PROJECT TITLE: "VISHNUPRAYAG HYDRO-ELECTRIC PROJECT (VHEP) BY JAIPRAKASH POWER VENTURES LTD."

Document Prepared By Jaiprakash Power Ventures Ltd

Contact Information

Jaiprakash Power Ventures Limited

Sector 128, Noida -201304, Uttar Pradesh

Contact Number +91-120- 4609000

E-mail: rk.narang@jalindia.co.in

Project Title	*Vishnuprayag Hydro-electric Project (VHEP) by Jaiprakash Power Ventures Ltd.*
Version	*02*
Report ID	*VHEP/MR/12*
Date of Issue	*01-11-2012*
Project ID	*173*
Monitoring Period	*01-04-2012 to 30-09-2012 (Both days included)*
Prepared By	*Jaiprakash Power Ventures Ltd.*
Contact	*R.K. Narang* *Director* *Jaiprakash Power Ventures Limited* *Sector 128, Noida -201304, Uttar Pradesh* *Phone: +91-120- 4609000* *Email: rk.narang@jalindia.co.inIndia*

Table of Contents

1 Project Details 3
1.1 Summary Description of Project 3
1.2 Sectoral Scope and Project Type 3
1.3 Project Proponent 3
1.4 Other Entities Involved in the Project 4
1.5 Project Start Date 4
1.6 Project Crediting Period 4
1.7 Project Location 4
1.8 Title and Reference of Methodology 5
2 Implementation Status 5
2.1 Implementation Status of the Project Activity 5
2.2 Deviations from the Monitoring Plan 6
2.3 Grouped Project 6
3 Data and Parameters 6
3.1 Data and Parameters Available at Validation 6
3.2 Data and Parameters Monitored 7
3.3 Description of the Monitoring Plan 12
4 Quantification of GHG Emission Reductions and Removals 13
4.1 Baseline Emissions 13
4.2 Project Emissions 15
4.3 Leakage 18
4.4 Summary of GHG Emission Reductions and Removals 18
5 Additional Information 19
5.1 Revision in Monitoring Plan 19
5.2 Comparison between Actual VERs Generated v/s VERs Estimated in the Registered PD 19
5.3 Meter Calibration 19

1 PROJECT DETAILS

1.1 Summary Description of Project

Vishnuprayag Hydroelectric Project (VHEP), a 4 x 100 MW Run-of-the-River Project, implemented by Jaiprakash Power Ventures Ltd. (JPVL) - a subsidiary of Jaiprakash Associates Limited (JAL a well-known business group of India), is located across river Alaknanda near Joshimath in Chamoli district of Uttarakhand state of India . An agreement was entered into by the Company with State Government of Uttaranchal (now Uttarakhand), State government of Uttar Pradesh and Uttar Pradesh Power Corporation Limited (UPPCL) for implementation of VHEP.

Project activity generates electricity using renewable hydel energy and sells it to UPPCL. As the project activity involves generation of electricity by renewable source of energy it will reduce anthropogenic Green House Gases (GHG) emissions that would have been generated to supply power to grid using fossil fuel.

The project was successfully commissioned as per the schedule; running successfully till date and the expected operational lifetime for the project is 30 years. The commissioning dates of each turbine are mentioned below:

S.No.	Unit	Date of commissioning
1	Unit I	17/06/2006
2	Unit II	14/07/2006
3	Unit III	31/08/2006
4	Unit IV	13/10/2008

The total emission reductions achieved in this monitoring period is 1,106,589 CO_2.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01, Energy industries (renewable-/ non-renewable sources)

The specified project is not a part of a grouped project

Type I **:** Renewable energy projects

1.3 Project Proponent

Roles and Responsibilities:

The project proponent is responsible for installation, commissioning and subsequent operation and maintenance of the project. The project proponent is also responsible for monitoring and keeping the records as required for the project activity.

