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

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Revision history of this document

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

SECTION A. General description of small-scale project activity

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

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Title- 2 x 3.5 MW Ullunkal Hydro Power Project in Kerala, India.

Version: 01

Date: 12/05/2008

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

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The project activity entails generation of electricity by Energy Development Company Limited (EDCL) through a run-of- the-river power plant across the left bank of river Kakkad at Chittar village, in the district of Panthanmthitta, in the state of Kerala and export of the net electricity to the Southern Regional Electricity grid. The small scale project activity under consideration will consist of a 7 MW run-of-the-river hydro power project that will utilize the water of river Kakkad. Since the project will be of run-of-river type, minimal storage of water will be required at the weir. A diversion weir will be constructed to divert the river water. The diverted water will be taken through an intake conduit. Then it will flow through two penstock intake gates into the power house. Each penstock will lead to a horizontal shaft Kaplan type turbine. Two turbines of 3.5 MW capacity will be employed to generate a net electricity of 30.16 million kWh per annum. In absence of the project activity the same would have been generated by the grid mix mainly consisting of fossil fuel fired generating units resulting in equivalent amount of GHG emission at the grid end. Thus the project activity will result in reduction of a quantum of 25757 tonnes of CO_2 per annum. The generated electricity will be stepped up to 11 KV to be exported to the nearest 11 KV sub station of Kerala State Electricity Board (KSEB) at Kakkad through a dedicated double circuit overhead spanning up to 4 km.

The project activity will contribute to the sustainable development of the country which is elaborated under these three main pillars of as follows:

Environmental well- being:

The power generation by using renewable energy will avoid the use of fossil fuel like coal and fuel oil leading to reduction in GHG emissions at the thermal power plants connected to the grid. Apart from that, SPM, SO_x, NO_x emissions associated with fossil fuel combustion and emissions corresponding to transportation and excavation/exploration of fossil fuels will also be avoided. Therefore power generation from renewable energy

source will create global as well as local air pollutant benefits. The project activity positively contributes towards the reduction in demand for India's carbon intensive energy resources.

Economic well-being:

The project activity will create business opportunities for local stakeholders such as bankers, consultants, equipment suppliers, manufacturers and contractors during the implementation phase. The contribution of the project activity towards the infrastructural development of the region will result in an economic well-being for the local populace throughout the project lifetime.

Social well-being:

The project activity will not cause any dislocation of the local population. Moreover during the construction and operational phase it will provide employment opportunities to the local people thereby improving the employment level of the local people. Proper training and education will be imparted to the recruited people for smooth operation of the power plant and also to ensure proper monitoring of the relevant parameters related to GHG performance of the power plant.

Technological well-being:

The project activity will result in minimum transmission loss due to generation of power close to load points. So this will increase the amount of electricity being exported to the Southern Regional Grid thus further leading to the increase in reduction of GHG emissions.

A.3. Project participants:

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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 proponent(Yes/No)
Ministry of Environment and Forests, Government of India	Energy Development Company 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):

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India

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

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Kerala

A.4.1.3.	City/Town/Community etc:

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Chittar village, Pathanamthitta District.

