Monitoring Report
(Version 06)
Date: 13.12.2010

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

UN Reference Number: 2937
Methodology: AMS I D/Version 13

Monitoring Period

26 September 2008 – 28 February 2010
(both days inclusive)

Energy Development Company Limited(EDCL)
7.Camac Street, 1st Floor, Kolkata-700017
Azimganj House, Kolkata

Contents

1.0 General Information

1.1 Project Activity

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 project activity is Independent Power Producer (IPP) by EDCL. The small scale project activity under consideration consists of a 7 MW run-of-the-river hydro power project that utilizes the water of river Kakkad. Since the project is a run-of-river type, minimal storage of water is required at the weir. A diversion weir has been constructed to divert the river water. The diverted water is taken through an intake conduit. Then it flows through two penstock intake gates into the power house. Each penstock leads to a horizontal shaft Kaplan type turbine. Two turbines of 3.5 MW capacity is employed to generate electricity which is exported to the Southern Regional Grid. 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.

1.2 Project Commissioning

Start date of operation: 26/09/2008

1.3 Monitoring Period

The monitoring period is chosen from 26/09/2008 to 28/02/2010 (both days included).

1.4 Monitoring Protocol

The emission reduction resulting from the project activity is calculated as a difference between the 'Baseline Emissions (BE_y)' and the 'Project Emissions from in house DG Consumption(PE_{DG})' following the guidance of the Approved Small-scale Methodology AMS ID/ Version 13.

The monitoring protocol requires the following parameters to be monitored for the purpose of determination of baseline emissions:

- Net units of electricity substituted in the grid during the year 'y' (in MWh)
  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 and calibrated by the project proponent. Net electricity exported to the grid, is 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 is taken by the designated officials KSEB and EDCL. Monthly power export bills are generated by EDCL against the main meter readings. Emission reduction is claimed on the basis of the net electricity exported to grid as per the joint meter readings, since the same is the most conservative figure.
- Emission factor of the Grid (in tCO_2/MWh)
  The value of EF_{GRID} has been calculated ex-ante and has been kept fixed for the entire crediting period. The same has been sourced from the CO_2 Baseline Database for Indian Power Sector (Version 3.0, December 2007).

The monitoring protocol requires the following parameters to be monitored for the purpose of determination of project emissions from in-house DG Consumption:

- Net Calorific Value of the Diesel

  The value has been taken from IPCC 2006 guidelines and is considered to be 43 TJ/Gg which has been kept fixed ex-ante

- Fuel consumption of the DG Set

  The same was monitored (*i.e.* whenever there was DG Operation). The same is further cross verified with the receipts of the diesel bought inside the plant.

- Oxidation Factor

  The value has been taken from IPCC 2006 guidelines which and is considered to be 1 and has been kept fixed ex-ante.

- Density of Diesel

The value has been taken from IPCC 2006 guidelines which and is considered to be 0.89 and has been kept fixed ex-ante.

- Emission Factor of Diesel

The value has been taken from IPCC 2006 guidelines and is considered to be 74.1 tCO_2/TJ which has been kept fixed ex-ante.

1.5 Details of Monitoring Parameters as per Section 7.1 of registered PDD

1.5.1 Parameters for Baseline Emissions

<table>
<tr><th colspan="2">Parameter 1: Total Electricity Generated</th></tr>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Measured, Calculated, Estimated</td><td>Measured</td></tr>
<tr><td>Source of Data</td><td>Monthly Joint Meter Readings and cross verified with the Electricity Invoice of EDCL.</td></tr>
<tr><td>Measurement Unit</td><td>MWh</td></tr>
<tr><td>Monitoring Equipment</td><td>Two Energy Meters in line 1 & 2 each (one main meter and one check meter) respectively</td></tr>
<tr><td>Location of Monitoring Equipment</td><td>The meters are located at the interconnection point between the EDCL and KSEB. Main Meters are located at the Kakkad sub-station and the Check Meters are located at the Power House of EDCL.</td></tr>
<tr><td>Specification of Monitoring Equipment</td><td>The details of the two joint meters are as provided below:

<u>Main Meter</u>

<table>
<tr><td>Line 1</td><td>Line 2</td></tr>
<tr><td>Make: L&T</td><td>Make: L&T</td></tr>
<tr><td>Sl No: 07360977 (Line 1)</td><td>Sl No: 07041610 (Line 2)</td></tr>
<tr><td>Multiplication Factor: 30000</td><td>Multiplication Factor: 30000</td></tr>
<tr><td>Accuracy Class: 0.2</td><td>Accuracy Class: 0.2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><u>Check Meter</u>

<table><tr><td>Line 1</td><td>Line 2</td></tr><tr><td>Make: Secure Meters</td><td>Make: Secure Meters</td></tr><tr><td>Sl No: EL110501 (Line 1)</td><td>Sl No: EL110502 (Line 2)</td></tr><tr><td>Accuracy Class: 0.5s</td><td>Accuracy Class: 0.5s</td></tr></table></td></tr>
<tr><td>Calibration of Monitoring Equipment</td><td><u>Main Meter</u>

Calibration is solely under the purview of KSEB.

<table><tr><td>Line 1</td><td>Line 2</td></tr><tr><td>10.10.2007 (Manufacturer’s Calibration before supply of the meter)</td><td>5.12.2007 (Manufacturer’s Calibration before supply of the meter)</td></tr><tr><td>03.09.2008 done by TMR division of KSEB[1]</td><td>03.09.2008 done by TMR division of KSEB</td></tr></table>(vide Test Report 46/08-09)

<u>Check Meter</u>

<table><tr><td>Line 1</td><td>Line 2</td></tr><tr><td>07.09.2007 (Calibration before supply of the meter done by Secure Meters)</td><td>07.09.2007 (Calibration before supply of the meter done by Secure Meters)</td></tr></table>Initial calibration vide test report (dated 07/09/2007)</td></tr>
<tr><td>Accuracy of Monitoring Equipment</td><td>Class-0.2</td></tr>
<tr><td>Uncertainty of Data</td><td>Low</td></tr>
</table>

[1] Vide Test Report 46/08-09

Justification	The main meter readings have been considered for emission reduction computation to be on the most conservative side since the main meter is located at the end of the interconnection point thus the reading takes into account the transmission losses (if any). Calibration is done in accordance to the guidance provided in EB 35 Annex 35 para 12(c) (once in three years). The uncertainty of the data is considered to be low as the monitoring equipment is of reputed make and of high accuracy level.

1.5.2 Parameters monitored for Project Emissions

Parameter 1: Quantity of Diesel used for DG Generation	
Parameter	Description
Measured, Calculated, Estimated	Measured
Source of Data	Plant Records-Taken from the Diesel flow meter
Measurement Unit	Litres
Monitoring Equipment	Oil Meter
Location of Monitoring Equipment	The meter is located at the inlet of the Diesel Generator.
Specification of Monitoring Equipment	Make- Aqua Metro Model-VZ04 Serial Number-4794202
Calibration of Monitoring Equipment	Initial calibration done before the commissioning of the plant on 24/09/2008 (vide Certificate of calibration Number OM08-109)
Accuracy of Monitoring	Error levels within-+/-0.5% (as per calibration

Equipment	certificate)
Uncertainty of Data	Low
Justification	The uncertainty of the data is considered to be low as the monitoring equipment is of reputed make and of high accuracy level. Further the data recorded can be cross verified with the purchase receipts. Calibration is done in accordance to the guidance provided in EB 35 Annex 35 para 12(c) (once in three years).