Contact Information:

R.K. Narang

Director

Jaiprakash Power Ventures Limited

Sector 128, Noida -201304, Uttar Pradesh

Phone: +91-120- 4609000

Email: rk.narang@jalindia.co.in

1.4 Other Entities Involved in the Project

No other entities involved in the project activity.

1.5 Project Start Date

03/06/2006 (commissioning date of the project activity)

1.6 Project Crediting Period

- **Credit Period:** 10 years and 0 month; fixed
- **Crediting Period**[1]: 03/06/2006 – 03/06/2016

1.7 Project Location

The project is located near Joshimath in Chamoli district of Uttaranchal (now Uttarakhand) (Between Lat. $30^0$32'-$30^0$42'N and Long. $79^0$28'-$79^0$38' E). The project site is located at Rishikesh-Badrinath highway. Nearest railhead is Rishikesh at a distance of about 250 km from the project site and 525 km from Delhi. Location is depicted in following maps-

[1] As per VCS-version 3

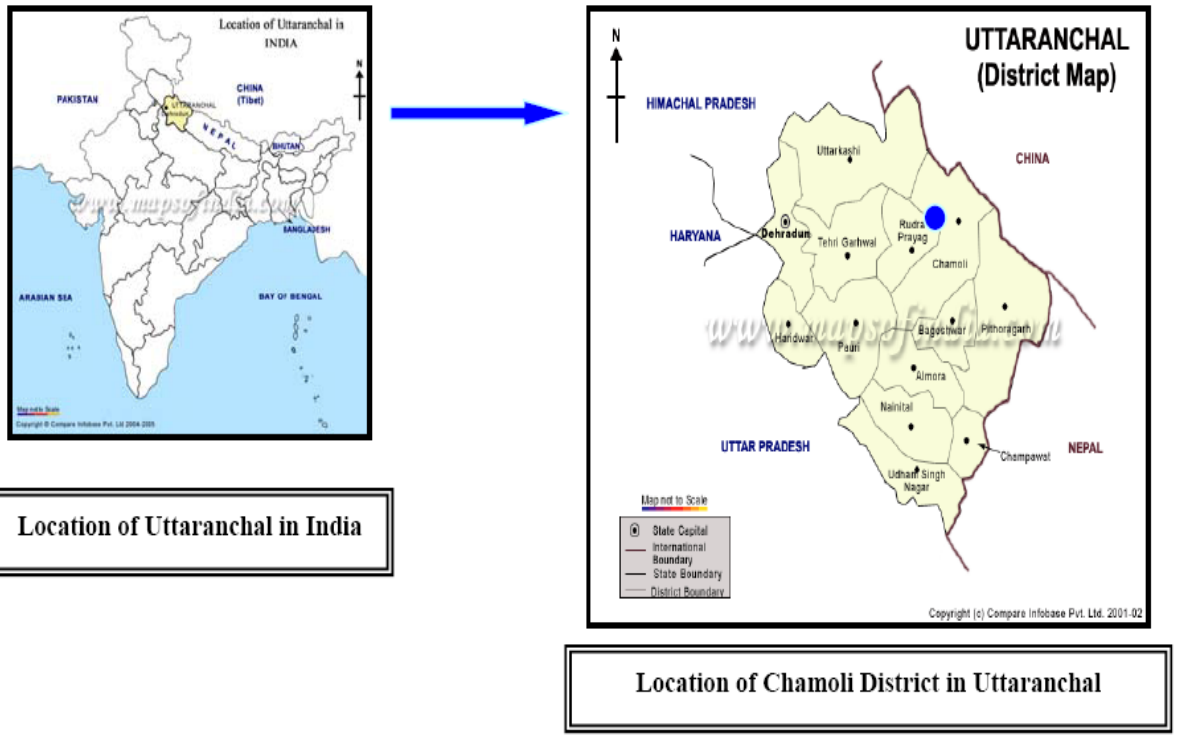


Figure 1: Location of project activity

1.8 Title and Reference of Methodology

Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated baseline methodology ACM0002/Version 06, Sectoral Scope: 1, 19/05/2006

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project was successfully commissioned as per the plan and all the four turbines are running successfully till date. The commissioning dates of each turbine are mentioned below:

S.No.	Unit	Date of commissioning
1	Unit I	17/06/2006
2	Unit II	14/07/2006
3	Unit III	31/08/2006
4	Unit IV	13/10/2008

There are no changes that have happened in project activity which may impact the applicability of the methodology.

