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:

Karikkayam Hydro Power Project in Kerela, India

Version 01

Date: 12/05/2008

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

The proposed project activity involves setting up of a 15 megawatt (MW) run-of –the river hydro power generating plant by Ayyappa Hydro Power Limited (AHPL), a wholly owned subsidiary of Energy Development Company Limited (EDCL). The clean power generated from this proposed project activity will be exported to Kerela State Electricity Board (KSEB) grid (part of Southern Regional grid[1]) of India. The proposed project activity will thus aid in displacing an equivalent amount of electricity generation from fossil fuel based thermal power plants feeding to the grid leading to reduction in greenhouse gas (GHG) emissions.

The proposed project activity will primarily consist of construction of a 26.55 meter high diversion weir] across river Kakkad and a dam-toe power house with an installed capacity of 15 MW (3 x 5 MW) on the left bank of the river. Under the proposed project activity, a concrete diversion weir with gates will be constructed across upstream of the Kakkad river basin at Chittar Village in the Panthanamthitta district of Kerala. The diverted water will be led through intake structure and finally dropped to 3 individual penstocks to three independent turbo generating sets of 5 MW to generate power. Power thus generated from the proposed Karikkayam Hydro Power Project will be stepped up from 11 kV to 110 kV and the energy generated will be evacuated to KSEB grid via a 110 kV loop-in loop-out line formed by diverting Kakkad-Maniyar- Panthanamthitta 110 kV existing line. Around 71.67 million kilo watt-hour (MkWh) of electrical energy is expected to be annually generated under the proposed project activity and around 67.06 MkWh is expected to be fed to the Southern Regional Electricity grid after taking into account the auxiliary consumption of the power plant, the transformation and outage losses[2].

[1] From the view point of electricity generation, India is demarcated into five regions viz. Northern Region, Western Region, Southern Region, Eastern Region and North-Eastern Region. The southern region comprises of Andhra Pradesh ,Karnataka, Kerala, Tamil Nadu, Pondicherry, Lakshadweep

[2] There is no transmission loss for the proposed project activity.

The proposed project activity will contribute to sustainable development of India in the following ways:

Social well-being: It will provide additional employment during construction and operational phases of the project activity which will help in the upliftment of economic standards of the local populace. The project proponent will also develop approach roads, communication facilities, housing and other infrastructure for the proposed project activity which will lead to an overall infrastructure development in the remote area.

Economic well-being: The proposed project activity will lead to creation of business opportunities for local stakeholders such as bankers, consultants, suppliers, manufacturers and contractors. It will also help in infrastructure development that would bear related long-term economic benefits for the local population.

Technological well-being: The proposed project activity will generate power using an environment friendly technology. Its success would encourage other private entrepreneurs of Kerala to venture into the business of hydro power generation as independent power producers (IPPs). Moreover, it will also help 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 proposed project activity will generate electricity using hydro power potential which would otherwise be generated by the grid as per the grid mix. Being a renewable resource, using hydel energy to generate electricity will contribute to conservation of natural resources and also avoidance of greenhouse gas emissions associated with the combustion of fossil fuel. Unlike most fossil fuel based thermal power plants, hydro power projects produce no end products in the form of solid waste (ash *etc*), thereby contributing to environmental sustainability.

A.3. Project participants:

Name of the 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	Ayyappa Hydro Power Limited (Private Entity)	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):

India

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

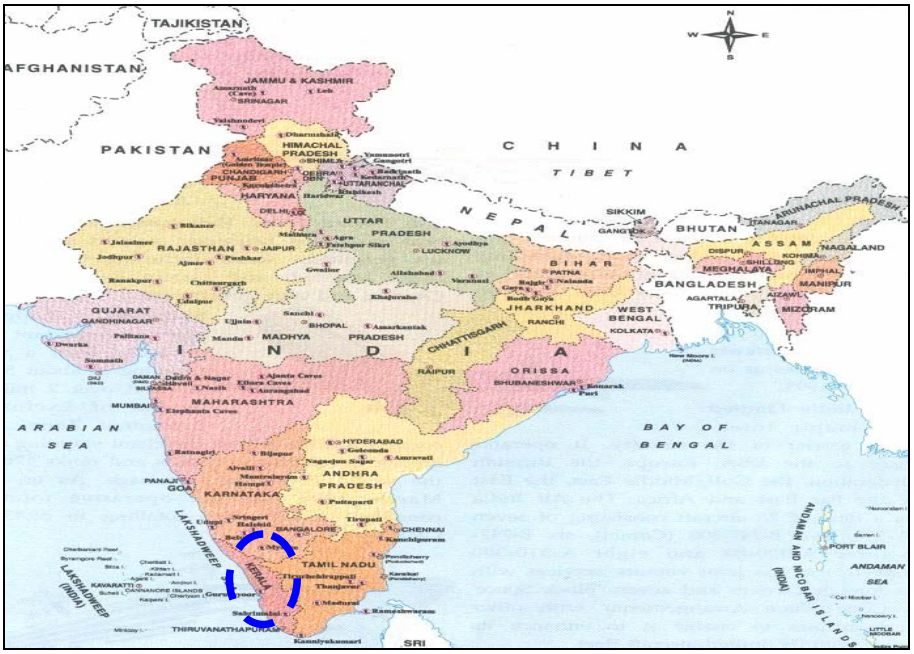
Kerela

A.4.1.3. City/Town/Community etc:

Village:Chittar Panchayat , Taluka: Ranni, District :Pathanamthitta , State- Kerala

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

Karikkayam Small Hydro Project is located in Chittar Panchayat of Ranni Taluka, Pathanamthitta District in the State of Kerala in the Southern India. The geographical coordinates of the project activity are Latitude-9^0 20'North and Longitude-76^0 56' East. The Karikkayam Project site is about from 23 kms from Pathanamthitta town. The nearest railway station is at Tiruvanathapuram, about 110 kms by road from Karikkayam. The nearest airport as well as seaport is located at Kochi which is 175 km away from Pathanamthitta. The physical location of the project activity is shown in figure given below:



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

According to the categorization of Appendix B to the simplified modalities and procedures for small scale CDM project activities (http://cdm.unfccc.int/methodologies/SSCmethodologies) the project activity fits the type and category as specified below:

Type: *Type I – Renewable Energy Projects*

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

Technology:

The technology for the project activity involves the installation of a run-of-the-river small hydroelectric power plant.

The different components of the hydro power plant will be:

- Diversion Structure
- Intake
- Penstocks
- Powerhouse

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- Interconnection point with grid

The diversion structure will consist of concrete gravity weir of height 26.65 meters gated spillway opening of 36 meters and normal bed level of 27.35 meters with a maximum flood discharge capacity of 1160 cumecs (m^3/s) of water. There will be 11 blocks with one core wall each on either bank of the river Kakkad. There will be three intake gate vent of size 4 x 4 meters and three penstocks of 4 meters diameter each and a thickness of 14 millimeter with a discharge capacity of 31.74 m^3/sec. The water will then be then guided through a penstock gate and jetted into the turbine which will in turn rotate the turbine. The turbine will be horizontal shaft, axial flow S type full Kaplan tubular turbines. There will be three such turbines with a capacity of 5 MW each. The power house will be of surface type with a design head of 18.74 meters, width of 22.78 meters and height of 23.96 meters. The rotation of the turbine will rotate the generator connected to the turbine which in turn will produce electricity. The water will then be evacuated through the tail race having a minimum water level of 29 meters directly to the river.

Power House:

The electricity after meeting the in-house auxiliary consumption of the power plant will be stepped up from 11 kV to 110 kV and evacuated to KSEB grid via a 110 kV loop in loopout line formed by diverting Kakkad-Maniyar- Panthanamthitta 110 kV existing line.

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

Years	Estimation of annual emission reductions in tonnes of CO_2 e
January 2009- December 2009	57005
January 2010- December 2010	57005
January 2011- December 2011	57005
January 2012- December 2012	57005
January 2013- December 2013	57005
January 2014- December 2014	57005
January 2015- December 2015	57005
January 2016- December 2016	57005
January 2017- December 2017	57005
January 2018- December 2018	57005
Total estimated reductions CO_2 e	**570050**
Total number of crediting years	**10**

Annual average of the estimated reductions over the crediting period (tCO_2e)	57005

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

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 defines 'debundling' as 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.

AHPL has not implemented any other project activity, which falls under 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. No such project activity, proposed by AHPL with the same project category and technology/ measure and whose boundary is within 1 km of the project boundary of the small-scale project activity under consideration at its closest point, is registered in the last two years.

With the above explanation, it can be concluded that the small-scale project activity of AHPL is not a debundled component of a large project activity. Therefore the project activity under consideration is eligible to make use of "*Appendix B of the simplified modalities and procedures for small-scale CDM project activities"* for the determination of emission reductions resulting from the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Title of Approved Baseline Methodology: 'Grid Connected Renewable Electricity Generation'

Reference of the Approved Baseline Methodology: Category I.D - Renewable Energy Projects – Version 13 of AMS –I.D., Sectoral Scope 1, EB 36 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:

As per the provisions of Paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21], "to use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall[3]":

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][4] ;

Type I: Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent)

The proposed project activity involves setting up a run-of –the –river hydro power plant with an installed capacity of 15 MW and therefore conforms to the Type I category for small scale project activities.