2.0 Monitored Results

Parameters monitored for Baseline Emissions

Month	Net units of Electricity substituted in the grid	Emission Factor of the Grid	Baseline Emissions
	EG_y	EF_{GRID}	BE_y
	(MWh)	(tCO2/MWh)	(tCO2)
26/09/2008-31/10/2008	801.90	0.85	681.62
November-08	849.60		722.16
December-08	737.70		627.05
ER (Year 2008)	**2389.20**		**2030.82**
January-09	760.20		646.17
February-09	909.30		772.91
March-09	1113.90		946.82
April-09	905.40		769.59
May-09	835.20		709.92
June-09	1368.30		1163.06
July-09	2563.80		2179.23
August-09	2191.80		1863.03
September-09	2451.60		2083.86
October-09	2104.50		1788.83
November-09	2291.70		1947.95
December-09	1476.90		1255.37
ER (Year 2009)	**18972.60**		**16126.71**
January-10	1110.30		943.76
February-10	852.00		724.20
ER (Year 2010)	**1962.30**		**1667.96**
Total	**23324.10**		**19825**

Parameters monitored for Project Emissions

Month	Fuel Consumption in the DG Set	Density of diesel	Net Calorific Value of the Diesel	Oxidation Factor	Emission Factor of the Diesel	Project Emissions due to DG Generation
	FF_{DG}	D_{DG}	NCV_{DG}	Oxid	EF_{DG}	PE_{DG}
	(litres)	(kg/litre)	(TJ/Gg)	-	(tCO2/TJ)	(tCO2)
26/09/2008-31/10/2008	50					0.14
November-08	50					0.14
December-08	50					0.14
ER (Year 2008)	**150.00**					**0.43**
January-09	50					0.14
February-09	25					0.07
March-09	50					0.14
April-09	50					0.14
May-09	50					0.14
June-09	50	0.89	43	1.00	74.1	0.14
July-09	25					0.07
August-09	50					0.14
September-09	50					0.14
October-09	50					0.14
November-09	50					0.14
December-09	50					0.14
ER (Year 2009)	**550.00**					**1.56**
January-10	25					0.07
February-10	25					0.07
ER (Year 2010)	**50.00**					**0.14**
Total	**750**					**2.13**

3.0 Computation of Emission Reduction

Month	Net units of Electricity substituted in the grid	Emission Factor of the Grid	Baseline Emissions	Fuel Consumption in the DG Set	Density of diesel	Project Emissions due to DG Generation	Emission Reduction
	EG_y	EF_{GRID}	BE_y	FF_{DG}	D_{DG}	PE_{DG}	ER_Y
	(MWh)	(tCO2/MWh)	(tCO2)	(litres)	(kg/litre)	(tCO2)	(tCO2)
26/09/2008-31/10/2008	801.90		681.62	50		0.14	681
November-08	849.60		722.16	50		0.14	722
December-08	737.70		627.05	50		0.14	627
ER (Year 2008)	**2389.20**		**2030.82**	**150.00**		**0.43**	**2030**
January-09	760.20		646.17	50		0.14	646
February-09	909.30		772.91	25		0.07	773
March-09	1113.90		946.82	50		0.14	947
April-09	905.40		769.59	50		0.14	769
May-09	835.20		709.92	50		0.14	710
June-09	1368.30	0.85	1163.06	50	0.89	0.14	1163
July-09	2563.80		2179.23	25		0.07	2179
August-09	2191.80		1863.03	50		0.14	1863
September-09	2451.60		2083.86	50		0.14	2084
October-09	2104.50		1788.83	50		0.14	1789
November-09	2291.70		1947.95	50		0.14	1948
December-09	1476.90		1255.37	50		0.14	1255
ER (Year 2009)	**18972.60**		**16126.71**	**550.00**		**1.56**	**16125**
January-10	1110.30		943.76	25		0.07	944
February-10	852.00		724.20	25		0.07	724
ER (Year 2010)	**1962.30**		**1667.96**	**50.00**		**0.14**	**1668**
Total	**23324.10**		**19825**	**750**		**2.13**	**19823**

4.0 Summary of Emission Reduction

Month	Net units of Electricity substituted in the grid	Baseline Emissions	Emission Reduction
	EG_y	BE_y	ER_y
	(MWh)	(tCO2)	(tCO2)
ER (Year 2008)	2389.20	2030.82	2030
ER (Year 2009)	18972.60	16126.71	16125
ER (Year 2010)	1962.30	1667.96	1668
Total	23324.10	19825	19823

Comparison of actual emission reduction claimed in the monitoring period with the estimate in the registered PDD

The Plant Load factor of the project activity has been considered to 45% based on the hydrological study in the registered PDD.