2.2 Deviations from the Monitoring Plan

No deviation is taken during the current monitoring period

2.3 Grouped Project

The specified project is not a part of a grouped project

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	**$EFco_{2,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y
Source of data:	CEA website, publically available
Value applied:	0.75 tCO_2/MWh
Purpose of the data:	The data is used for calculation of baseline emissions. The data is based on published data on Central Electricity Authority (CEA). CEA being a central authority, undertaking of Indian government, has all the first hand information available for calculation of GEF
Any comment:	The data is fixed for crediting period

3.2 Data and Parameters Monitored

Data Unit / Parameter:	**EG_y**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project activity during the year y
Source of data:	Electricity meters maintained by state departments
Description of measurement methods and procedures to be applied:	The measurements are done from electricity meters maintained by state authorities. There is a pair of meters viz. main meter and check meter provided on each transmission line. The readings of these meters are taken as basis for calculation of emission reductions.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	1,475,549
Monitoring equipment:	Type of Meter: Energy Meters (Line I & Line II) Accuracy Class: 0.2% **Main Meters** Serial Number: APM 20005 (Line I) & APM 20004 (Line II) Calibration Frequency: Quarterly Date of last calibration for both the meters: 31/03/12 & 30/06/12 Validity: 30/06/12 & 30/09/12 **Check Meters** Serial Number: APM 20007 (Line I) & APM 20006 (Line II) Date of last calibration for both the meters : 31/03/12 & 30/06/12

	Validity: 30/06/12 & 30/09/12
QA/QC procedures to be applied:	Electricity meters are properly maintained with regular testing and calibration schedules developed as per the technical specification requirements and PPA to ensure accuracy. Electricity supply data to the grid could also be cross checked with the invoices for sale of electricity to the UPPCL.
Calculation method:	The net electricity delivered by project activity to grid is calculated by subtracting total electricity imported by project from gird via line I and II from total electricity delivered by project to grid via line I and Line II
Any comment:	The Monitored Data to be kept for a minimum period of two years after the end of the crediting period.

Data Unit / Parameter:	**EG** $_{Import,grid,y}$
Data unit:	MWh
Description:	Total electricity imported by project activity from grid during the period y.
Source of data:	Energy meter installed at plant site
Description of measurement methods and procedures to be applied:	Data is archived from energy meters installed at plant site.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	62.130
Monitoring equipment:	Type of Meter: Energy Meter Accuracy Class: 0.5% Serial Number: 619137 Calibration Frequency: Yearly Date of last calibration: 17/12/11 & 03/05/12 Validity: 17/12/2012 & 03/05/2013
QA/QC procedures to be applied:	Energy meter is calibrated as per schedule.

Calculation method:	Not applicable
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period.

Data Unit / Parameter:	**$EG_{Import,DG,y}$**
Data unit:	MWh
Description:	Total electricity imported by project activity from Diesel Generator during the period y
Source of data:	Energy meter installed at plant site
Description of measurement methods and procedures to be applied:	Data is archived from energy meters installed at plant site.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	15.867
Monitoring equipment:	Type of Meter: Energy Meter Accuracy Class: 0.5% Serial Number: 619139 Calibration Frequency: Yearly Date of last calibration: 13/01/2012 & 25/05/2012 Validity: 13/01/2013 & 25/05/2013
QA/QC procedures to be applied:	Energy meter is calibrated as per schedule.
Calculation method:	Not applicable
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period.