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

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

[3] *Extract of paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities*

[4] *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;

Technology/Measure as per AMS I.D	Measure of the project activity	Whether applicable in the context of the proposed project activity.
"This category comprises renewable energy generation units such as photovoltaics, hydro, tidal/wave, wind, geothermal and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit."	The proposed project activity is a renewable energy generation unit which will utilize the hydro power generation potential of river Kakkad in Kerala. The generated energy is supplied to Kerela State Electricity Board (KSEB) grid (part of Southern Regional grid) of India which is dominated by fossil fuel thermal plants. In Southern Regional Grid around 55 %[5] of power is supplied by thermal power plants like coal and gas. (The power generated by the project activity helps in displacing electricity that would have been supplied by the thermal power plants connected to the grid	YES
"The capacity of the entire unit shall not exceed 15 MW".	The proposed project activity will involve setting up of a 15 megawatt (MW) run –of- the- river hydro electric project to export clean power to the Southern Electricity Grid.	YES
"Combined heat and power (co-generation) systems are not eligible under this category."	Not Applicable.	NO
"In the case of project activities that involve the addition of renewable energy generation units at an	The proposed project activity is a greenfield project which involves setting up of a run of the river hydro	NO

[5] Central Electric Authority (CEA) CO_2 Baseline Database, Version 2.0, June 2007(http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf)

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."	power plant across the river Kakkad with an installed capacity of 15 MW. Since the proposed activity does not include any capacity additions, this condition is not applicable.	
"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 proposed project activity is a greenfield project.	NO

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

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 [FCCC/CP/2002/7/Add.3, English, Page 21]. The justification of the same has been provided in Section A.4.5

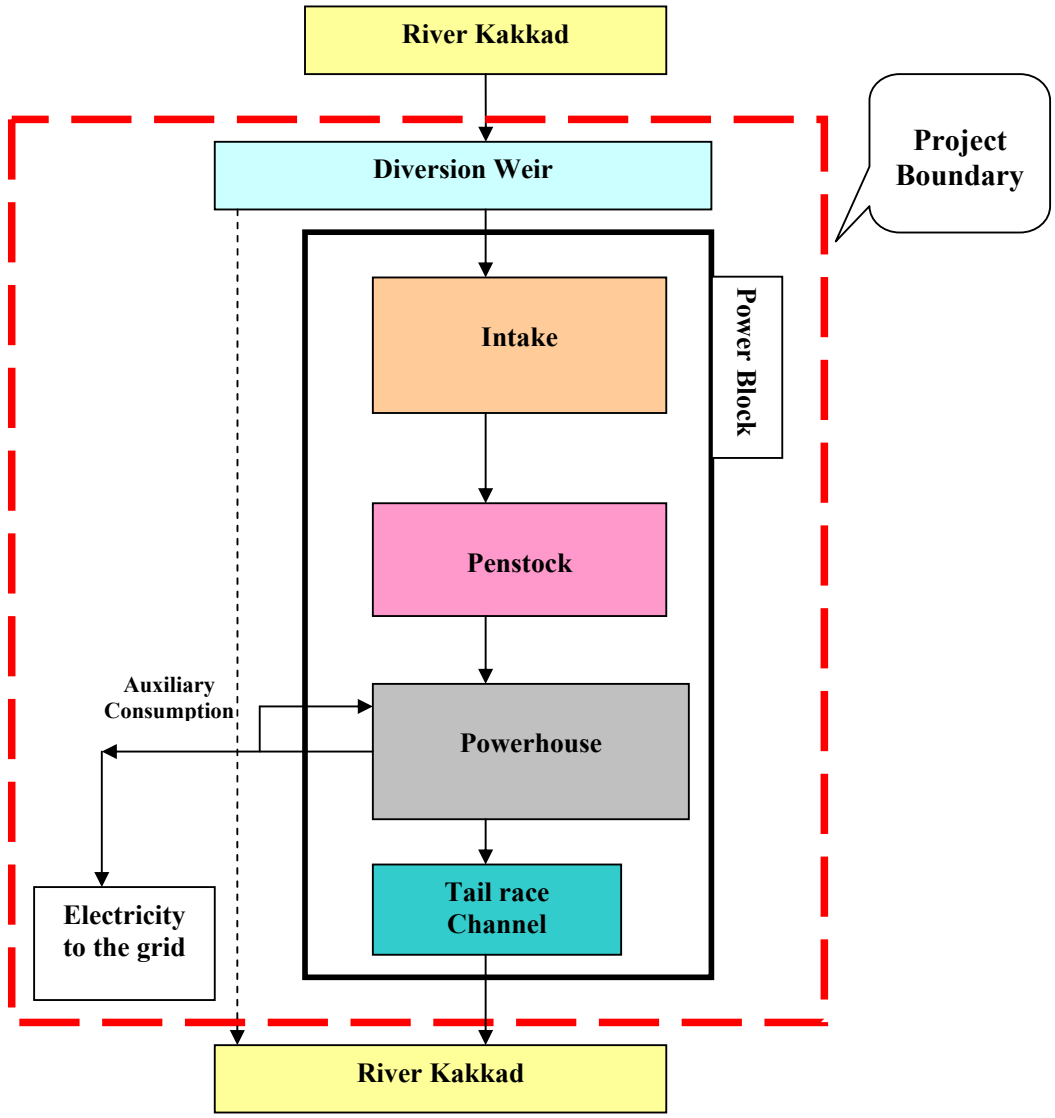
Therefore the project activity meets the 'Small Scale CDM Project Activities' applicability criteria. The justification for the proposed project activity is given as below:

B.3. Description of the project boundary:

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 proposed project activity, the project boundary will consist of the diversion weir, intake structure , penstock, power generation house, tail race canal and the power evacuation system up to the

grid substation. Further, for the purpose of estimation of baseline emissions, the Southern Regional Grid of India has been considered within the system boundary.



