300MW HYDROPOWER PROJECT BY JHPL

Document Prepared By

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Project Title	300MW Hydropower project by JHPL
Version	1.1
Report ID	JHPL/8
Date of Issue	24/09/2013
Project ID	92
Monitoring Period	01/01/2013 – 30/06/2013
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Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of Project

The Baspa project is a run-of-the-river hydro-electric power plant with an installed capacity of 300 MW. The diversion barrage of the project is located across river Baspa, at Kuppa in Himachal Pradesh. The power house is located at Karcham village in Kinnaur District. The project activity is an initiative of Jaiprakash Power Ventures Limited (JPVL) (formerly known as Jaiprakash Hydro Power Limited (JHPL)) a part of the Jaypee Group. Jaypee is a well-known business group of India and had entered into agreement with State Government of Himachal Pradesh to implement the project. The purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB).

The project site is located about 210 Kms from Shimla. Shimla is connected to the project site by National Highway-22 (Hindustan Tibet Road). Nearest broad gauge railway station from the project site is Kalka which is about at a distance of 300 Kms from the project site.

Technical description of the project:

The project, being a run-of-river type Hydro-Power project, would generate power by utilizing the water diverted from the flow of river Baspa. The flow in the river Baspa is contributed by several nullahs and khuds and numerous glaciers. The diversion barrage of the project is located across river Baspa, one of the major tributaries of river Satluj, at Kuppa in Himachal Pradesh. Water is diverted from the barrage to the power house through a diversion barrage. Two open sedimentation chambers are used after the diversion barrage to exclude the silt from water used for power generation. The water is passed through a head race tunnel of about 7.95 km long and steel lined pressure shaft (about 845 meters long to create a design head of 702 meters) which is branching into three penstocks for running 3 pelton turbines of 100 MW each. A surge shaft has been constructed between the head race tunnel and the pressure shaft which would be used to regulate the flow.

The power generated is stepped up to 400 KV and is evacuated by two circuits of 400 KV lines for the power station to Jhakri substation, which is about 55 Km from the site. The transmission line from the power station to Jhakri consisting of 121 towers has been installed as a part of the project. From Jhakri, 400 KV transmission system is utilized to evacuate the full output of JPVL (300 MW) hydro electric project.

1.2 Sectoral Scope and Project Type

Sectoral Scope:1, Energy industries (Renewable - / non-renewable sources)[1]

Project Type: Renewable Energy Project

The project activity is not a grouped project

1.3 Project Proponent

Mr. R.K.Narang
Director
M/s Jaiprakash Power Ventures Limited
Corporate Office Sector 128,

[1] http://cdm.unfccc.int/DOE/scopes.html#1

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Email: rk.narang@jalindia.co.in
Website: www.jhpl.com

Roles and responsibilities of the PP: Successful execution and smooth operation of the project activity.

1.4 Other Entities Involved in the Project

Not applicable for this project

1.5 Project Start Date

Project Start date: 8th June 2003 which is the start date of commercial operation of the plant.

1.6 Project Crediting Period

Crediting Period start date: 01/04/2006

Credit Period: 01/04/2006 to 31/03/2016 (10 years fixed crediting period).

1.7 Project Location

The project site is located about 210 Kms from Shimla. Shimla is connected to the project site by National Highway-22 (Hindustan Tibet Road). Nearest broad gauge railway station from the project site is Kalka which is about at a distance of 300 Kms from the project site. The geographical location of the power house is between Longitude $78^0$17' East and Latitude $31^0$50'north. Location is depicted in following maps-

Location of Himachal Pradesh in India

Location of Kinnaur district

1.8 Title and Reference of Methodology

The VCS methodology applied to the project activity is:

Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
Reference: Approved consolidated baseline methodology ACM0002/Version 08, Sectoral Scope: 1, EB 44[2]

Title: Tool to calculate the emission factor for an electricity system
Reference: Version 01.1, EB 35

Title: Tool for the demonstration and assessment of additionality
Reference: Version 05.2, EB 39
The project primarily displaces power from the NEWNE grid. Hence, the baseline calculation is carried out as per approved large scale CDM methodology ACM0002 and the emission factor as per "Tool to calculate emission factor for an electricity system", EB 35 Annex 12.