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

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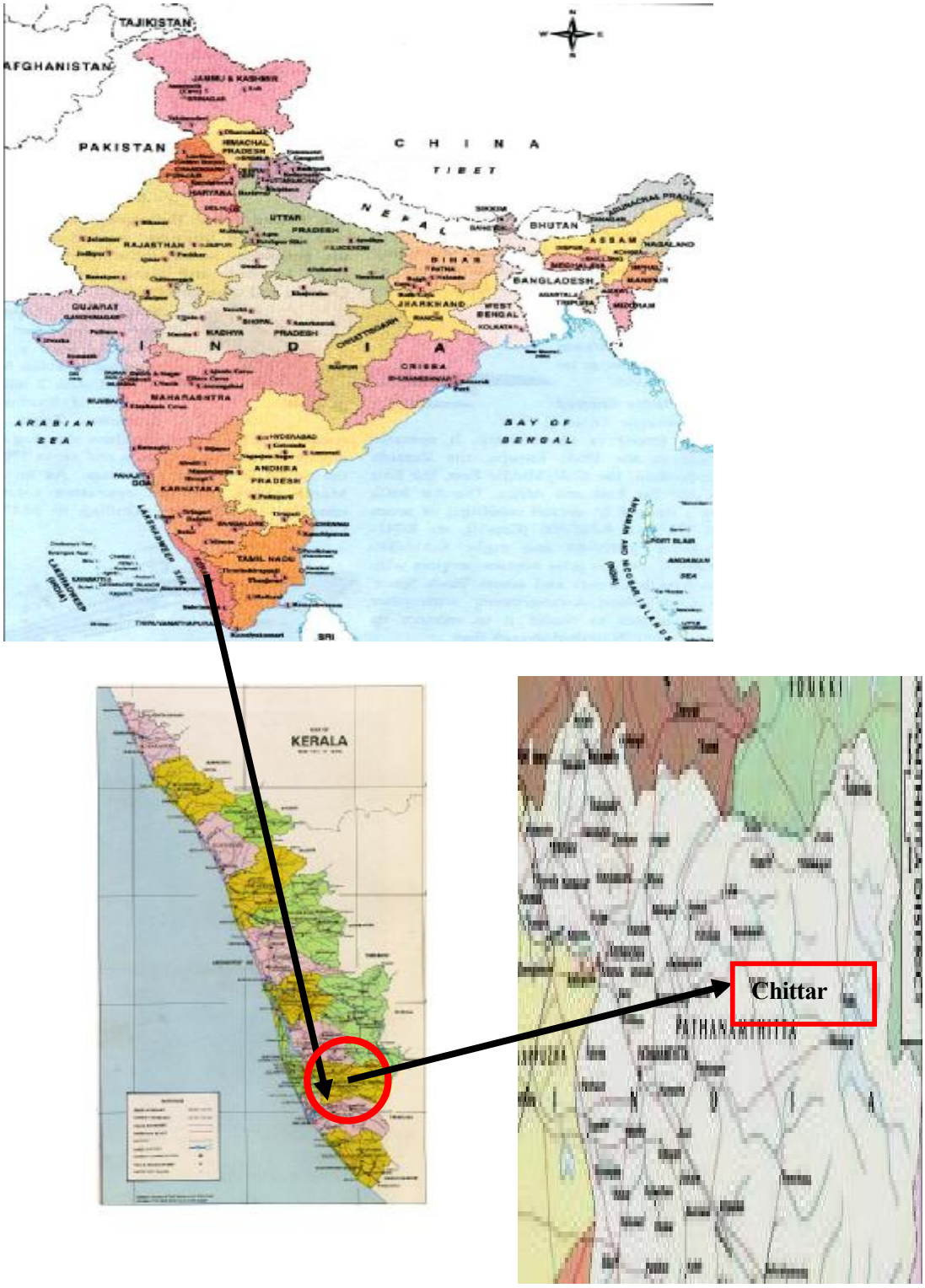
The project site is located at Chittar village which is in the district of Pathanamthitta in the state of Kerala. It is bounded by 9°20'30" N latitude and 76°56'00"E longitude. The site is 33 km from Pathanamthitta. Nearest railway station is Thiruvananthapuram which is 110 km by road. The nearest airport as well as seaport is located at Kochi 175 km away from Pathanamthitta. The physical location of the project activity is shown in the figure below:


TAJIKISTAN
AFGHANISTAN
PAKISTAN
C H I N A
TIBET
NEPAL
BHUTAN
ASSAM
BANGLADESH
I N D I A
ARABIAN SEA
BAY OF BENGAL
KERALA
Chittar

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

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Since the capacity of the project activity is less than 15 MW, the project activity qualifies for a small scale CDM project.

Sectoral Scope: 01 [Energy Industries (Renewable-Non renewable sources)]

Type: I- Renewable energy projects.

Category: I.D-Grid connected renewable electricity generation.

Technology

It will comprise of a 2 X 3.5 MW run-of-the-river hydro power plant. The river water will be diverted through a high concrete gravity and gated diversion weir. It will then be guided through a penstock gate and jetted into the turbine. This action will rotate the turbine which in turn will rotate the generator thus producing electricity. The electricity after meeting the in-house auxiliary consumption will be exported to the Southern Regional Grid.

The hydro power plant will broadly consist of a gated diversion weir, power block comprising of trash rack, inlet-gate, penstock turbine, generator, powerhouse, draft tube gate, control switch gears, transformers and switchyard. The technical specifications of the above mentioned components are provided in the table below:

Diversion Structure	
Type of structure	Concrete Gravity weir with gates
Total Length	121 m
Normal bed level	48 m
Height above bed	12 m
Maximum discharge capacity	1120m^3/s
Spillway	
Length of the spillway	30 m
Crest level of spillway	52.5m
Intake	

Size of Intake Gate	1 x 4.3 x 4.3
Number of Intake Gate Vents	2

Penstock	
No of Penstocks	2
Diameter of Pipe	3.8m
Thickness of pipe	12 mm
Discharge in one pipe	48.13 m^3/s

Turbine	
Type	Horizontal Shaft, S Type, Full Kaplan
Number	2
Capacity	3.5 MW each

Tail Race Channel	
Mode of Discharge	Direct to river
Number of draft tube vents	2
Size of the Draft tube gate	1 x 5.3 x 3.3

Power evacuation	
Voltage level	11 kV
Number of circuits	2
Length of Transmission Line	4 kms
Interconnection point	Kakkad 11 kV sub station

The generated power will be evacuated to the grid from the power house at 11 kV by a double circuit overhead line to KSEB's Kakkad power house switch yard 4 km away from the power house.