The ex-ante prediction of emission reduction based on the above PLF was 21949 tCO_2 per annum. Thus for 1 years 5 month the same would have been 31094 tCO_2 according to ex-ante prediction

However, during the start-up phase of the project activity, the Plant Load factor (PLF) achieved has been much less than the estimated figure (especially in the 1st 8 month period *i.e.* October'08-May'09, thereby leading to a lesser power generation. Furthermore, during the same period due to the unavailability of the appropriate water flow, the power generation quantum has been further reduced. This has subsequently resulted in the lower amount of Emission Reduction as compared to the predicted value in the PDD.

However compared to the ex-ante prediction the emission reduction figure actually achieved is conservative.

5.0 Management & Operational System

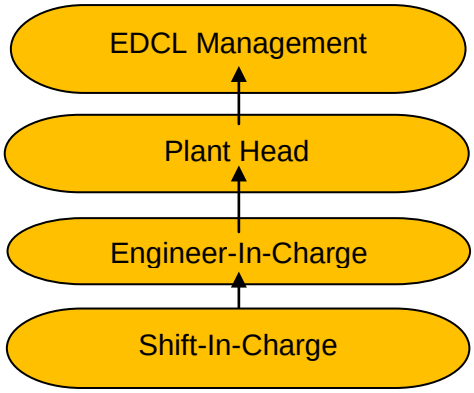
Recording & Reporting of Data: The data of the net electricity as per the check meter readings is recorded directly in the Central Control Room on a daily basis. The Shift In-charge of the power plant takes readings of the data and keeps the complete and accurate records on a daily

basis in the Plant Log Book for proper administration. The daily and monthly reports are prepared based on the recorded parameters and are cross verified with the monthly Joint Meter Readings at Kakkad substation by the Plant Head.

QA/QC Procedure to be followed: The parameters are monitored with meters of reputed make. The Shift In-charge is responsible for regular maintenance and calibration of the check meter ensures the accuracy and reliability of the metered parameters. Remedial actions are taken immediately be undertaken in case any discrepancy is identified. The calibrations of the main meters are solely under the purview of the State Electricity Board (KSEB). Therefore it can be concluded that the reliability and accuracy of the results are ensured by EDCL both as a statutory requirement and for the project activity as well.

Verification of monitored parameters

The hierarchy followed in the recording and verification of the monitored data is shown below:



The readings recorded by the Shift In-charge in the Plant Log Book are verified by the Engineer-in-Charge on a daily basis. All the records are further verified against the invoices of electricity exported once in a year by Plant Head and EDCL Management which ensures the compliance of the monitoring system as described in the 'Monitoring Plan'. In case of any non-compliance (if any) of the monitoring system from that of the 'Monitoring Plan', corrective actions are suggested by the EDCL management. The same is addressed on a priority basis by the Plant Head and Project Management Team.

6.0 VCS-PD specific requirements

Requirements	Project Applicability
Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.	The project activity is small hydro project which entails power generation from clean energy sources. Thus there cannot be any GHG emissions associated with the project activity thus it demonstrates that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction. The project is also registered project under the Clean Development Mechanism of UNFCCC (UN Reference Number-2937) which further supports the aforementioned justification.
Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates)	PP has given a declaration that the project activity has not applied for any other form environmental credits apart from CDM and VCS 2007.1
Project rejected under other GHG programs (if applicable).	The project is also registered project under the Clean Development Mechanism of UNFCCC (UN Reference Number-2937). Further to this the PP has already given a declaration that the project activity has not applied for any other form environmental credits apart from CDM and VCS 2007.1, thus there is no question of rejection from other GHG programs
Proof of Title	The project is also registered project under the Clean Development Mechanism of UNFCCC (UN Reference Number-2937). The project activity has the same title as per the title in the current Monitoring Report of VCS 2007.1 which could be verified from the UNFCCC website. The title could also be verified from the Host Country Approval the project received from

	Ministry of Environment & Forests, Government of India
Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable).	PP has given a declaration that the project activity has not applied for any form of Emissions Trading program

7.0 Simple Line Diagram