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[2] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_323M30IDF1IH6AG3GRCJ4PKR9CKM7P

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project was commissioned on 8th June 2003, which is the start date of commercial operation of the plant

The project was running smoothly during this Monitoring Period.
There was no event happened during this present monitoring period, which may impact the GHG emission reductions.

Outage details:

Month		Unit No.	Total Downtime (Hrs.)	Reason
16/06/2013	17/06/2013	1	39.32	Generation kept down due to high silt in Baspa River
17/06/2013	18/06/2013	2	39.02	
		3	39.40	

2.2 Project Description Deviations

There is a deviation in the monitoring plan from registered PD in the present monitoring period. As per the registered PD energy meters (two sets of main & check meters) are installed at the Jhakri substation of HPSEB. The location of the main and check energy meters have been shifted from Jhakri substation to powerhouse of the project activity from 12/05/2011 onwards. In the calculation of the baseline emissions, 0.65% transmission loss is being considered by the state electricity utility (HPSEB) as the location of the energy meters is changed from the substation of the HPSEB to power house of the project activity. Hence, the net energy supplied to the grid has been considered after deduction of the 0.65% transmission losses which is conservative and in accordance with the current practice being followed in the project activity after the change in the locations of the energy meters as per PPA.

The change in monitoring plan also fulfills all monitoring requirements of the applied methodology. Therefore, the project remains in compliance with the applied methodology.
Hence, as per Section 3.6 of the *VCS Standard* document[3] the deviations from the monitoring plan is acceptable.

2.3 Grouped Project

The project is not under grouped project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF_{grid}

[3] http://v-c-s.org/sites/v-c-s.org/files/VCS%20Standard,%20v3.3.pdf

Data unit:	tCO_2/MWh
Description:	Grid emission factor for the project activity
Source of data:	CO_2 database published by Central Electricity Authority (CEA) (http://www.cea.nic.in/reports/planning/cdm_co2/database_publishing_ver4.zip)
Value applied:	0.805
Purpose of the data:	The data is used for baseline and project emission calculation
Any comment:	

Data Unit / Parameter:	ℓ_{diesel}
Data unit:	Kg/liter
Description:	Density of diesel
Source of data:	http://www.iocl.com/Products/DieselSpecifications.pdf, page 1, sl.no. xiv.
Value applied:	0.860
Purpose of the data:	The data is used for project emission calculation
Any comment:	Maximum value of density i.e. 0.860 kg/ l has been considered for the conservative estimation of project emissions for diesel combustion.

Data Unit / Parameter:	EF_{diesel}
Data unit:	tCO_2/TJ
Description:	Emission factor of diesel
Source of data:	IPCC default
Value applied:	74.1
Purpose of the data:	The data is used for project emission calculation
Any comment:	

Data Unit / Parameter:	GWP_{SF6}
Data unit:	
Description:	Global Warming Potential of SF_6
Source of data:	IPCC default
Value applied:	23900

Purpose of the data:	The data is used for project emission calculation
Any comment:	

3.2 Data and Parameters Monitored

Data Unit / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project activity during the year y
Source of data:	Joint Meter Reading (JMR) by SEB
Description of measurement methods and procedures to be applied:	For the measurement of net energy delivered to the grid, two transmission lines are provided. Each transmission line has a set of main meter and check meter have been installed at the power house of project activity. The meters are capable of metering export and import data separately. The net electricity delivered to the grid would be the difference of export and import energy. The JMR Readings form the basis for calculation of the emission reductions. The JMR Readings are taken at the power house of the project activity in the presence of SEB officials and the PP representative.
Frequency of monitoring/recording:	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value monitored:	509128.98[4]
Monitoring equipment:	Type of meters: Energy Meter Serial No. **Line – 1(Main meter):** HPU 02547 **Line -1 (New Main meter):** UPU 01237 **Line – 2 (Main meter):** HPU 02549 **Line -2 (New Main meter):** UPU 01238 Type: E3M021 Make: Secure meter Ltd. Accuracy Class:0.2s

[4] The net generation value has been obtained after accounting Transmission Losses @ 0.65% between Baspa II power house and Jhakri substation as per PPA .