Data Unit / Parameter:	**EF_{OM}**
Data unit:	tCO_2/MWh
Description:	Generation Weighted Average Operating Margin
Source of data:	CEA database, version.7[2]
Description of measurement methods and procedures to be applied:	Data is calculated as generation weighted average of operating margin. Data is taken from CEA database, version 7, 1st January, 2012, which accounts for data from various plant

[2] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

	sources; uses latest versions of "**Tool to calculate the emission factor for an electricity system"**
Frequency of monitoring/recording:	Recording Frequency : Every Verification
Value monitored:	0.984
Monitoring equipment:	Not Applicable (NA)
QA/QC procedures to be applied:	NA
Calculation method:	Data is calculated as generation weighted average of operating margin. Data is taken from CEA database, version 7, 1st January, 2012, which accounts for data from various plant sources; uses latest versions of **"Tool to calculate the emission factor for an electricity system"**
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period.

Data Unit / Parameter:	**EF_{BM}**
Data unit:	tCO_2/MWh
Description:	Build Margin
Source of data:	It is calculated data taken from CEA database, version.7[3]
Description of measurement methods and procedures to be applied:	Data is taken from CEA database, version 7, 1st January, 2012, which accounts for data from various plant sources; uses latest versions of "**Tool to calculate the emission factor for an electricity system"**
Frequency of monitoring/recording:	Recording Frequency : Every Verification
Value monitored:	0.859
Monitoring equipment:	Not Applicable (NA)
QA/QC procedures to be applied:	NA
Calculation method:	Data is taken from CEA database, version 7, 1st January, 2011, which accounts for data from various plant sources; uses latest versions of **"Tool to calculate the emission factor for an electricity system"**
Any comment:	The Monitored Data to be kept for a minimum of

[3] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

	two years after the end of the crediting period.

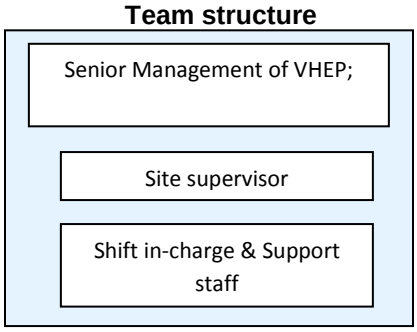
Data Unit / Parameter:	**$EF_{CO2,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 Baseline emission factor of the grid
Source of data:	It is calculated as weighted average of Operating Margin and Build Margin according to the tool to calculate the emission factor for an electricity system
Description of measurement methods and procedures to be applied:	CEA database, version.7
Frequency of monitoring/recording:	Recording Frequency : Every Verification
Value monitored:	0.921
Monitoring equipment:	Not Applicable (NA)
QA/QC procedures to be applied:	NA
Calculation method:	It is calculated as : 0.5 % * EF_{OM} + 0.5 % EF_{BM} The data for Operating Margin and Build Margin is taken from CEA database, version 7, 1st January, 2012, which accounts for data from various plant sources; uses latest versions of **"Tool to calculate the emission factor for an electricity system"**
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period.

Data Unit / Parameter:	**$EF_{CO2,DG}$**
Data unit:	tCO_2/MWh
Description:	Emission Factors for diesel generator systems
Source of data:	CDM Methodology AMS 1-F "**Renewable electricity generation for captive use and mini-grid**", version.2
Description of measurement methods and procedures to be applied:	Default, As per AMS 1-F, version.2, Table I.F.1, for diesel generators of capacity more than 200 KW
Frequency of monitoring/recording:	Recording Frequency : Every Verification
Value monitored:	0.8
Monitoring equipment:	NA
QA/QC procedures to be applied:	NA

Calculation method:	NA
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period.

3.3 Description of the Monitoring Plan

A project team is constituted with participation from relevant departments. This team will be responsible for data collection and archiving. This team will meet periodically to review performance of project activity, check data etc. In case of any irregularity observed by any of the CDM team member, it shall be informed to the concerned person for necessary actions. On monthly basis, these reports are forwarded at the management level.



