

**MONITORING REPORT FORM (CDM-MR) \***  
**Version 01 - in effect as of: 28/09/2010**

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\* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

**MONITORING REPORT**  
**Version 1.0 and date 19/12/2011**

**2 X 3.5 MW ULLUNKAL HYDRO POWER PROJECT IN KERALA, INDIA**

**Reference Number: 2937**

**Monitoring Period: 01**

**Monitoring Period: 08/03/2010-31/10/2011 (both days included)**

**SECTION A. General description of the project activity**

**A.1. Brief description of the project activity:**

**Purpose of the Project Activity:**

The project activity involves generation of electricity by EDCL Power Projects Limited through a run-of-the-river power plant across the left bank of the river Kakkad. The project activity is located at Chittar village, in the district of Panthamthitta, in the state of Kerala. The power generated will be exported to the Southern Regional Electricity grid post the auxiliary consumption by the power plant.

The project activity has been developed as an IPP by EDCL Power Projects Limited. The total installed capacity of the project activity is 7 MW (3.5 MW X 2). The purpose of the project activity is to generate clean power by utilizing the hydel power generating potential of the river Kakkad. The project has contributed towards reduction of GHG emissions by displacing equivalent amount of electricity in the fossil fuel dominated Southern grid.

**Brief description of the installed technology and equipments**

The project activity comprises of a 2 X 3.5 MW run-of-the-river hydro power plant. The river water is diverted through a high concrete gravity and gated diversion weir. It is then guided through a penstock gate and jetted into the turbine. This action rotates the turbine which in turn rotates the generator thus producing electricity. Two horizontal shafts, “S type” full Kaplan turbines have been installed at the project site. The electricity after meeting the in-house auxiliary consumption will be exported to the Southern Regional Grid.

**Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)**

The construction of the project activity started in September, 2006 and it took almost 2 years to complete the construction. The project activity was commissioned on 26th September, 2008 and it has continued operation since then with no major interruption in generation.

**Total emission reductions achieved in this monitoring period.**

The total emission reduction achieved during this monitoring period (08/03/2010 – 31/10/2011 both days inclusive) is 36,097 tCO<sub>2</sub>.

**A.2. 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	M/s. EDCL Power Projects Limited	No

**A.3. Location of the project activity:**

The project site is located at Chittar village which is in the district of Pathanamthitta in the state of Kerala. The site is 33 km from Panthanmthitta. 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 geographical co ordinates of the project activity are given below:

Latitude: 9°20'30" N

Longitude: 76°56'00"E

**A.4. Technical description of the project**

The hydro power plant consists 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	48m
Height above bed	12m
Maximum discharge capacity	1120m <sup>3</sup> /s
Spillway	
Length of the spillway	30 m
Crest level of spillway	52.5 m

<b>Intake</b>	
Size of Intake Gate	1X 4.3X4.3
Number of Intake Gate Vents	2
<b>Penstock</b>	
No. of Penstocks	2
Diameter of Pipe	3.8m
Thickness of Pipe	12mm
Discharge in One Pipe	48.13m <sup>3</sup> /s
<b>Turbine</b>	
Type	Horizontal Shaft, S Type, Full Kaplan
Number	2
Capacity	3.5 MW each
<b>Tail Race Channel</b>	
Mode of Discharge	Direct to River
Number of draft tube vents	2
Size of the Draft tube gate	1X5.3X3.3
<b>Power Evacuation</b>	
Voltage Level	11KV
Number of Circuits	2
Length of Transmission Line	4km
Interconnection Point	Kakkad 11 kV sub station

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

**Title of the 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 I, EB 36 of the Appendix B of Simplified Modalities and Procedures (M&P) of Small Scale CDM Project Activities.

**A.6. Registration date of the project activity:**

08<sup>th</sup> March, 2010

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

The crediting period for the project activity is 10 years.