<table>
<tr><td>QA/QC procedures to be applied:</td><td>Two sets of meters (main & check meters) are used for measuring the electricity export to the grid and electricity import from the grid. The meters are calibrated annually. The details of calibration are as flows:
<table>
<tr><th>Line No.</th><th>Main Meter No.[5]</th><th>Date of Testing</th><th>Calibration validity</th></tr>
<tr><td>1</td><td>HPU 02547</td><td>19/01/2012</td><td>18/01/2013</td></tr>
<tr><td>1</td><td>UPU 01237</td><td>19/01/2013</td><td>18/01/2014</td></tr>
<tr><td>2</td><td>HPU 02549</td><td>19/01/2012</td><td>18/01/2013</td></tr>
<tr><td>2</td><td>UPU 01238</td><td>19/01/2013</td><td>18/01/2014</td></tr>
<tr><th>Line No.</th><th>Check Meter No.</th><th>Date of Testing</th><th>Calibration validity</th></tr>
<tr><td>1</td><td>HPU 02548</td><td>19/01/2012</td><td>18/01/2013</td></tr>
<tr><td>1</td><td>UPU 01235</td><td>19/01/2013</td><td>18/01/2014</td></tr>
<tr><td>2</td><td>HPU 02550</td><td>19/01/2012</td><td>18/01/2013</td></tr>
<tr><td>2</td><td>UPU 01236</td><td>19/01/2013</td><td>18/01/2014</td></tr>
</table></td></tr>
<tr><td>Calculation method:</td><td>Net Energy Generation = Total energy export to the Grid – Total energy import from the grid</td></tr>
<tr><td>Any comment:</td><td>-</td></tr>
</table>

Data Unit / Parameter:	Q_{SF6}
Data unit:	tonne
Description:	Quantity of SF6 loss during the year y
Source of data:	Measured

[5] Line 1 Main meter and Check meter were changed on 21/01/2013 and Line 2 Main meter and Check meter were changed on 22/01/2013.

Description of measurement methods and procedures to be applied:	SF6 is stored in cylinders at the project site and are used to top up the circuit breaker compartments in event of pressure drop inside. The quantity of SF6 thus filled into the system has been estimated based on difference in cylinder weight before and after any such topping up.
Frequency of monitoring/recording:	Monitoring Frequency: Quarterly
Value monitored:	0
Monitoring equipment:	Electronic balance Model No. CSP 2000k Sl. No. 8111312 Capacity : 2000 kg Least count: 200gm Class: III
QA/QC procedures to be applied:	The weight of the SF6 is done using electronic balance. The details of calibration of Electronic balance are as below.
Calculation method:	-
Any comment:	

Date of calibration	Calibration Validity
21.08.2012	20.08.2013

Data Unit / Parameter:	$P_{BAY\ VT}$
Data unit:	bar
Description:	SF_6 gas pressure in the BAY VT
Source of data:	Measured
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the bay is annually (once in a calendar year) checked with the help of a Digital pressure indicator (DPI-705) instrument. If the value of pressure is found to be below 3.05, it will require topping up.
Frequency of monitoring/recording:	Monitoring Frequency: Daily monitoring with GIS alarm system with consolidated monthly records or when abnormalities are observed.
Value monitored:	Provided in Appendix II: Results of GIS pressure measurement

<table>
<tr><td>Monitoring equipment:</td><td>
<table>
<tr><td colspan="2">Details of the SF6 Calibration Equipment</td></tr>
<tr><td>DPI-705</td><td>Least count 0.001 bar</td></tr>
<tr><td>Make: Druck Limited</td><td>Sr. No. 70553534/10-07</td></tr>
<tr><td>Range: 0-20 bars</td><td></td></tr>
</table>
</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The correctness is checked on the site on an annual basis.

Calibration details:
<table>
<tr><th>Date of Calibration</th><th>Calibration Validity</th></tr>
<tr><td>05.09.2012</td><td>04.09.2013</td></tr>
</table>
</td></tr>
<tr><td>Calculation method:</td><td>-</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

<table>
<tr><td>Data Unit / Parameter:</td><td>$P_{breaker}$</td></tr>
<tr><td>Data unit:</td><td>bar</td></tr>
<tr><td>Description:</td><td>SF6 gas pressure in the Breaker</td></tr>
<tr><td>Source of data:</td><td>Measured</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The pressure of SF_6 of the breaker is annually (once in a calendar year) checked with the help of a Digital pressure indicator (DPI-705) instrument. If the value of pressure is found to be below 4.95, it will require topping up.