Technology Transfer:

There is no transfer of technology involved in the project activity.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2 e
2008-09	25757
2009-10	25757
2010-11	25757
2011-12	25757
2012-13	25757
2013-14	25757
2014-15	25757
2015-16	25757
2016-17	25757
2017-18	25757
Total estimated reductions(tonnes of CO_2 e)	257570
Total number of crediting years	10
Annual average over the crediting period of	25757

estimated reductions (tonnes of CO_2 e)	

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

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There is no public funding available 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:

According to Appendix C of the simplified modalities and procedures for small-scale CDM project activities; *'**de-bundling'** is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a larger project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.*

According to paragraph 2 of Appendix C [1] - A proposed small-scale project activity shall be deemed to be a de-bundled 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;*
- *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*

The present project activity is not a de-bundled component of a large project activity as the project proponent has not registered or applied to register any other small scale CDM project activity of same project type/category within a project boundary of 1 km prior to the present project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of the Approved Baseline Methodology: 'Grid connected renewable electricity generation'

[1] Appendix C to the simplified M&P for the small-scale CDM project activities, http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

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

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As per the provisions of Paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities[2], to use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall:

1. Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 28 of Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its second session, held at Nairobi from 6 to 17 November 2006 [FCCC/KP/CMP/2006/10/Add.1, English, Page 08][3] ; Point i. [Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent)]

The proposed project activity primarily aims at the reduction of emissions of GHGs by setting up a hydro power plant of 7 MW capacity. In the process, a renewable source of energy will be harnessed and the electricity generated by the activity will displace from the grid an equivalent amount of electricity generated by fossil fuel combustion. Since the project activity is a renewable energy project activity with a maximum output capacity equivalent of less than 15 MW, it meets the eligibility criterion under consideration for qualifying as a small scale project.

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

The project is a Renewable Energy project with maximum output capacity of 7 MW (≤15 MW, the maximum output for small scale project) Hence this comes under the Appendix B of the simplified modalities & procedures for small-scale CDM-project activities. The power generated by hydro power project is supplied to Southern Regional Grid.

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

[3] 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;

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[4]. 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.

Further in accordance with Paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in this appendix (Appendix B) may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in Attachment A of this Appendix (B). The project activity faces investment barriers listed in Attachment A of Appendix B in order to reduce CO_2 emissions as required by the Paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities. The details of the barriers are enlisted in Section B5.

Justification of the small scale project activity as per technology/measure of AMS I.D/Version 13

The applicability of the project activity under the above methodology is provided in the table below:

Technology/Measure as per AMS I.D/Version 13	**Measure of the project activity**	**Conclusion**
"This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit."	The project activity is a run-of-the-river hydro power plant. The generated electricity will be exported to the southern regional grid which in absence of the project activity would have been generated by the grid mix consisting of several fossil fired generating units.	The project activity satisfies the applicability criterion.

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

"If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel[5], the capacity of the entire unit shall not exceed the limit of 15MW."	The unit has only renewable component. Since the project activity generates electricity harnessing hydro-power generating potential, there is no scope of co-firing of fossil fuel. The project activity generates about 7 MW which is less than 15 MW.	This eligibility criterion is met by the project activity.
"Combined heat and power (co-generation) systems are not eligible under this category."	The project activity does not deal with cogeneration.	This eligibility criterion is not applicable for the project activity under consideration.
"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[6] from the existing units."	The proposed project activity is a green field one. It does not involve the addition of renewable energy generation units at an existing renewable power generation facility	So the criterion is not applicable for the project activity under consideration

[5] Co-fired system uses both fossil and renewable fuels.

[6] 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".

"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 project activity is a green field one. So the question of retrofitting does not arise in this case.	The criterion is not applicable.

B.3. Description of the project boundary:

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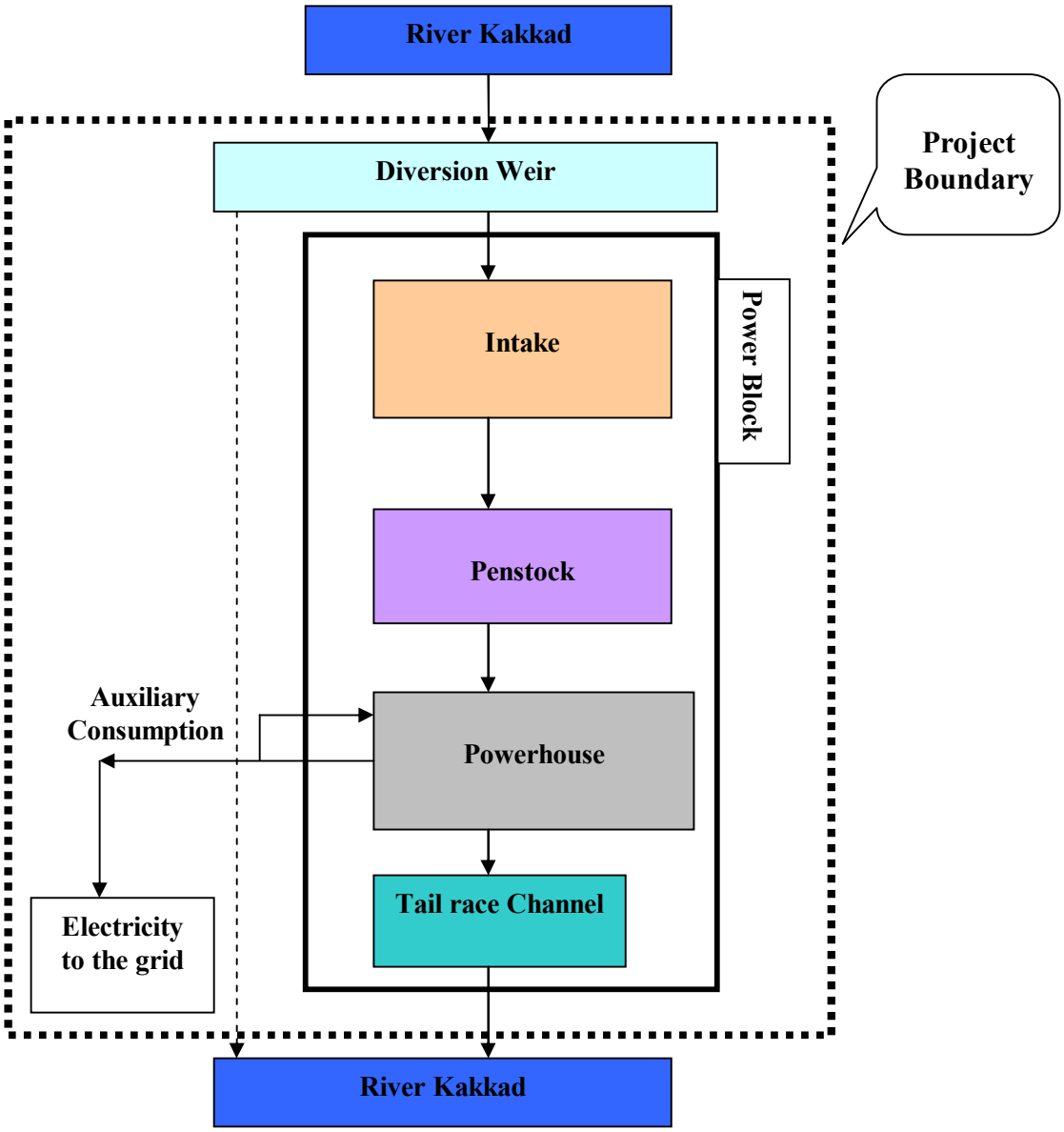
As per paragraph 6 AMS I.D *the project boundary will consist of the physical, geographical site of the renewable generating source.*

Hence the project boundary will cover the following components:

- Diversion weir.
- Intake.
- Penstock.
- Powerhouse
- Interconnection point with grid.
- Tail race channel.

Further for the purpose of determining baseline emissions the Southern regional grid of India has also been included within the project boundary.



B.4. Description of baseline and its development:

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EDCL identified the following alternatives that are viable in absence of the proposed CDM project activity.

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

In absence of the CDM project activity, the project proponents would not have set up the small hydro power plant and no electricity would have been generated by the project activity. In the Southern Regional grid there is negligible gap between the demand and supply fronts of electricity (about 2.9% in the year 2006-07). Moreover 62% of the generation comes from thermal sources *i.e.* fossil fuel based power plants. Therefore, in absence of the project activity, the same amount of electricity would have been generated by the grid mix which mainly consists of fossil fuel fired units[7] resulting in an equivalent amount of GHG emission. In addition to this if we consider the build margin analysis for the Southern Regional grid about 58% [8]of the new plants are based on fossil fuel generating units. These figures clearly indicate that mainly fossil fuel fired power plants will come up in region to overcome this demand supply gap. If the project activity had not supplied the power to grid, the requirement shall be met by new grid connected thermal power plants as per the trend indicated by Build Margin for Southern Regional grid.

This will result in GHG emissions as per the carbon intensity of the Southern Regional Electricity Grid of India. This alternative is in compliance with all applicable legal and regulatory requirements. Therefore, this alternative may be a part of the baseline.

Therefore the Alternative 1 is considered further for arriving at the baseline scenario.

Alternative 2- *The proposed project activity not undertaken as a CDM project activity.*

In this case, the project activity would be implemented without the consideration of CDM revenues. The Ullunkal hydropower project would have been connected to the Kerala State Electricity Board (KSEB) grid and therefore would displace an equivalent amount of electricity of the grid mix of Southern Regional Electricity grid. This alternative is in compliance with all applicable legal and regulatory requirements. But without the consideration of CDM revenues, it would not have been viable for the project proponent to go ahead with the project activity due to the barriers associated with it as discussed in section B.5

Therefore this alternative cannot be further considered for arriving at the baseline scenario.

Hence from the above discussion it can be concluded that the baseline scenario would be the continuation of the current scenario *i.e.* same amount of electricity would have been generated by the grid mix consisting of fossil fuel fired generating units resulting in equivalent amount of GHG emissions at the grid end.

[7] http://www.srldc.org/var/ftp/reports/yearlyrep/2006-07-year.pdf

[8] CEA Version 3, December 2007 database.

The baseline emission for the project activity is as per paragraph 9 of AMS I.D. which mentions that the baseline emission is the kWh produced by the renewable generating unit multiplied by an emission factor of the regional grid in which it displaces electricity.

