check meters which are also regularly calibrated whenever the main meter becomes faulty the check meter is used as reference for arriving at the energy generated data
Purpose of data	Monitored for baseline Emissions
Additional comment	The data will be archived 2 years after the end of the crediting period or the last issuance of CERs.

Data/Parameter	$EG_{import, y}$
Data unit	kWh
Description	Grid electricity import to the project activity during the year y
Source of data	Import Export Meters installed
Value(s) applied	---
Measurement methods and procedures	Measured and recorded using calibrated meters at the KPTCL substation
Monitoring frequency	Monthly
QA/QC procedures	The data will be recorded both at the project site as well as at the grid substation, which is under the control of KPTCL. The energy will be measured and recorded using calibrated meters at the KPTCL substation. Records of measurements will be used for verification of emissions reductions. Sales bills / receipts may be compared as an alternative proof of the power exported to the grid. The energy meters are being periodically calibrated and the calibration certificates are being maintained. The project proponents also have the provision of check meters which are also regularly calibrated whenever the main meter becomes faulty the check meter is used as reference for arriving at the energy generated data
Purpose of data	Monitored for baseline Emissions
Additional comment	The data will be archived 2 years after the end of the crediting period or the last issuance of CERs.

Data/Parameter	$EG_{PJ, y}$
Data unit	MWh
Description	Net electricity generation supplied to the grid by the project activity
Source of data	Joint Meter Readings
Value(s) applied	11,037.6
Measurement methods and procedures	The net electricity supplied to the grid is calculated as difference between the electricity exported to the grid and electricity imported from the grid to the project and adjusting transmission losses $EG_{y} = EG_{export,y} - EG_{imports,y} -$
Monitoring frequency	Monthly
QA/QC procedures	----
Purpose of data	To calculate baseline Emissions

Additional comment	-----

B.7.2. Sampling plan

No sampling is required for the project activity

B.7.3. Other elements of monitoring plan

The management structure proposed for monitoring of emissions and reductions due to the project activities mainly comprises a GHG audit team / committee appointed for the purpose. The committee will be authorised to perform various functions such as measuring, recording, storage of measured data and reporting to the project participants. The outcome of the committee will be monthly and annually GHG audit reports. The committee may also include outside experts. Whenever required external independent GHG auditors will be deputed for the monitoring activities. The Committee will review the data collected at regular intervals such as monthly and suggest corrective actions wherever required.

Detailed monitoring plan is given below.

Data Collection Procedures

Information flow including data generation and recording

Energy meters (Main and Check) installed at Switchyard near the plant to measure and monitor electricity exported to the grid and also electricity imported from the grid. Measurement of electricity exported / imported by these meters is on daily basis .It is carried out by the shift engineer/operator and recorded in the designated register at the power house.

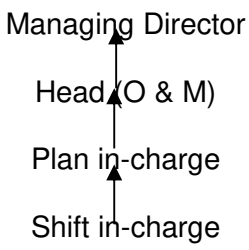
The monthly electricity generation is also recorded and certified jointly by the representatives of GESCOM, KPTCL and Bhoruka Power Limited on monthly (1st week of every month) basis. The joint meter readings will be presented in the form of Form-B. This Form-B will present net electricity export and import by each main and check meters.

Form-B, the log books and sales bills/receipts would be kept in hard copy format for 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data aggregating, calculation and reporting

The generation data will be aggregated annually based on monthly Form-B for calculation of the emission reductions and this will be reported to the Managing Director.

Organization structure (for monitoring of emission reductions)



Roles and responsibilities of the team

Managing Director

Managing Director is responsible for the total monitoring plan. The Managing Director will examine the reports generated by Head- O & M w.r.t; the monthly electricity exported to grid, electricity imported from grid and annual emission reduction calculations as per the monitoring plan. He also examines the internal audit reports prepared by Internal auditor / Head- O & M every six months once and will in particular take note of any deviations in data over the norms and monitor that the corrective actions have resulted in adherence to standards.