Senior Management of VHEP/Technical Head: Overall responsibility of compliance with the monitoring plan.

Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation

Shift In-charge: Responsibility of daily report generation

Data Monitoring:

Completeness-

For Electricity generation data: The project activity has installed the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. An hourly log and daily report, of data is prepared by the shift in-charge. Parameters monitored are the total power generated, power exported to the grid and auxiliary power consumed.

Reliability-

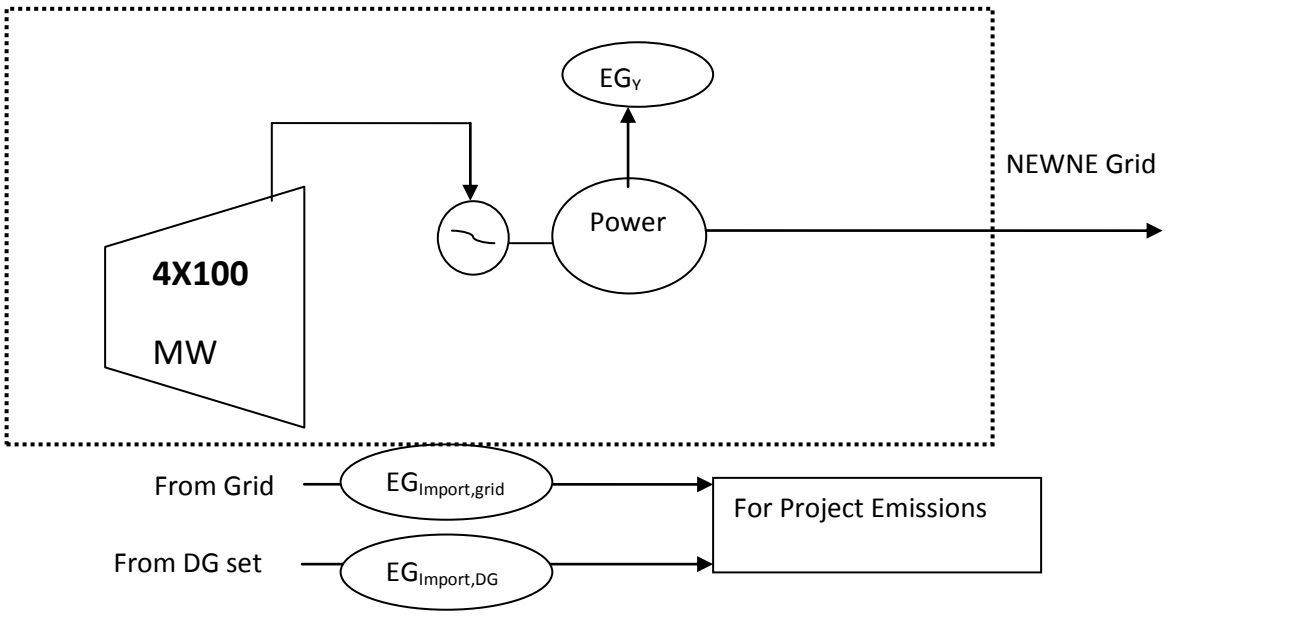
For electricity generation data: automatic control meters for power generation and exports are regularly maintained. The regular plant operation & maintenance procedure also includes process of regular meter testing, calibration & maintenance.

Actual power generation data is also metered using power output meter at the substation. The billing invoices for the power sold and meter readings could be used to validate the data accuracy.

Frequency-

The measurement is recorded and monitored on a continuous basis. An hourly log is prepared by the shift in-charge. At the end of the day, hourly data is aggregated in a daily report.

All relevant monitoring points for the project are depicted in the diagram below:



EG_Y = Energy Meter for measuring electricity supplied to the grid by the project activity during the year y

$EG_{Import,grid}$ = Energy Meter for measuring electricity imported by project activity from grid

$EG_{Import,DG}$ = Energy Meter for measuring electricity imported by project activity from Diesel Generator

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

"The baseline is the MWh produced by the renewable generating unit multiplied by an emission coefficient (measured in tCO_2eq/MWh) calculated in a transparent and conservative manner as: The weighted average emissions (in tCO_2eq/MWh) of the current generation mix.