The emission factor of the grid calculated by Central Electricity Authority (CEA) and made publicly available in the form of CO_2 Baseline Database (Version 3.0, 15th December 2007), has been considered. In the database, emission factor of the different regional electricity grids of India have been calculated in accordance with the 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)'. The combined margin emission factor for the Southern Regional Electricity grid as per this database is 0.854 tCO_2/MWh. Hence the total baseline emission is 25,757 tonnes of CO_2 per annum.

Parameters required for calculation of Baseline emissions:

Serial No.	Variables	Parameters	Data Sources
1.	EF_{GRID}	Electricity baseline emission factor.	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)'
2.	EG_y	Net electrical energy exported to grid.	Plant records

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:

The fact that the project activity qualifies to use simplified methodologies has been justified in Section B.2 where it has been shown to qualify as a small scale CDM project of Category I.D.

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. This project activity involves hydro electric power generation at the district of Pathnamthitta in the state of Kerala. An analysis of the Southern Regional grid generation mix gives the baseline emission factor in $kgCO_2/kWh$ for the crediting period, and the GHG (CO_2) emission reductions that the project activity will achieve will be through substitution of an equivalent grid supply, and which would not happen in absence of the project activity.

Barriers and Additionality

In accordance with Attachment A to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website the barriers to the project are discussed below:

Investment additionality

EDCL during the conceptualization of the project activity, took payback period into consideration in order to assess the financial viability of the project activity. They set their internal benchmark for payback period to be 8-10 years while taking over the project activity from Tecil Chemicals & Hydro Power Limited on the basis of the pay-back period for their Harangi Phase I hydro power generation project. This benchmark is being also used by EDCL for its similar two other project activities *i.e.* Karikkayam and Harangi Phase II hydro power project for assessing their financial viability.

The payback period of the Ullunkal project activity without CDM revenues was calculated based on the following parameters:

Sl.No	Parameters	Value
1	Capacity	7 MW
2	Capital cost with IDC	INR 400.78 million
3	Interest Rate on Loan	10.00%
4	Loan Repayment Period	7 years
5	Debt Equity Ratio	70:30
6	Discount rate	12%

7	Plant Load factor	53%
8	Gross generation	32.23 GWh
9	Net energy sent to grid	30.16 GWh
10	Power selling rate/unit	Rs 2.44/KWh
11	Escalation Rate	0%
12	O&M charges inclusive insurance	1.5%
13	O&M escalation rate	4%/year
14	Depreciation rate as per electricity act	3.6%
15	Min Alt Tax	11.33%
16	Income Tax Rate	33.66%
17	Interest on working capital	11%
18	MNES subsidy obtainable in second year	INR 53.76 million

The payback period for the project activity comes out to be 13 years without taking CDM into consideration which is quite higher than the company's internal benchmark of 8-10 years.

The project proponent found that the payback period of the Ullunkal project activity with CDM revenues improved and was found to be acceptable within the company's internal benchmark. This acted as the driving force for EDCL to go ahead with the implementation of the project activity with the consideration of CDM revenues.

The proposed project activity received the final approvals only after the consideration of CDM revenue stream which has a major impact on the financial viability of the proposed project activity.

All financial data used to arrive at the payback period of the Ullunkal project activity with and without CDM revenues would be provided to the DOE in the process of Validation.

Institutional Barriers:

The Ullunkal hydro power project was initially allocated to Tecil Chemicals & Hydro Power Limited to be set up as a captive power plant (CPP). But when it was taken over by EDCL, they had to establish the power plant as an independent power producer (IPP). The rules and regulations for entering into a power purchase agreement (PPA) with KSEB are different for an IPP as compared to a CPP, thereby causing delay in the signing of PPA between EDCL and KSEB. Implementation agreement is the most essential prerequisite to the project activity. But the same has been delayed in-spite of repeated pursues from EDCL.[9] Both of these factors have led to time and cost over-run for the project activity under consideration.

Other Barriers:

During the rainy season significant area over which the rain water falls from the dam down face, powerhouse and transformer yard gets collected at the sump and has to be pumped out, thus causing recurring costs.

Step 4.Common Practice Analysis

In the southern region the total hydroelectric power generation potential is 10763 MW. But out of that only 55.5%[10] have been captured yet. In Kerala the figure is even less than 50%. So considering the huge amount of untapped energy and high demand supply gap in the state the government is encouraging private enterprises to come up with hydro power projects. Even though hydro power consists of about 60% of the total power in Kerala, the project proponent is only the 2nd private entity[11] to take up a hydro project in Kerala. The other project has been registered by UNFCCC[12]. Moreover the fact distinguishing project activity from other similar projects is that it was first taken up by Tecil Chemicals & Hydro Power Limited as a CPP. But they suffered heavy financial losses followed by labor unrest in their chemical plant. This caused the stoppage of the construction work of the project activity and the status of the power plant was converted from CPP to IPP. Then it was taken over by EDCL. Tecil was then in a financial mess, and EDCL took over for a consideration of 23.5 Crores to settle all the debts of Tecil related to the project activity. Considering the history of time overruns[13] for most of the hydro projects in Kerala, it was a risky venture for EDCL as the proposed project activity was already being delayed for 7 years. Thus considering all these factors and in spite of being financially less attractive the project proponent took over the Ullunkal project with their faith on CDM revenues.