Monitoring Frequency: Daily monitoring with GIS alarm system with consolidated monthly records or when abnormalities are observed.</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.</td></tr>
<tr><td>Value monitored:</td><td>Provided in Appendix II: Results of GIS pressure measurement</td></tr>
<tr><td>Monitoring equipment:</td><td>
<table>
<tr><td colspan="2">Details of the SF6 Calibration Equipment</td></tr>
<tr><td>DPI-705</td><td>Least Count 0.001 bar</td></tr>
</table>
</td></tr>
</table>

	Make: Druck Limited | Sr. No. 70553534/10 Range: 0-20 bars
QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis. Calibration details: **Date of Calibration**: 05.09.2012 | **Calibration Validity**: 04.09.2013
Calculation method:	-
Any comment:	

Data Unit / Parameter:	P_{feeder}
Data unit:	bar
Description:	SF6 gas pressure in the Feeder
Source of data:	Measured
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the breaker is annually (once in a calendar year) checked with the help of a Digital pressure indicator (DPI-705) instrument. If the value of pressure is found to be below 4.95, it will require topping up. Monitoring Frequency: Daily monitoring with GIS alarm system with consolidated monthly records or when abnormalities are observed.
Frequency of monitoring/recording:	Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.
Value monitored:	Provided in Appendix II: Results of GIS pressure measurement
Monitoring equipment:	**Details of the SF_6 Calibration Equipment** DPI-705 | Least Count 0.001 bar Make: Druck Limited | Sr. No. 70553534/10 Range: 0-20 bars

QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis. Calibration details **Date of Calibration**: 05.09.2012 **Calibration Validity**: 04.09.2013
Calculation method:	-
Any comment:	

Data Unit / Parameter:	Q_{diesel}
Data unit:	Litre
Description:	Quantity of diesel consumed during the year y
Source of data:	Measured
Description of measurement methods and procedures to be applied:	For measuring diesel consumption, a level gauge has been provided on the fuel injection tank of each DG set.
Frequency of monitoring/recording:	Monitoring Frequency: Daily monitoring with monthly recording of data.
Value monitored:	49029
Monitoring equipment:	
QA/QC procedures to be applied:	The D.G. sets (2 x 625 KVA) have static graduated level gauges on the fuel injection tanks. Graduations on the level gauge have been marked by pouring diesel in tank using standard measuring jar (the capacity of the jar is 5 litres and the graduations on the tube are also having graduations of 5 litres). The level of the graduated glass tubing on the tank corresponds to the diesel level and the consumption is regularly recorded in the log book and can be verified.
Calculation method:	-
Any comment:	There are two tanks of 320 litres (80 cm tank height) and 280 litres (75 cm tank height) respectively. The DG sets are of Cummins India Limited make. The diesel is procured centrally from the store and is drawn on requisition for DG sets. Diesel consumption and running hours of

	the DG sets (on an average 10 hours daily) are recorded daily in the log-books. The consumption may be verified with the log books.

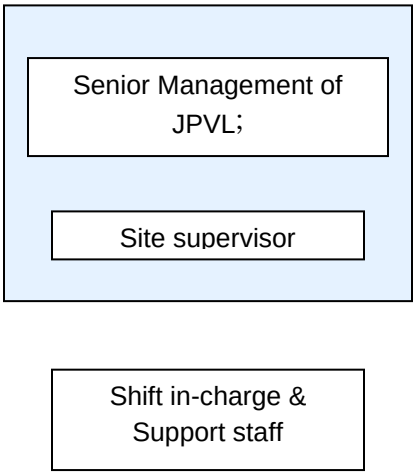
Data Unit / Parameter:	$E_{22\ kV}$
Data unit:	kWh
Description:	Electricity consumed during the year y
Source of data:	Monthly HPSEB invoices/ bills
Description of measurement methods and procedures to be applied:	The energy meter at the substation is used to measure the reading.
Frequency of monitoring/recording:	Monitoring Frequency: Continuous monitoring with hourly measuring and monthly recording by SEB Recording Frequency: Monthly
Value monitored:	1545600
Monitoring equipment:	Type of meter: Energy Meter Serial No.HPS00409 513029 Type: C3v055 (Static Meter) Accuracy class:0.5 S
QA/QC procedures to be applied:	The meters are calibrated on a periodic basis by HPSEB.
Calculation method:	-
Any comment:	