$BEy = EF_{co2,y} X EG_y$

Where,

BE_y : Baseline emissions

EG_y : Electricity supplied to the grid by the project activity during the year y in MWh, and

$EF_{co2,y}$: CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

Energy supplied to Grid

The energy supplied to grid is measured using electricity meters at the supply points. The net electricity supplied is measured as

EG_y = Total Generation – Auxiliary Consumption

Energy supplied to Grid

The energy supplied to grid is measured using electricity meters at the supply points. The net electricity supplied is measured as

EG y = Total Generation – Auxiliary Consumption

Power generation details for current verification are as follows (all figures in MWh):

Month	Net Generation EGy (Power Supplied to Grid) (MWh)*
April,12	81,356
May,12	1,81,738
June,12	2,98,948
July,12	3,09,883
August,12	2,97,196
September,12	3,06,428
Total	**14,75,549**

*** As a conservative approach, the figures, for each month, have been rounded down.**

Grid Emission Factor

The GEF is fixed ex-ante in the PDD as given below:

Parameter	Value
OM	0.98

BM	0.53
CM	**0.75**

Therefore **EF** $_y$ = 0.75 tCO_2/MWh

For baseline emission calculation the grid emission factor has been calculated, in accordance with ACM0002, version 6, dated 19/05/ 2006 using the values for operating margin and build margin emission factors provided in the CEA database and their respective weights for calculation of combined margin emission factor. The baseline grid emission factor (CM) has been established ex-ante as 0.75 t CO_2e/MWh. This is conservative compared to the calculated value of 0.921 tCO_2e/MWh for the project emission calculation based on the CEA CO_2 baseline data base version.7 for the NEWNE grid (which comprises northern grid) published in the year 2011-12.

Baseline Emissions

Formula for Baseline emissions as discussed is GEN i * GEF

Month	Electricity Delivered to the grid (MWh)	Grid emission factor (tCO_2/MWh)	Baseline emissions (tCO_2)*
April,12	81,356	0.750	61,017
May,12	1,81,738	0.750	1,36,304
June,12	2,98,948	0.750	2,24,211
July,12	3,09,883	0.750	2,32,412
August,12	2,97,196	0.750	2,22,897
September,12	3,06,428	0.750	2,29,821
Total	**14,75,549**		**11,06,661**

* Total baseline emission has been rounded down as a conservative approach

4.2 Project Emissions

Project activity emissions have been calculated for the amount of electricity imported from the state grid and DG sets for running the auxiliaries.

Calculation of Grid emission factor:

Calculation of the operating margin emission factor according to the selected method

The full generation weighted average for the most recent years has been considered from the Central Electricity Authority data[4].

Operating Margin

Year	Simple Operating Margin (tCO_2/MWh)	Net Generation (MWh)
2008-09	1.01	421,802,632.89
2009-10	0.98	458,043,084.56
2010-11	0.97	476,986,721.35
Generation weighted average	0.984	

Calculation of build margin:

Build Margin

Year	tCO_2/MWh
2010-11	0.859

Calculation of combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

[4] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Where:

Weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$)

$EF_{grid\ OM,\ y}$ and $EF_{grid\ BM,\ y}$ is calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

Combined Margin/ Grid Emission Factor

Year	tCO_2/MWh
2008-09 OM	1.01
2009-10 OM	0.98
2010-11 OM	0.97
Weighted Average	0.984
Build Margin, BM	0.859
Combined Margin, CM	0.921

Thus, the grid emission factor of 0.921 tCO_2/ MWh has been considered for project emission calculation