B.4. Description of baseline and its development:

According to paragraph 9 of the small scale methodology AMS I.D, the baseline of the proposed 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. .

As per paragraph 9 under Category I.D. in Appendix B of the Simplified M&P for small scale CDM project activities (Version 13 : EB 36), *the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2equ/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.

The proposed project activity will displace an equivalent amount of electricity that would have been drawn from the Southern Regional grid generation-mix. Since the displaced electricity generation is the element that is likely to affect both the operating margin in the short run and the build margin in the long run, electricity baselines should reflect a combination of these effects. Therefore an ideal baseline approach is envisaged as the one that combines both Operating and Build Margin as prescribed in first alternative given in paragraph 9 under Category I. D of the UNFCCC M&P for small scale projects. In case of the proposed project activity, a combined margin (CM) emission factor, calculated according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system", has been used for arriving at the baseline. 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_{grid}	Electricity baseline emission factor	Calculated as per the "Tool to calculate the emission factor for an electricity system". This is calculated ex-ante and kept constant for the entire crediting period.
2	EG_y	Net electrical energy exported to grid	Plant records maintained by AHPL

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. The Appendix B of the simplified M&P for small-scale CDM project activities' of the UNFCCC requires the project proponent to determine the additionality of the project activity as per the guidance provided in Attachment A to Appendix B. The additionality of the proposed project activity has been elucidated below:

Investment Additionality

The Karikkayam Hydro Electric project activity originally belonged to Travancore Electro Chemical Industries Limited (TECIL). TECIL suffered heavy losses due to labor unrest and some other factors owing to which the company was in a financial mess. All work related to the Karikkayam Hydro Electric project was stowed.

It was at this juncture that AHPL took over the project activity. During that point in time, TECIL was termed as a "sick"[6] industry by Board for Industrial and Financial Reconstruction (BIFR). AHPL took over the project activity after repaying to TECIL amounting to INR 170 millions to clear its debts. The Karikkayam hydro electric project was taken over by AHPL which was inturn to be taken up by EDCL (Energy Development Company Limited). The Karikkayam hydro electric project activity was not a economically viable option for EDCL[7].

The project proponent conducted an investment analysis of the project activity with the pay back period as the financial indicator. 'Pay back period' is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions.

The pay back period for the project activity was calculated and compared it with the company's internal benchmark for similar kind of project activities.

During the time of takeover it was found that the pay back for the project activity was 14 years which was too high considering other similar hydro projects taken up the group. All assumptions pertaining to the calculation of the pay back period is tabulated as below:

S. No.	Parameters	Unit	Value
	PLANT CAPACITY & CAPITAL COST		
1.	Capacity (MW)	MW	15.00
2.	Capital Cost (in Rs. Million)	Rs. Million	859.36
3.	Interest During Construction + Finance charges	Rs. Million	93.23
4.	Capital Cost with IDC (in Rs. Million)	Rs. Million	952.59
5.	Interest Rate on loan / Working Capital from financial institution (%)	%	10.00
6.	Loan Repayment Period in years (1+9)	Years	7.00
7.	Equity Portion (%)	%	30.00
8.	Debt Portion (%)	%	70.00
9.	Equity Amount	Rs. Million	289.35
10.	Debt Amount	Rs. Million	663.24
11.	Discount rate (%)	%	12.00
12.	Capital Cost / MW (in Rs. Million)	Rs. Million	63.51
13.	**ENERGY GENERATION**		
14.	Plant Load Factor	%	55
15.	Total Energy Generation (Annual) in Mus	Mus	71.670

[6] In the host country, the criteria to determine sickness in an industrial company are (i) the accumulated losses of the company to be equal to or more than its net worth i.e. its paid up capital plus its free reserves (ii) the company should have completed five years after incorporation under the Companies Act, 1956 (iii) it should have 50 or more workers on any day of the 12 months preceding the end of the financial year with reference to which sickness is claimed. (iv) it should have a factory license.

[7] Communication between TECIL and EDCL and Management Approval of EDCL.

16.	After Outage of 5%		68.087
17.	Auxiliary Consumption (0.5%)	Mus	0.34
18.	Loss due to transmission	Mus	0.00
19.	Loss due to transformation (1.0%)	Mus	0.68
20.	Net energy sent out to the grid	Mus	67.065
21.	Net Saleable Energy	Mus	67.07
22.	MNES Subsidy	Rs. Million	52.50
23.	**ENERGY SELLING RATE**		
24.	Power selling rate per unit in Rs.	Rs.	2.44
25.	Escalation factor for power selling rate per year %		0.00
26.	**OPERATION & MAINTENANCE**		
27.	O&M Charges inclusive Insurance %	%	1.50
28.	O&M Escalation rate after every years %	%	4.00
29.	**DEPRECIATION**		
30.	Depreciation rate as per Electricity Act	%	3.60
31.	Capital cost - Civil Works (in Rs. Million)	Rs. Million	332.54
32.	Capital Cost - Electro-Mechanical (in Rs. Million)	Rs. Million	365.96
33.	MAT (Min. Alt. Tax) %	%	11.33
34.	I. Tax Rate %	%	33.66
35.	Interest on Working Capital	%	11%

With CDM revenue, the pay back of the project activity improves and was found to be within the acceptable limit for the company.