Head- O & M

Head- O & M is assisting and reporting to Managing Director for completing the task discussed above. The Head- O & M is responsible for the electricity generations at their individual locations. They will cross check, sign the log book regularly and report to Managing director for any abnormality. The calibration of the meters installed are taken care by him as per the monitoring plan.

Plant In charge

The plant in charge will examine the reports generated by Shift in charge w.r.t, the monthly electricity generated, exported and plant down times, if any etc. The monthly reports will be generated and submitted to the Head- O & M for verification and emission reduction calculations. The responsibility of storage and archiving of information in good condition also lies with the head- O& M. He also maintains internal audit reports and whenever necessary, will be submitted to Managing Director.

Shift In charges

Shift In charge is responsible for recording the electricity meter readings in the electricity main meter and check meter, monitor the equipment healthiness on daily basis. He will also responsible to take note of electricity exported to grid and Import from grid plant shut down times, if any etc.

Emergency procedures for the monitoring system

Fire hydrants and sand buckets are provided at important locations in the plant where there might be a situation leading to a fire hazard.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

4.5MW grid-connected Sugur Mini Hydel Scheme: 18/12/2004 (Generation Start date)

C.2. Expected operational lifetime of project activity

30y-0m

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period (second crediting period)

C.3.2. Start date of crediting period

Renewed start date of the crediting period: 24/03/2014 or the date of registration, which is later
Previous crediting period: 24/03/2007 – 23/03/2014

C.3.3. Duration of crediting period

7 years 00 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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As per the earlier notification of Ministry of Environment, Forest and Climate Change (erstwhile Ministry of Environment and Forests), Govt. of India, Environmental Impact Assessment is not required to be carried out for small hydro projects involving investment less than INR100 Crore. Since, the total project cost is only INR 31 Crore , the project does not call for an Environmental Impact Assessment. However, the project shall, prior to setting up, shall obtain clearance from Karnataka State Pollution Control Board (KSPCB).

According to the recent amendments of amendments to the notification by the Ministry of Environment, Forest and Climate Change regarding the requirement of EIA on 14/07/2018[21],

"The following projects or activities shall require prior environmental clearance from the concerned regulatory authority, which shall hereinafter referred to be as the Central Government in the Ministry of Environment and Forests for matters falling under Category 'A' in the Schedule and at State level the State Environment Impact Assessment Authority (SEIAA) for matters falling under Category 'B' in the said Schedule, before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity:

(i) All new projects or activities listed in the Schedule to this notification;
(ii) Expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, that is, projects or activities which cross the threshold limits given in the Schedule, after expansion or modernization;

Any change in product - mix in an existing manufacturing unit included in Schedule beyond the specified range."

As per this amended notification, hydro power projects of capacity 50 MW or more and the hydro power projects of capacity between 25 MW and 50 MW (river valley projects) falling in more than one state come under the scope of Environmental Impact Assessment.
This project activity has capacity of 4.5 MW, so this project does not need any Environmental Impact Assessment.

Further, the project participants already approached KSPCB and obtained clearance for setting up the project. Further, the project does not result in any negative impacts on the socio-economic environment of the region. Displacement of local populace, disturbance in the local eco systems, deforestation etc. are not involved. Though there is a diesel generator, which is used at the time of construction and the present use of the same, is negligible (since the project is run of river and not canal based) compared to the amount of CO_2 displacement of the project activity.

Hence, in conclusion, the project does not cause any impacts on the environment or socio-economic situation in the region.

D.2. Environmental impact assessment

The environmental impacts of the project activity are not considered to be significant by the project participant or the host party.

[21]EIA Notification 2018: http://www.egcipl.com/Doc/Gazzette%20Notification.pdf

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The local stakeholder comment invitation and compilation process involved is as follows:

The local stakeholders are immediately affected by the activities of the project. The effect is on the local environment, social life and economics. All the individuals and organizations falling in the above effects are perceived as stakeholders. They can be within the boundaries of the village, district, state or nation.