3.3 Description of the Monitoring Plan

A project team is constituted with participation from relevant departments at the site. It is comprises of personnel at the Kuppa barrage, and the Sholtu office. This team is responsible for data collection and archiving. They meet periodically to review the project activity, and check the data collected, etc. The Kuppa office is responsible for barrage control and the operation and maintenance of hydro mechanical equipment. The Sholtu office looks into the general administration along with the liaisoning with various government departments' viz civil administration, horticulture etc and is overall incharge of the Baspa plant along with the barrage, transmission lines and co-ordination with HPSEB. The JMR of commercial metering installed at the power house of project activity is jointly recorded by the representatives of JHPL and HPSEB every month.

The JMR reports are checked and discussed by the senior team members/managers periodically. In case of any irregularity observed by any of the team member, it is informed to the concerned person for necessary actions. The project site also has a digital system SCADA for the overall monitoring of the project.

The management structure is as given in the diagram below:



Senior Management of JPVL/Technical Head: Overall responsibility of compliance with the Project activity 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 generation

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline Emissions (BE_y)

$$BE_y = EF_y \times EG_y$$

Where
BE_y: Baseline emissions due to displacement of electricity during year y in tons of CO_2
EG_y: Electricity supplied to the grid by the project activity during the year y in MWh, and
EF_y: CO_2 baseline emission factor for the electricity displaced due to the project activity was fixed ex ante in the PD as 0.805 tonne CO_2/MWh.

Energy supplied to Grid (EG_y)

The energy supplied to grid is measured using electricity meters installed at the have been installed at the power house of project activity. The net electricity delivered to the grid is based on the JMR readings taken in the presence of the plant personnel and HPSEB official.

Monthly power generation details are given below :

Month	Power Exported to grid	Less Transmission Losses between Baspa II power house and Jhakri substation as per PPA @ 0.65%	Power Export to grid after deducting transmission loss*	Power Import from grid*	Power Export	Power Import	Net power exported to grid
Unit	**(MWh)**	**MWh**	**MWh**	**(MWh)**	**(MWh)**	**(MWh)**	**(MWh)**
Jan-13	30945.00	201.14	30743.86	5.00	30743.86	5.00	30738.86
Feb-13	25680.00	166.92	25513.08	0.00	25513.08	0.00	25513.08
Mar-13	31320.00	203.58	31116.42	0.00	31116.42	0.00	31116.42
Apr-13	50100.00	325.65	49774.35	0.00	49774.35	0.00	49774.35
May-13	158410.00	1029.67	157380.34	0.00	157380.34	0.00	157380.34
Jun-13	216010.00	1404.07	214605.94	0.00	214605.94	0.00	214605.94
Total	**512465.00**	**3331.02**	**509133.98**	**5.00**	**509133.98**	**5.00**	**509128.98**

*Power exported to grid by the power plant is imported by the grid and the power imported by the power plant is exported by the grid.

Grid Emission Factor (EF_y)

GEF has been fixed Ex-ante in the PD at 0.805 tCO_2/ MWh[6] and the same has been used in calculation of emission reductions in this Monitoring Report.

Baseline Emissions (BE_y)
Baseline emissions are calculated as the electricity produced multiplied by the grid emission factor.

[6] As per the registered VCS PD, CO_2 Emissions Data base version 4 -CEA, Downloaded from http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf..