Start Date of the crediting period: 08/03/2010

End Date of the crediting period: 07/03/2020

<b>A.8. Name of responsible person(s)/entity(ies):</b>
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Contact Information of Responsible Person

Designation: Advisor

Responsible Person: Mr L.K. Sadani

Mobile: +91-98310 27058

E-mail: [lbsadani@gmail.com](mailto:lbsadani@gmail.com)

Address : EDCL House-1-A, Elgin Road, Kolkata – 700020. West Bengal

<b>SECTION B. Implementation of the project activity</b>
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<b>B.1. Implementation status of the project activity</b>
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The project activity involves the implementation of a 7 MW (2 X 3.5 MW) hydro power project at Chittar village in the district of Pathanamthitta in the state of Kerala. The project was commissioned on 26<sup>th</sup> September, 2008 and is operational since then.

There have been no events or situations during the monitoring period, which may impact the applicability of the methodology.

<b>B.2. Revision of the monitoring plan</b>
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There is no change in the monitoring plan of the project activity.

<b>B.3. Request for deviation applied to this monitoring period</b>
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No deviations have been applied for this project activity.

<b>B.4. Notification or request of approval of changes</b>
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Not Applicable

## **SECTION C. Description of the monitoring system**

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 registered 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' that is involved in the monitoring, reporting and verification of GHG performance related parameters.

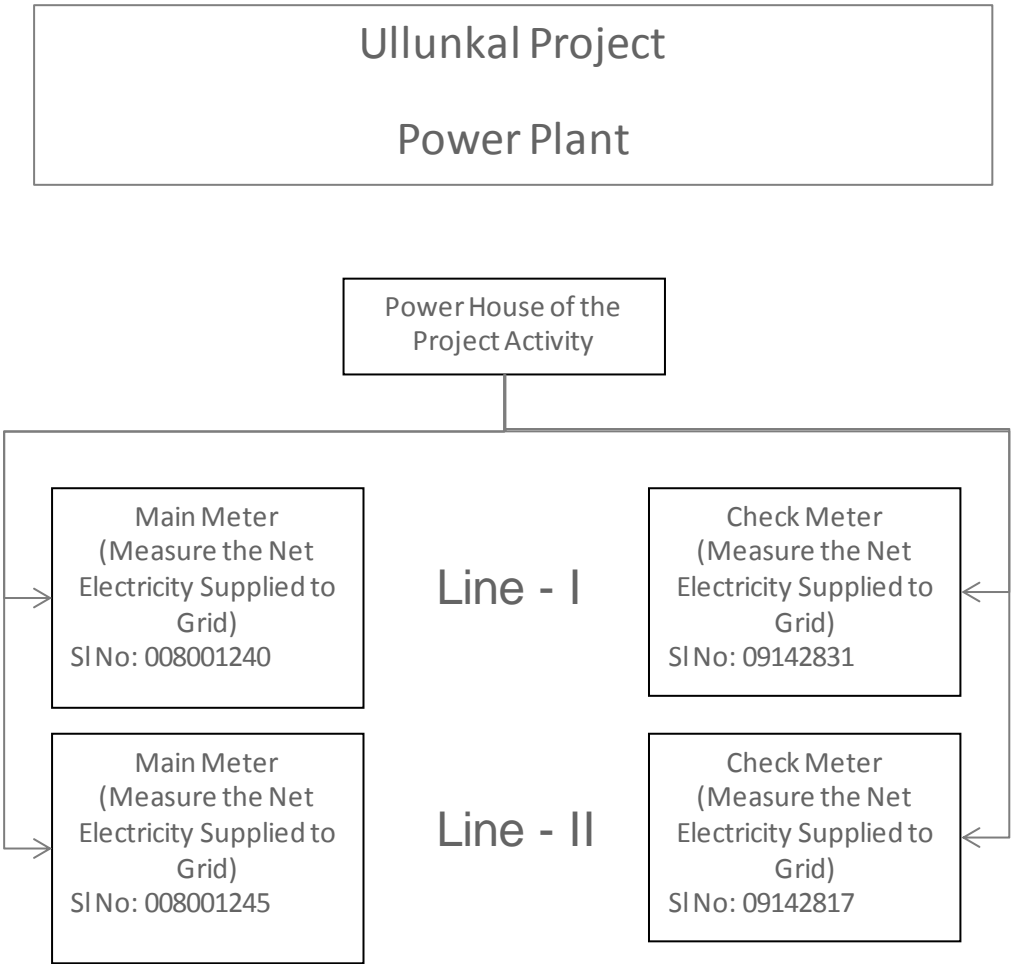
**Recording & Reporting of Data:** Registration of data (total electricity generated and auxiliary electricity) is available online. Measurement of the export of energy by the project activity is done at the plant premises, where there is a dual energy metering system – (i) external metering system comprising of the main meter, that is sealed, maintained and calibrated by KSEB and (ii) internal metering system comprising of the check meter that is maintained by the project proponent. Monthly joint meter reading of the main meter is taken by the designated officials KSEB and EDCL Power Projects Limited. Monthly power export invoice are generated by EDCL Power Projects Limited against the joint meter readings.