Therefore the incentive through sale of the emission reductions would improve the pay back of the project activity. The main driving force for taking over the hydro electric project, at a point when TECIL was down with severe financial losses was the revenues that could be accrued through the CDM en- route[8]. Hence, it can be concluded that CDM revenue was very crucial to sustain the operations of the project activity.

Other Barriers:

Delay in finalizing the Power Purchase Agreement (PPA): A new electricity framework called the Electricity Act was passed in India in June 2003 to usher in power sector reforms. As per the Act, State Electricity Regulatory Commission (SERC) shall determine the tariff for renewable energy projects selling power to grid. The Karikkayam hydro electric project was originally conceived to be a Captive Power Plant (CPP) for the ferroy alloy plant of TECIL. After AHPL took over the Karikkayam hydro electric project the project proponent had to face some barrier (regulatory and time delay) for changing its status to an Independent Power Producer (IPP). The project proponent is also

[8] Board Minutes

facing problems in finalizing its PPA with KSEB, thereby delaying the commissioning of the project and resulting in cost over-run.

Delay in obtaining Implementation Agreement –Any Independent Power Producer, should have an Implementation Agreement with the Government just after the project is awarded to the project proponent. The Implementation Agreement was attained by TECIL when the project was being developed as a Captive Power Project. After AHPL took over the project as an IPP, a MoU with the state government was required which is not yet accomplished. All ground work for the project activity viz: land acquisitons, construction work has been stalled and the cost implications in terms of the delay will have to be borne entirely by the project proponent.

Barriers due to prevailing practice

AHPL is one of the first private IPP to develop the Karikkayam hydro electric power project in Kerala. There are 24 hydro power projects owned by KSEB and 2 by private agencies and are being developed for captive purposes[9].

Impact of CDM Revenues:

As discussed above, the proposed project activity was not financially attractive for the project proponent and the decision to take up the project by AHPL from TECIL was governed primarily by banking on the CDM revenues. The proposed project activity getting registered as a CDM project would help the project proponent earn revenues through sale of carbon credits. Overall success of the project activity would also act as a precursor for other private enterprises of the state to invest in small hydro projects in the state leading to further reduction in GHG emissions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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

[9] :http://www.kseboard.com/

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.

Since the proposed project activity will affect both current and future generation mix of the grid, the project proponent has opted for 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 Southern Regional electricity grid (EF_y) has been calculated in accordance with the "Tool to calculate the emission factor for an electricity system" The same emission factor for the grid has been used for calculation of emission reductions. For details please refer to Annex 3 of this project document.

Baseline Emission Calculations

The Baseline Emission is calculated as,

$$BE_y = EG_y \otimes EF_{grid} \quad \text{..... (1)}$$

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) . This will be calculated ex-ante and will be kept constant over the entire crediting period.

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 proposed project activity.

III. Leakage Emissions: According to the methodology "*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. However in the project activity there is no such provision as the turbines installed are newly procured and hence there is no leakage emission.

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

$ER_y = [BE_y – (PE_y + L_y)]$..... **(2)**

where,

ER_y = emission reductions for the project activity in tonnes of CO_2 e

BE_y = Baseline emissions in tonnes of CO_2 e

PE_y = Project emissions in tonnes of CO_2 e = 0

L_y = Leakage emissions in tonnes of CO_2 e = 0

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

(Copy this table for each data and parameter)

Data / Parameter:	EF_{GRID}
Data unit:	tCO_2/MWh
Description:	Emission Factor of the Southern Regional grid (tCO_2/MWh)
Source of data used:	CO_2 Baseline Database (Version 3.0, 15th December 2007), calculated in accordance to the 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)'
Value applied:	0.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of EF_{GRID} considered has been calculated in CO_2 Baseline Database (Version 3.0, 15th December 2007), calculated in accordance to the 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)' (Refer to Annex 3)
Any comment:	The value of EF_{GRID} has been calculated ex-ante and will be kept fixed for the entire crediting period

B.6.3 Ex-ante calculation of emission reductions:

Parameter	**Unit of Parameter**	**Value**	**Comments/Assumptions**
Power Generation capacity of the project	MW	15	As per specifications by equipment suppliers
Gross Energy generated by the project activity	MWh	71.67	As projected in Detailed Project Report
Auxiliary Power Consumption	MkWh	0.35	Auxiliary power consumption is assumed to 0.5 %