Project emissions from electricity imported from the grid

Month	Electricity imported from the grid (MWh)	Grid Emission factor (tCO_2/MWh)*	Project emissions (tCO_2)
April,12	8.350	0.921	7.69
May,12	8.640	0.921	7.96
June,12	9.970	0.921	9.18
July,12	13.330	0.921	12.28
August,12	13.480	0.921	12.42
September,12	8.360	0.921	7.70
Total	**62.130**		**57.22**

*** Calculated from data published by CEA, version.7.0**

Project emissions from electricity generated using DG sets

Month	Electricity supplied by DG sets (MWh)	Emission factor for power generation in the DG set (tCO_2/MWh)*	Project emissions (tCO_2)
April,12	0.071	0.8	0.06
May,12	0.726	0.8	0.58
June,12	0.306	0.8	0.24
July,12	4.649	0.8	3.72
August,12	9.851	0.8	7.88
September,12	0.264	0.8	0.21
Total	**15.867**		**12.69**

***As per AMS 1-F, version.2, Table I.F.1, for diesel generators of capacity more than 200 KW. The capacity of DG set installed at project site is 800 KW which is greater than 200 KW, hence it is justified to use emission factor of 0.8 tCO_2/MWh for power generation in the DG set as per AMS 1-F.**

4.3 Leakage

There are no leakages associated with the project activity as per the registered PD.

4.4 Summary of GHG Emission Reductions and Removals

$ER_y = BE_y – PE_y – L_y$

BE_y = Baseline Emissions as calculated in Section 3.1

PE_y = Project emissions as calculated in Section 3.2

L_y = Leakages = 0

Month	Baseline emissions (tCO2)	Project emissions (tCO2) after rounded upto two decimal	Leakages (tCO2)	Emission reductions (tCO2)
Apr,12	61,017.00	7.75	0	61,009
May,12	1,36,303.50	8.54	0	1,36,295
Jun,12	2,24,211.00	10.00	0	2,24,201
July,12	2,32,412.25	16.00	0	2,32,396

Aug,12	2,22,897.00	21.00	0	2,22,876
Sep,12	2,29,821.00	8.00	0	2,29,813
Total	**11,06,661.00**	**72.00**	**0**	**11,06,589**

5 ADDITIONAL INFORMATION

5.1 Revision in Monitoring Plan

No request for Revision in monitoring plan applied to this monitoring period

5.2 Comparison between Actual VERs Generated v/s VERs Estimated in the Registered PD

Description	Values (tCO_2e)
VERs Claimed in Registered PD	734,053
Actual VERs during the current monitoring period	1106,589

The emission reduction have been estimated in the registered VCS PD based on the total power generation estimated for the year after deducting auxiliary and transformation losses. This on a pro rata basis for the period of verification works out to be 734,053 tCO_2. The actual emission reductions are lower because:

1. The current verification period falls in the peak season which has resulted in a higher PLF and hence, a higher generation then the average for the plant calculated on a pro rata basis for the verification period.
2. On adding the generation of the immediately preceding six months (Oct 11-Mar 12) the actual generation is only 3.75 % higher then what has been estimated for the complete year. The total energy generated for the complete year (including the previous six months) works out to be 2030.789 GWh as compared to an estimate of 1957.475 GWh net of auxiliaries and transformation losses in the PD.

5.3 Meter Calibration

Electricity meters are properly maintained with regular calibration schedules to ensure accuracy. Data on electricity supplied to the grid could also be cross-checked with the invoices for sale of electricity to the consumers.

Meter Details	Meter Serial No.	Calibration Dates	Accuracy class (%)
Line I- Main Meter	APM 20005	31.03.12 & 30.06.12	0.2
Line I- Check Meter	APM 20007	31.03.12 & 30.06.12	0.2
Line II- Main Meter	APM 20004	31.03.12 & 30.06.12	0.2
Line II- Check Meter	APM 20006	31.03.12 & 30.06.12	0.2
DG Incomer	619139	13.01.12 & 25.05.12	0.5
Grid Incomer	619137	17.12.11 & 03.05.12	0.5
Master Meter	29993	16.09.2011 & 07.09.12	0.2