**QA/QC Procedure to be followed:** The parameters are monitored with meters of reputed make. The main meter is sealed maintained and calibrated by KSEB where as the check meter is maintained and calibrated by the project proponent. According to the state electricity board's (grid operator) regulations also, the calibration and verification of electricity meters are mandatory for all power generating units. Net electricity exported to the Southern Regional Grid is verified against the monthly electricity invoice(s).

**Verification of monitored parameters:** The readings recorded by the Shift In-charge in the Plant Log Book are verified by the Engineer-in-Charge on a daily basis. The Internal Audit, conducted once in a year by Management, ensures the compliance of the monitoring system as described in the 'Monitoring Plan'. In case of any non compliance of the monitoring system from that of the 'Monitoring Plan', corrective actions are suggested by the Internal Audit team. The same is addressed on a priority basis

by the Project Management Team. Reviewing of such corrective actions is included in the agenda of the subsequent Internal Audit.

**Line Diagram showing Monitoring Points**





## SECTION D. Data and parameters

### D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

<b>Data / Parameter:</b>	EF <sub>GRID</sub>
Data unit:	tCO <sub>2</sub> /MWh
Description:	Emission Factor of the Southern Regional grid (tCO <sub>2</sub> /MWh)
Source of data used:	CO <sub>2</sub> Baseline Database for Indian Power Sector (Version 3.0, December 2007) published by Central Electricity Authority, Ministry of Power, Govt. of India, calculated in accordance to the 'Tool to calculate the emission factor for an electricity system-Version 01 ( EB 35)'
Value(s) :	0.85
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The value of EF <sub>GRID</sub> considered has been calculated in CO <sub>2</sub> Baseline Database for Indian Power Sector (Version 3.0, December 2007), calculated in accordance to the ' <i>Tool to calculate the emission factor for an electricity system</i> '-Version 01 ( EB 35)'
Additional comment:	Please refer Annex 3 of the registered PDD for details.

<b>Data / Parameter:</b>	NCV <sub>DG</sub>
Data unit:	TJ/Gg
Description:	Net Calorific Value of Diesel
Source of data used:	IPCC, 2006 guidelines
Value(s) :	43
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for the calculation of project emission resulting from the operation of DG sets (if any)
Additional comment:	Please refer section B.6.2 of the registered PDD for details.

<b>Data / Parameter:</b>	OXID
Data unit:	-
Description:	Oxidation Factor
Source of data used:	IPCC, 2006 guidelines
Value(s) :	1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for the calculation of project emission resulting from the operation of DG sets (if any)
Additional comment:	Please refer section B.6.2 of the registered PDD for details.

<b>Data / Parameter:</b>	EF <sub>DG</sub>
Data unit:	tCO <sub>2</sub> /TJ
Description:	Emission Factor of Diesel
Source of data used:	IPCC, 2006 guidelines
Value(s) :	74.1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for the calculation of project emission resulting from the operation of DG sets (if any)
Additional comment:	Please refer section B.6.2 of the registered PDD for details.

<b>Data / Parameter:</b>	D <sub>DG</sub>
Data unit:	Kg/litre
Description:	Density of Diesel
Source of data used:	IPCC, 2006 guidelines
Value(s) :	0.89
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for the calculation of project emission resulting from the operation of DG sets (if any)
Additional comment:	Please refer section B.6.2 of the registered PDD for details.