Net Power exported to the Southern Regional Grid	MkWh	67.065	After accounting for transformation losses and outage loss as projected in DPR
Combined Margin electricity emission factor of Southern Regional Grid of India **EFy**	kgCO2e / kWh	0.85	Source: CEA CO2 Baseline Database, Version 3.0, December 2007, http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver3.pdf
Annual Baseline Emission **BEy = (EGy * EFy)**	t CO2e / yr	57005	Calculated as per equation (1) of Section B.6.1
Annual Project Emission **PEy**	t CO2e / yr	0	
Leakage due to project activity **Ly**	tCO2 e/yr	0	As detailed above there is no transfer of equipments from another project activity and that all the project equipments have been procured new. Thus there is no leakage for the project activity.
Annual Emission Reduction **ERy = [BEy – (PEy + Ly)]**	t CO2e / yr	57005	Calculated as per equation (2) of Section B.6.1

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

Years	Estimation of project activity Emissions (tonnes of CO2 e)	Estimation of baseline Emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emission reductions in tonnes of CO_2 e
January 2009- December 2009	0	57005	0	57005
January 2010- December 2010	0	57005	0	57005
January 2011- December 2011	0	57005	0	57005
January 2012- December 2012	0	57005	0	57005
January 2013- December 2013	0	57005	0	57005
January 2014- December 2014	0	57005	0	57005
January 2015- December 2015	0	57005	0	57005
January 2016- December 2016	0	57005	0	57005
January 2017- December 2017	0	57005	0	57005
January 2018- December 2018	0	57005	0	57005
Total (tonnes of CO_2 e)	**0**	**570050**	**0**	**570050**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	EG_Y
Data unit:	kWh
Description:	Net units of electricity substituted in the Southern Regional Electricity grid during the year y.
Source of data to be used:	Plant records maintained by AHPL
Value of data	67.065 [10]
Description of measurement methods and procedures to be applied:	Measurement of the export of energy by the project activity will be done at the plant premises, where there will be a dual energy metering system – (i) external metering system comprising of the main meter, that will be sealed, maintained and calibrated by KSEB and (ii) internal metering system comprising of the check meter that will be maintained and calibrated by the project proponent. Net electricity exported to the grid, will be monitored daily by EDCL on the basis of the check meter readings. Monthly joint meter readings of the main meter and check meter at the interconnection point will be taken by the designated officials KSEB and EDCL. Monthly power export bills will be generated by AHPL against the main meter readings. Emission reductions will be claimed on the basis of the net electricity exported to grid as per the check meter readings.
QA/QC procedures to be applied:	Net electricity exported to the Southern Regional Grid will be verified against the monthly electricity bills.
Any comment:	Please refer to Annex 4: Monitoring Plan for further details

B.7.2 Description of the monitoring plan:

[10] As projected in the Detailed Project Report for the project.

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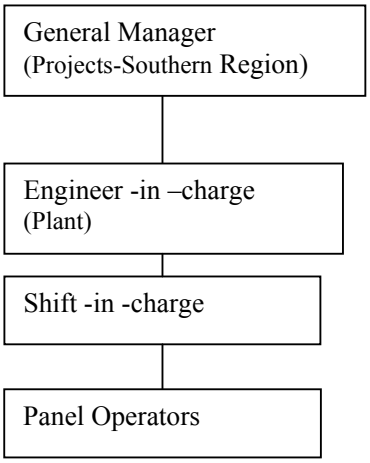
Organization structure for data monitoring

The project proponent will appoint staffs who will take the full responsibility for the implementation of the monitoring plan. The responsible staff will be supported by the Technical Department and the Financial Department of the proposed project activity.

Data for the proposed project activity will be recorded and monitored by the panel operators which will be verified by shift-in-charge and then reviewed by the Engineer in-charge and finally communicated to the General Manager (Projects). The diagram below illustrates the roles and responsibilities of the proposed CDM Team of AHPL and the monitoring and archival procedures that will be followed at AHPL with the commissioning of the proposed project activity.



The **Panel Operators** in the plant will be responsible for recording the energy generation data in the daily log books from the check meters installed at the plant.

The data recorded by the panel operators will be checked and verified by **Shift –in –charge** and any discrepancy will be reported to the Engineer-in- charge.

The **Engineer in- charge** will be responsible for reviewing the GHG performance related parameters as recorded by the Shift Engineers/ Panel Operators in every shift. His roles and responsibilities will include:

- Implementation of appropriate corrective measures in case any discrepancies are identified in the reported parameters.
- Preparation of daily and monthly reports.

The **General Manager (Projects)** will be responsible for reviewing the daily and monthly reports in consultation with the Engineer- in-charge.

- Implementation of appropriate corrective measures in case any discrepancies are identified in the daily and monthly reports.
- Ensuring calibration of the monitoring equipments as and when required.

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

Date of completion of the application of the baseline and monitoring methodology: 12/05/2008

Name of person responsible: Mr. L.K.Sadani, Director, Ayyappa Hydro Power Limited (as listed 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:

11/01/2006[11]

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

25y-0m

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:

01/01/2009 or the date of registration under UNFCCC, whichever is later.