On deciding above criteria for qualification of the stakeholders, the idea was to decide most appropriate representatives who are covering above. During interaction of the corporate headquarter and the plant management, the stakeholders were identified as:

- Local Populace represented by the Village Panchayat
- Karnataka Renewable Energy Development Ltd. (KREDL)
- Karnataka Power Transmission Corporation Ltd. (KPTCL)
- Karnataka State Pollution Control Board (KPCB)
- Energy Department, Govt. of Karnataka

All the above identified stakeholders are statutory organizations / governing bodies and need to be consulted and personally approached with necessary documentation to seek their approvals / clearances / licenses before setting up any project. After scrutiny of the documentation, the stakeholders release their consent / licenses / approvals to the project participants.

The local populace is represented by the Village Panchayat, which is an elected body for administration of the village. Clearance from the concerned Village Panchayat in the form of “No Objection Certificate” is mandatory for any project before starting implementation. For this purpose, the project proponents need to conduct a meeting within the village with the Village Panchayat together with the villagers. If the villagers satisfy the project participants submission, the Village Panchayat issues “No Objection Certificate”.

The project participant invited the local populace along with the other stakeholders through public notice by Village Panchayet in various places (markets, schools, Panchayet office, post office etc.) of the project site village mentioning the date, venue and purpose of the meeting, in case of other stakeholders (government nodal agencies), invitation was sent through mail by the project participant informing the date, venue and purpose of the meeting. In the meeting detailed information was communicated to all the stakeholders and their views of the project were noted. Meeting took place the premises adjacent to village panchayet office.

The representatives from project participants explained details of the project and its purpose of the project along with the information how it would lead sustainable development in the region.

. No negative comments are received from them. Necessary clearances / approvals are already released in favour of the project.

Village Panchayat issued No-Objection Certificate to set up the project. In fact, the local populace is welcoming the project due to various benefits like development of infrastructure in the area and improvement in socio-economic standards due to the project activity.

KREDL is the policy implementation body in respect of renewable energy projects in the Karnataka State. KREDL reviewed the project documentation about the legal, financial, economical and environmental feasibility and accorded clearance for utilising renewable energy sources. Energy Department, Govt. of Karnataka also endorsed the project for implementation.

KSPCB has prescribed standards of environmental compliance and monitors the adherence to the standards and has issued consent to establish the project.

KPTCL will give clearance for evacuation and feeding of power to the grid. This will be through proper Power Purchase Agreement. The company had extensive discussions with KPTCL and signed the Power Purchase Agreement.

Purchase / lease of government and private land:

The Village Panchayat, which is an elected body for administration of the village. The local stakeholders have been consulted by calling the meeting of all villagers (known as village panchayat – headed by elected governing council). They were apprised about the project allotment and planned activities for the implementation of the project. Also it was made sure that none of the villagers have become land-less

E.2. Summary of comments received

There was no comments from the stakeholders.

E.3. Consideration of comments received

In view of various direct and indirect benefits (social, economical, environmental), no concerns were raised during the consultation with stakeholders, hence it is not required to take due account of the comments.

SECTION F. Approval and authorization

The letter of approval from the party involved in the project activity has been submitted.

Appendix 1. Contact information of project participants

Organization name	Bhoruka Power Corporation Limited
Country	India
Address	#48, Lavelle Road, Bangalore – 560001, Karnataka, India
Telephone	+91 80 22272271
Fax	+91 80 22245246
E-mail	sekhar@bhorukapower.com
Website	
Contact person	Mr. S Chandrasekhar

Appendix 2. Affirmation regarding public funding

No Public Funding is available to the project.

Appendix 3. Applicability of methodologies and standardized baselines

Applicability of the methodology has been explained in section B.2.

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

The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the Combined Margin emission factor for the Indian grid, the details of which are available on the following website.
http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

The procedures and formulas used for estimation of the baseline factor and the assumptions made have also been detailed in there

Appendix 5. Further background information on monitoring plan

The monitoring plan has been already explained in section B.7. Furthermore all the responsibilities and procedures related to monitoring of emission reductions in the CDM project activity are outlined.

Appendix 6. Summary report of comments received from local stakeholders

No negative comments received from local stakeholders. Please refer section E of the PDD.

Appendix 7. Summary of post-registration changes

No post-registration changes has been done to this project activity

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.

Version	*Date*	*Description*
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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