## **D.2. Data and parameters monitored**

<b>Data / Parameter:</b>	EG <sub>y</sub>
Data unit:	KWh
Description:	Net units of electricity substituted in the Southern Regional Electricity grid during the year y.
Measured /Calculated /Default:	Measured
Source of data:	Electricity generation parameters are available online. The readings are recorded directly in the Central Control Room on a daily basis. The Shift In-charge of the power plant takes reading of the data and maintains complete and accurate records on a daily basis in the Plant Log Book for proper administration. The daily and monthly reports are prepared based on the recorded parameters
Value(s) of monitored parameter:	42,471,687 kWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline Emissions

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>From 08/03/2010 to 01/09/2010</b>	
	<b>Line 1</b>	<b>Line 2</b>
	Make: L&T	Make: L&T
	SI No: 07360977 (Line 1)	SI No: 07041610 (Line 2)
	Multiplication Factor: 30000	Multiplication Factor: 30000
	Accuracy Class: 0.2	Accuracy Class: 0.2
	<b>From 02/09/2010 to 31/10/2011</b>	
	<b>Line 1</b>	<b>Line 2</b>
	Make: L&T	Make: L&T
	SI No: 008001240 (Line 1)	SI No: 008001245 (Line 2)
	Multiplication Factor: 70	Multiplication Factor: 70
	Accuracy Class: 0.2	Accuracy Class: 0.2
Measuring/ Reading/ Recording frequency:	Monthly	
Calculation method (if applicable):	Not Applicable	
QA/QC procedures applied:	Net Electricity exported to the southern grid is verified against the invoices raised by EDCL Power Projects Limited to Kerala State Electricity Board	

<b>Data / Parameter:</b>	FF <sub>i</sub>
Data unit:	litres
Description:	Quantity of diesel used in the DG set in the year y
Measured /Calculated /Default:	Measured
Source of data:	Plant Records
Value(s) of monitored parameter:	1,358 litres
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>Diesel Flow Meter</b> Make: Aqua Metro  Sl. No: 4794202  Model: VZ04
Measuring/ Reading/	The parameter is measured continuously <i>i.e.</i> whenever Diesel is

Recording frequency:	consumed in the DG set in case of blackout situation
Calculation method (if applicable):	Not Applicable
QA/QC procedures applied:	The recorded diesel consumption figures is cross-checked with the calculated value obtained from operating hours of DG set and diesel Consumption per hour of DG set as per manufacturer's specifications.

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

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The start date of the monitoring period for the project activity is 08<sup>th</sup> March,2010 i.e the date of registration of the project activity. The emission factor for the southern grid has been calculated ex-ante the same will be fixed for the entire crediting period. Grid Emission Factor ( $EF_{GRID}$ ) = 0.85 tCO<sub>2</sub>/MWh. The value of net electricity exported to the grid is taken from the monthly invoices that EDCL Power Projects Limited raises to Kerala State Electricity Board.

The generation details for the current monitoring period are provided in the table below:

Year	Time Period	Net Electricity Exported to the grid(KWh)
<b>2010</b>	08/03/2010-31/03/2010	1,451,117.00
	01/04/2010-30/04/2010	1482300.00
	01/05/2010-31/05/2010	1571400.00
	01/06/2010-30/06/2010	2627100.00
	01/07/2010-31/07/2010	3172500.00
	01/08/2010-31/08/2010	2907000.00
	01/09/2010-30/09/2010	2102230.00
	01/10/2010-31/10/2010	2595950.00
	01/11/2010-30/11/2010	1979040.00
	01/12/2010-31/12/2010	1464330.00
<b>2011</b>	01/01/2011-31/01/2011	1381870.00
	01/02/2011-28/02/2011	1020460.00
	01/03/2011-31/03/2011	1987020.00
	01/04/2011-30/04/2011	1977220.00
	01/05/2011-31/05/2011	1842750.00
	01/06/2011-30/06/2011	2841160.00
	01/07/2011-31/07/2011	2497110.00
	01/08/2011-31/08/2011	2866360.00
	01/09/2011-30/09/2011	2825690.00
	01/10/2011-31/10/2011	1879080.00
<b>Total Electricity exported to the grid during the monitoring period</b>		<b>42,471,687</b>