C.2.2.2. Length:

10y-0m

[11] As per Board resolution regarding consideration of CDM revenues for undertaking the proposed project activity

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, 2006, Ministry of Environment and Forests, Government of India, New Delhi, the river valley projects less than 50 MW and utilizing less than 10,000 ha of culturable land area do not require an EIA submission[12]. The proposed project activity of 15 MW capacity is mainly built on hilly terrain and does not involve any disruption of culturable land area. However, the project has obtained the Consent to Establish (i.e. the No Objection Certificate) from the Kerala Pollution Control Board (KPCB). The hydro power generation 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 and hence no problem of resettlement is envisaged. The proposed project activity will thus have no negative impact on the environment.

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:

Not applicable

[12] http://www.enviswb.gov.in/ENV/downloads/EIA/so1533.pdf

SECTION E. Stakeholders' comments

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

Stakeholder consultation is an integral component for all project activities undertaken by AHPL. The same is carried out in a transparent manner as described below:

Identification of stakeholders: For the project activity under consideration, the following stakeholders have been identified:

- Elected body of representatives administering the local area (village Panchayat)
- Non-Governmental Organisations (NGOs)
- Local clubs
- Contractors

Information Sharing: Salient information regarding the proposed project activity has been shared with the identified stakeholders through written notification.

Compilation of the feedbacks received: The stakeholders have all provided their feedback on the proposed project activity in writing. The comments received from all the stakeholders have been compiled.

E.2. Summary of the comments received:

AHPL has received positive feedback from the local stakeholders of the project activity. The summary of the feedback from some of the stakeholders are as follows:

Sl No.	Name of Stakeholders	Mode of Communication	Feedback
1	Elected body of representatives administering the local area (village *Panchayat*)	Representatives from AHPL have met the local people in and around the plant premise. Brief details on the proposed project activity, its socio-	The local people acknowledged the contribution of the proposed project activity towards the abatement of environmental pollution. They have also acknowledged that the project activity has provided

Sl No.	Name of Stakeholders	Mode of Communication	Feedback
		economic and environmental impacts were communicated in writing to the Village Panchayat and the Panchayat was requested to provide feedback on the same.	employment opportunities to the local people, thereby improving the economic condition of the locality. The local people have commended AHPL effort and assured their support to the Management of AHPL
2	Non Governmental Organizations (NGO)	The details of the proposed project activity implementation, its associated environmental benefits have been communicated in writing to the NGO and their opinions on the same have been requested for.	The NGO has appreciated the initiative of AHPL to venture into generation of electricity using clean resource which would also help in the upliftment of the standards of the local people. They have also commended the efforts of AHPL in getting the project registered with UNFCCC as a CDM case.
3	Local Clubs	The representatives of AHPL have asked for a written communication to a local club about their feedback regarding the proposed project activity.	They expressed their satisfaction with the project activity identifying its benefits towards the environment and the society.
4	Contractors	The representatives of AHPL have asked for a written communication to the contractors about their feedback regarding the proposed project	They commended the project activity for its contributions towards the abatement of environmental pollution and also towards employment generation.

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Sl No.	Name of Stakeholders	Mode of Communication	Feedback
		activity.	

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

All the comments received, so far, have been considered and given due consideration while preparing the CDM Project Design Document.

Furthermore, as per the requirement of UNFCCC, the CDM Project Design Document will be web-hosted on the DOE's (Designated Operational Entity) website for a period of one month for global stakeholder consultation. The comments received during the period of global stakeholder consultation will be properly addressed as a part of CDM process.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Ayyappa Hydro Power Limited
Street/P.O.Box:	7,Camac Street
Building:	"Azimganj House", 1st Floor
City:	Kolkata
State/Region:	West Bengal
Postfix/ZIP:	700 017
Country:	India.
Telephone:	+ 91 33-22820046
FAX:	+ 91 33-22820045
E-Mail:	edclcal@airtelbroadband.in
URL:	
Represented by:	
Title:	Mr
Salutation:	Director
Last Name:	Sadani
Middle Name:	Kumar
First Name:	Lalit
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	lksadani@gmail.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the project activity.

Annex 3

BASELINE INFORMATION

The proposed project activity involves electricity generation by utilizing the hydro potential of the Kakkad river basin. In the absence of the proposed project activity, the electricity requirements of Southern Regional grid would have been met by the grid-connected power plants comprising of fossil fuel based thermal (coal, gas and diesel based), hydro and nuclear power plants and by the addition of new generation sources. The Emission Factor for the displaced electricity accruing due to the proposed project activity is calculated as per the "Tool to calculate the emission factor for an electricity system", EB 35.

STEP1. Identify the relevant electric power system.

As per the tool, for the purpose of determining the electricity emission factors, a project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

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 proposed project activity hosting plant AHPL is connected to the KSEB grid which falls under the Southern Regional Grid network of India. The Southern Regional Grid consists of state grids Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Pondicherry and Lakshadweep. The project proponent will be required to use the carbon intensity of the entire Southern Regional grid as the baseline emission factor for baseline emission calculations over the project activity's crediting period.