[9] Copies of the letter to Govt of Kerala, Power Department.

[10] Crisinfac Research Pro, Hydroelectric potential Table 17

[11] http://kseboard.com/

[12] http://cdm.unfccc.int/Projects/DB/SGS-UKL1200391307.92/view

[13] http://www.cds.edu/download_files/wp320.pdf

CDM – Executive Board

Impact of CDM registration

Hence from the investment additionality and other barriers as mentioned above it is quite evident that it would never have been financially viable for the project proponent to go ahead with the project activity without CDM revenues. The CDM revenues will assist the investor in achieving a better rate of return thus improving the pay-back period. Overall success of the project activity would also act as a precursor for other private enterprises 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:

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

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

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

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

Since the project activity will affect both current and future generation mix of the grid, the project proponent opts to use option a. - for estimating the emission coefficient of the electricity distribution system.

Emission Factor of the Grid (EF_{GRID})

Electricity baseline emission factor of Southern regional grid has been calculated in CEA Version 3.0, December 2007 database in accordance to the 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)' (Refer to Annex 3)

The same value has been used to calculate the emission reductions.

Baseline Emission Calculations

The Baseline Emission is calculated as,

$BE_Y = EG_Y \times EF_Y$

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 (tCO_2/MWh) calculated ex-ante and fixed for the entire crediting period.

Project Emissions: As the project activity consists of generation of electricity through a run-of-the river hydro power plant there is no emission arising from the project activity.

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.

Emission Reductions: The emission reductions resulting from the project activity is computed as a difference between the baseline emissions and the project emissions.

$$ER_Y = [BE_Y - (PE_Y + L_Y)]$$

Where,

ER_Y=Emission reduction for the project activity in tonnes of CO_2e

BE_Y=Baseline emissions in tonnes of CO_2e

PE_Y=Project emission in tonnes of CO_2e=0

L_Y=Leakage emission in tonnes of CO_2e=0

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

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:	0.854
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:

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Ex-ante estimation of Baseline Emissions

The ex-ante computation of baseline emission for the proposed project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated below:

Sl. No.	Operating Year	Baseline Emission (tonnes of CO_2 e)
1.	2008 – 2009	25757
2.	2009 – 2010	25757
3.	2010 – 2011	25757
4.	2011 – 2012	25757
5.	2012 – 2013	25757
6.	2013 –2014	25757
7.	2014 –2015	25757
8.	2015 – 2016	25757
9.	2016 –2017	25757
10.	2017 – 2018	25757
Total		**257570**

Ex-ante estimation of Project Emissions

As described above in Section B.6.1 above, there is no project emission from the proposed project activity and hence the project proponent did not consider any project emission for ex-ante computation of emission reductions resulting from the proposed project activity (please refer to 'Annex-3: Baseline Information' for detail computation). Therefore,

$PE_y = 0$

Where,

PE_y = Project Emissions in the year y (tCO_2)

Ex-ante estimation of 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 and hence there is no leakage emission is considered.

Therefore,

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$L_y = 0$

where,

L_y = Leakage Emissions in the year y (tCO_2)

Ex-ante estimation of Emission Reductions

The ex-ante computation of emission reductions resulting from the proposed project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated as below:

Sl. No.	Operating Year	Emission Reduction (tonnes of CO_2 e)
1.	2008 – 2009	25757
2.	2009 – 2010	25757
3.	2010 – 2011	25757
4.	2011 – 2012	25757
5.	2012 – 2013	25757
6.	2013 –2014	25757
7.	2014 –2015	25757
8.	2015 – 2016	25757
9.	2016 –2017	25757
10.	2017 – 2018	25757
Total		**257570**

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

>>

Year	Estimation of Proposed project activity Emission reductions (tonnes of CO_2 e)	Estimation of baseline Emissions reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2 e)
2008-09	0	25757	0	25757
2009-10	0	25757	0	25757
2010-11	0	25757	0	25757

Year	Estimation of Proposed project activity Emission reductions (tonnes of CO_2 e)	Estimation of baseline Emissions reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2 e)
2011-12	0	25757	0	25757
2012-13	0	25757	0	25757
2013-14	0	25757	0	25757
2014-15	0	25757	0	25757
2015-16	0	25757	0	25757
2016-17	0	25757	0	25757
2017-18	0	25757	0	25757
Total (tonnes of CO_2 e)	**0**	257570	**0**	257570

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_Y
Data unit:	kWh
Description:	Net units of electricity substituted in the Southern Regional Electricity grid during the year y.
Source of data to be used:	Power export bills.
Value of data	30.16×10^6
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 EDCL 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:

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Please refer to Annex 4 for details of the monitoring plan.

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

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Parameter	Details
Date of completing the final draft of this baseline selection and monitoring plan	12/05/2008
Name of person/ entity determining the baseline and establishing the monitoring plan	Energy Development Company Limited (EDCL).