Net units of electricity substituted in the Southern Regional Electricity grid during the monitoring period ( $EG_y$ ).= 42,471.69MWh

Now, Baseline Emission

$$BE_y = EG_y * EF_{GRID}$$

$$\begin{aligned} \text{Baseline Emission for the monitoring period under consideration} &= (42471.69 \times 0.85) \text{ tCO}_2 \\ &= \mathbf{36,100.93 \text{ tCO}_2} \end{aligned}$$

## E.2. Project emissions calculation

As per section B.6.1 of the registered PDD the emission from the combustion of fossil fuel in the DG sets is given as :

$$PE_{DG} = \left( \frac{FF_{DG} \times D_{DG}}{10^6} \right) \times NCV_{DG} \times Oxid \times EF_{DG}$$

Where,

Parameter	Description
$PE_{DG}$	Project Emissions due to electricity generation from the in-house DG set
$NCV_{DG}$	Net Calorific Value of Diesel
$FF_{DG}$	Fuel consumption of the DG set
$Oxid$	Oxidation factor
$EF_{DG}$	Emission Factor of Diesel
$D_{DG}$	Density of Diesel

As per Monitoring details ,

$FF_{DG}$  i.e. total diesel consumed for the monitoring period = 1,358 litres.

$D_{DG}$  i.e density of diesel = 0.89 kg/litres.

$NCV_{DG}$  i.e. Net calorific value of diesel = 43 TJ/Gg.

$Oxid$  i.e. oxidation factor =1.

$EF_{DG}$  i.e. emission factor of diesel = 74.1 tCO<sub>2</sub>/TJ

$$\begin{aligned} \text{Hence, the total emission due to operation of DG sets} &= (1358 \times 0.89) / 10^6 \times 43 \times 1 \times 74.1 \\ &= \mathbf{3.85 \text{ tCO}_2}. \end{aligned}$$

## E.3. Leakage calculation

As per the guidelines prescribed in the methodology applied to this project activity, AMS-I.D Version 13, *“If the energy generating equipment is transferred from another activity or if the existing*

*equipment is transferred to another activity, leakage is to be considered.”* Hence for this case the leakage emission will be zero.

Thus, Leakage Emissions (LE<sub>y</sub>) = 0 tCO<sub>2</sub>

#### **E.4. Emission reductions calculation / table**

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Total baseline emissions (BE<sub>y</sub>): 36,100.93 tCO<sub>2</sub>

Total project emissions (PE<sub>y</sub>) : 3.85 tCO<sub>2</sub>

Total leakage (LE<sub>y</sub>): 0 tCO<sub>2</sub>

Total emission reductions: Baseline Emission – Project Emission – Leakage Emission

$$= 36,100.93 - 3.85 - 0$$

$$= 36,097 \text{ tCO}_2 \text{ (Rounded down to the nearest integer number)}$$

#### **E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

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Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO <sub>2</sub> )	36,260 tCO <sub>2</sub>	36,097 tCO <sub>2</sub>

#### **E.6. Remarks on difference from estimated value in the PDD**

As per the registered PDD the estimated emission reduction from the project activity equals to 21,949 tCO<sub>2</sub>/annum, which translates to be around 60.13 tCO<sub>2</sub> per day. The current monitoring period covers (08/03/2010 to 31/10/2011) 603 days. Therefore the estimated emission reduction with respect to the *ex-ante* prediction of the project is calculated to be 36,260 tCO<sub>2</sub>.

The calculated emission reduction during the monitoring period based on the monitored data is 36,097 tCO<sub>2</sub>. This is 0.45% lower than the predicted emission reduction volume.

The deviation in the estimated emission reduction and the actual emission reduction is attributed to the decreased plant availability due to variation in monsoonal rainfall at the location where the project activity is situated.

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### History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Guideline, Form <b>Business Function:</b> Issuance		