Step 2. Select an Operating Margin (OM) method

As per the tool, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) can be calculated by any of the following:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

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(d) Average OM.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Simple OM method (Option a) is used as the low-cost/must-run resources constitute less than 50% of total grid generation.

STEP 3. Calculate the operating margin emission factor according to the selected method.

The Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Operating Margin emission factor of Southern Regional Grid as an average of the 3-years' (*i.e.* 2003-2004, 2004-2005 and 2005-2006). The following table gives the CO_2 Operating Margin emission factor of Southern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated June 2007'. The Simple Operating Margin is calculated ex-ante and is fixed during the entire crediting period as per the outlines of the tool.

Computation of Operating Margin Emission Factor for Southern Regional Grid					
Parameters	Unit	2004-	2005-	2006-	Remarks/ Source
Simple Operating Margin Emission Factor, $EF_{OM,Simple,y}$	tCO_2/MWh	1.00	1.01	1.00	Baseline Carbon Dioxide Emission Database/ Version 3.0 dated December 2007 available att http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Operating Marging Emission Factor, $EF_{OM,y}$	tCO_2/MWh	1			3-years'

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

As per the tool, the power plants to be included for the purpose of The sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

20% of Net Generation (GWh)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	27,046	28,283	28,949	31,009	31,458	33,641
East	10,670	11,619	11,968	13,686	15,594	17,203
South	24,232	24,726	25,558	25,675	26,935	27,666
West	30,082	30,625	32,890	31,956	34,145	35,201
North-East	1,039	1,043	1,134	1,150	1,552	1,531
India	93,069	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					32,064	34,340
East					15,818	17,567
South					27,987	28,158
West					35,257	35,425
North-East					2,055	1,793
India					113,181	117,283

As per the tool, Option 1.is used to calculate the Build Margin. For the first crediting period the build margin emission factor will be calculated *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.

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

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Build Margin emission factor of Southern Regional Grid for the year 2005-2006 . The following table gives the CO_2 Build Margin emission factor of Southern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated December 2007'.

Computation of Build Margin Emission Factor for Southern Regional Grid			
Parameters	Unit	2005-2006	Remarks/ Source
Build Margin Emission Factor, $EF_{BM,}$	tCO_2/MWh	0.85	Baseline Carbon Dioxide Emission Database/ Version 3.0 dated December 2007 Available at thttp://www.cea.nic.in/planning/c%20and%20e/user_guide_ver3.pd

Step 6. Calculate the combined margin emissions factor

As per the tool, the combined margin emissions factor is calculated as follows:

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

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 emission factor of Southern Regional Grid .The following table gives the CO_2 emission factor of the Southern 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 Southern regional Grid		
Parameters	Values (ton of CO_2/MWh)	Remarks
Operating Margin Emission Factor, $EF_{OM,y}$	1	Please refer to Step-3 above.
Build Margin Emision Factor, $EF_{BM,y}$	0.71	Please refer to Step-5 above.
CO_2 Emission Factor of Southern Regional Grid, EF_y	0.85	Calculated

The CO_2 Emission Factor of Southern 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 financial performance of the proposed project activity depends significantly on the CDM revenue to be availed through sale of Certified Emission Reduction (CER) units accrued from the project activity. This will require proper monitoring of the net electricity exported to the grid by the proposed project activity. Therefore the project proponent has developed a robust monitoring protocol which will be followed throughout the proposed crediting period in order to ensure proper operation of the project activity resulting in generation of carbon credits. The general principles for monitoring above parameters are based on:

- Frequency
- Data recording
- Reliability

Frequency

Monthly joint meter reading of main meter installed at the plant switchyard shall be taken at the same time and signed by authorized officials of AHPL and KSEB every month. The shift in-charge of AHPL will also record the energy exported to the grid daily from the check meters and maintain in plant log books. Joint meter reading shall be the basis for monthly invoice of net energy exported to the grid.

Data recording

Records of the joint meter reading of net energy exported to the grid would be maintained by AHPL and KSEB. This will be cross verified with the monthly readings recorded from the check meters and maintained in the plant log books. This data will be also be electronically maintained by AHPL. Daily and monthly reports stating the net power export on the basis of the check meter readings would be prepared by the shift in-charge and verified by the General Manager (Projects) on a monthly basis.

Reliability

For measuring the net energy exported to the grid, one main meter and one check meter is maintained in the plant busbar. The check meter readings will form the basis of calculation of emission reductions accruing due to the proposed project activity. Main meter reading will be the basis of billing and the monthly joint meter reading of main meters will be taken and signed by authorized officials of AHPL and KSEB every month. This will be verified with the meter readings of the check meter for the same period of time. Any discrepancy between the two meter readings will be reported. The main meter will be sealed and calibrated by KSEB officials. The check meters will be maintained and calibrated by AHPL.

AHPL shall archive and preserve all the monthly invoices raised against net saleable energy as well as plant records showing the net electricity exported to the grid, for at least two years after end of the crediting period. AHPL shall also archive the complete metering data at generation end on paper and all the data would be preserved for at least two years after end of the crediting period.

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