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:

>>

27/01/2006

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

>>

25 y 0 m

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:

>>

01/10/08 or the date of registration whichever is later.

C.2.2.2. Length:

>>

10 y 0 m

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:

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Environmental Impact Assessment (EIA) is an important management tool for ensuring optimal use of natural resources for sustainable development. According to EIA **Notification** dated 14th September, 2006[14], "River valley projects greater than 50 MW hydroelectric power generation occupying greater than 10,000 hectares of culturable command area or projects less than 50 MW but greater 25 MW hydroelectric power generation occupying less than 10,000 hectares of culturable command area" require an EIA clearance. Therefore the project activity being a 7 MW hydroelectric power generation does not fall into either of the two categories and thus does not require EIA submission. Due to the project activity there was no dislocation of population. The project activity being a run-of-river type it will not adversely affect the ecological balance of the region. The project is compatible with all pollution control norms for Water pollution, Air pollution and Solid waste disposal. Thus, the project is environmentally benign. The relevant clearances have been obtained for the project activity.

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

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Not Applicable.

SECTION E. Stakeholders' comments

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

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[14] http://envfor.nic.in/legis/eia/so1533.pdf

EDCL identified their relevant stakeholders and communicated about the project activity. The stakeholders were further requested to provide their feedback about the proposed project activity. Their comments whether positive or negative were properly addressed at the management level and relevant steps were taken for clarification of their comments. The stakeholder consultation was carried out in a phased manner at EDCL. The same is explained below:

Table E-1: Stakeholder Consultation Protocol	
Phase	Activity
Phase-I: Identification of Stakeholders	For the proposed project activity under consideration, the following parties and organizations have been identified as the stakeholders: ▪ Chittar Village panchayet. ▪ Employees of EDCL. ▪ Local NGO ▪ Local club
Phase-II: Information Sharing	The stakeholders were communicated about the project activity being implemented by EDCL, technology applied and the effect that the project activity will have on the local environment and the global scenario as a whole. The stakeholders were also communicated that EDCL has initiated the process to register the project activity under the Clean Development Mechanism set-up by UNFCCC as per the Kyoto protocol.
Phase-III: Compilation of the comments received and measures undertaken	Stakeholder consultation is an on-going process for the project activity under consideration. However, the comments received from some of the stakeholders have been compiled and their significance has been considered by the project team of EDCL. Appropriate measures will be undertaken to address the issues raised (if any) by the stakeholders. In case of any significant comment received from the stakeholders, the same will be escalated to the Management Level and necessary actions will be implemented by the Management of EDCL.

E.2. Summary of the comments received:

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Sl. No	Identified Stakeholders	Mode of communication	Feedback received
1.	Elected Body of the	The representatives of	The village panchayet

	representatives administering the local area. (Chittar Panchayet).	EDCL have communicated the village panchayet about the project activity, its socio-economic, environmental impacts through a letter and requested them to provide feedback.	has appreciated the concern of EDCL for the benefits of the local people and the environment.
2.	Employees of EDCL.	The management of EDCL have asked the employer's union through a letter to provide their opinion about the project activity.	The Employer's union has identified the benefits of the project activity and appreciated the same.
3.	NGOs	The details of the project activity along with its environmental benefits were communicated to the NGO and their opinion for the same was requested.	Citing the long term benefits of such project activities on the environment the NGOs have appreciated the project activity.
4.	Local Club	The representatives of EDCL 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.

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

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Energy Development Company Limited has so far received only positive feedbacks on the project activity from all the stakeholders. However stakeholder consultation is an on-going process for the project activity under consideration. 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 by the Validator 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:	Energy Development Company Limited(EDCL)
Street/P.O.Box:	7.Camac Street, 1st Floor, Kolkata-700017
Building:	Azimganj House
City:	Kolkata
State/Region:	West Bengal
Postfix/ZIP:	700017
Country:	India
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E-Mail:	edclcal@airtelbroadband.in
URL:	
Represented by:	
Title:	Advisor
Salutation:	Mr
Last Name:	Sadani
Middle Name:	K
First Name:	L
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	lksadani@gmail.com

Annex 2

There is no public funding for the project activity.

Annex 3

BASELINE INFORMATION

For the project activity the baseline scenario involves equivalent electricity generation from the southern regional grid which entails GHG emissions at the grid end. As per the simplified methodology AMS I D/Version 13, for grid power generation as baseline scenario the Emission Factor for the displaced electricity system is calculated in CO_2 Baseline Database (Version 3.0, 15th December 2007) database in accordance to the 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)'

Calculation of CO_2 emission factor for the electricity source i (where i=gr (grid)

CO_2 emission factor for the Southern Regional electricity grid is determined as follows:

Project proponent has calculated EF_{grid} using Combined Margin (CM). CM has been estimated based on guidance given in 'Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)'.

EF_{grid} is calculated as Combined Margin (CM) which is the combination of Operation Margin (OM) and Build Margin (BM) factors according to the following six steps:

Step 1: Identification of the relevant electric power system:

Central Electricity Authority (CEA), Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system. As per CEA the Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan).

For the purpose of calculating the emission reductions achieved by any CDM project, the 'Tool to calculate the emission factor for an electricity system' requires that the "*project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints*". This implies that the grid emission factors could be most appropriately calculated at the level of the five regional grids. The project activity is connected to the Southern Regional Grid network of India. Southern Regional grid comprises of 6,51,000 sq. km of area with 4 States namely Andhra Pradesh, Karnataka, Kerala and Tamilnadu, Union Territory of Pondicherry, generating stations at Central and State Sector, independent power producing stations, State DISCOMS and state transmission utilities STUs etc.[15] As per the delineation given by CEA, Kerala falls into the Southern Regional Grid.

Since the baseline involves generation of an equivalent amount of power in the Southern Regional Grid as generated by the project plant, 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 proposed project activity's crediting period

Step 2: Selection of an Operating Margin (OM) method:

For calculation of operating margin four options are available:

(a) Simple operating margin;

(b) Simple adjusted operating margin;

(c) Dispatch data analysis operating margin;

(d) Average operating margin

Simple OM has been used as the low-cost/must run resources constitute less than 50% (only 23.6 % - Average of five years, as shown in table below) of the total grid generation of Southern Grid in average of the five most recent years.

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%	27.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%	9.0%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%	28.3%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%	13.9%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%	44.1%
Average for 5 years for South							23.6%

[15] http://www.srldc.org/Brief%20Details.aspx

Step 3: Calculation of operating margin emission factor for the region based on Simple OM:

OM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 3, December 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Simple Operating Margin for Southern Region(tCO_2/MWh)	
Year	OM
2006-2007	1

Note: As per the 'Tool to calculate the emission factor for an electricity system', the calculation of OM has been done ex ante based on the most recent 3 years for which data is available at the time of PDD submission.

Step 4: Identification of the cohort of power units to be included in Build Margin (BM):

BM calculation is based on 20% most recent capacity additions in the grid based on net generation. 20% of the most recent capacity additions have been shown in Annex 3. Power plant registered as CDM project activities have been excluded from the sample group m. Capacity additions from retrofits of power plants have not been included in the calculation of the build margin emission factor.

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	27,046	28,283	28,949	31,009	31,458	33,641	35,845
East	10,670	11,619	11,968	13,686	15,594	17,203	18,764
South	24,232	24,726	25,558	25,675	26,935	27,666	30,441
West	30,082	30,625	32,890	31,956	34,145	35,201	37,099
North-East	1,039	1,043	1,134	1,150	1,552	1,531	1,366
India	93,069	96,296	100,498	103,475	109,685	115,241	123,513

Net Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North						34,340	36,511
East						17,567	18,907
South						28,228	30,442
West						35,425	38,242
North-East						1,793	1,437
India						117,353	125,538

BM calculation has been done ex-ante and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculation of build margin emission factor for the region (ex ante):

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 3, December 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Build Margin for the Southern Region(tCO_2/MWh)	
Year	BM
2006-07	0.71

Step 6: Calculation of combined margin (CM) emissions factor -CO_2 emission factor of grid ($EF_{Elec, i, j, y}$):

The CO_2 emission factor of grid $EF_{Elec,i,j,y}$ is calculated as the weighted average of the operating margin emission factor ($EF_{OM, simple, y}$) and the build margin emission factor ($EF_{BM, y}$), where the weights w_{OM} and w_{BM}, by default, are 50%[16] (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM, y}$ and $EF_{BM, y}$ are calculated as described in Steps 1 and 2 above and are

$EF_{Elec,i,j,y} = 0.5(EF_{OM, simple, y} + EF_{BM, y})$

$EF_{Elec,i,j,y} = 0.854$

[16] According to the "Tool to calculate the emission factor for an electricity system-Version 01 (EB 35)", $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period , and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Annex 4

MONITORING INFORMATION

The CDM mechanism stands on the quantification of emission reductions and keeping the track of the emissions reduced. The proposed project activity reduces the carbon dioxide whereas an appropriate monitoring system ensures this reduction is quantified and helps maintaining the required level. The monitoring system for the CDM project activity has been developed in order to determine the baseline emissions and the project emissions (if any) over the entire credit period.

Objective

- To ensure proper monitoring and recording of all the parameters required for the computation of emission reductions from the project activity (as mentioned in Section B.7.1 of the PDD)
- To ensure proper evaluation of the project activity performance at regular intervals
- To identify the discrepancies in the data monitoring, recording and archiving system and to open up the opportunities for future improvement.

The project proponent has developed a 'CDM Team' who will be involved in monitoring, reporting and verification of all the GHG performance related parameters.

Hierarchal Level	CDM Team	Roles and Responsibility
Level -4	Panel Operators	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. All of the above parameters will be recorded in hard as well as electronic copies and will be maintained for the entire crediting period + 2 years.
Level -3	Shift –in –charge	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.
Level -2	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 Engineer in- charge will also be responsible for verifying the daily records of electricity (kWh) and joint authorization of monthly figure from the main meter provided at the plant premises.
Level -1	General Manager (Projects)	He 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.