Month	Net power exported to grid	Emission Factor	Baseline Emissions
Unit	**(MWh)**	**(tCO_2/MWh)**	**(tCO_2)**
Jan-13	30738.86	0.805	24744.78
Feb-13	25513.08	0.805	20538.03
Mar-13	31116.42	0.805	25048.72
Apr-13	49774.35	0.805	40068.35
May-13	157380.34	0.805	126691.17
Jun-13	214605.94	0.805	172757.78
Total	**509128.98**		**409848**

4.2 Project Emissions

A) Emissions from Diesel Consumption (PE_{y1})

There are two 625 KVA capacity DG sets of Cummins India Limited make. The records of diesel consumption are made on a daily basis in the DG operation logbook. This has been included in the project emission calculation from the project activity. Project Emissions from diesel consumption are found using the formula given below.

PE_{y1} is the project emission from diesel consumption.

$PE_{y1} = Q_{diesel} \times \ell_{diesel} \times EF_{diesel} / 1000$

Where

Q_{diesel} = Quantity of diesel consumed, litre

ℓ_{diesel} = Density of diesel, 0.860 kg/ litre[7]

EF_{diesel} = Emission factor of diesel, 3.186 tCO_2e/ tonne[8] (IPCC Default value)

Month	Diesel consumption	Project Emission (PE_{y1})
Unit	**(litres)**	**(tCO_2)**

[7] http://www.iocl.com/Products/DieselSpecifications.pdf

[8] Source of IPCC default value: 2006 IPCC guidelines for National GHG Inventories - Table 1.2 for NCV value of diesel, and Table 1.4 for carbon oxidation factor and default carbon content for diesel.

Jan-13	14228	38.984
Feb-13	15172	41.571
Mar-13	11690	32.030
Apr-13	3745	10.261
May-13	984	2.696
Jun-13	3210	8.795
Total	**49029**	**134.337**

PE_{y1} = 134.337 tCO_2e

B) Emissions from 22 KV Transmission line (PE_{y2})

The project site at Sholtu is connected via a 22 kV line which supplies power from the HPSEB substation to the site to meet the daily electricity requirements. The reading is measured by the energy meters at the substation and monthly invoices are used to account for the project emissions[9].

PE_{y2} is the project emission from the 22 kV line which is used for supplying electricity at the site.

$PE_{y2} = E_{22\ kV} * EF_{grid} / 1000$

Where

$E_{22\ kV}$ = Electricity consumed at the site in kWh

EF_{grid} = Grid Emission Factor for NEWNE Grid, 0.805 tCO_2/Mwh (fixed ex ante in PD)

Month	Power consumption	Project emissions (PE_{y2})
Unit	**(Kwh)**	**(tCO_2)**
Jan-13	354400	285.292
Feb-13	277400	223.307
Mar-13	276800	222.824

[9] Monthly invoices are used to monitor these emissions, 22 kv line bill, has the data that has been used in the estimation of PE_{y2}

Apr-13	264200	212.681
May-13	219400	176.617
Jun-13	153400	123.487
Total	**1545600**	**1244.208**

PE_{y2} = 1244.208 tCO2e

C) Emissions from SF6 (PE_{y3})

At the project site the PP stores some quantity of SF6 which may be required to top up the circuit breaker compartments in case of any pressure drop as per the monitoring parameters. The PP monitors the SF6 pressure parameter on the SCADA system to account for abnormalities[10]. In case of any leakage or any abnormality observed in any of the units, the alarm trips on the SCADA system and the PP records the pressure in the various units. The tripping of the alarm is directly related to the pressure conditions of the breaker, bay and feeders at the respective pressures as given below:

Monitoring Parameter	Description	Value
$P_{BAY\ VT}$	SF6 gas pressure in the BAY VT	3.05 bar
$P_{breaker}$	SF6 gas pressure in the Breaker	4.95 bar
P_{feeder}	SF6 gas pressure in the Feeder	4.55 bar

The table shows the minimum pressure which must be maintained in the compartments to prevent the alarm from tripping and thus leakage of SF6. The monthly statements maintained by the PP show that no leakage of the gas took place in the current monitoring period. The "*no*" in the statement indicates that there was no tripping of alarm on a particular day, thus implying that the minimum pressure was maintained in the individual compartments.

Annual readings of pressure are taken at bay, breaker and feeder using the Digital pressure indicator (DPI). These were taken on 15/12/2012 no abnormality was being reported from the pressure system. The pressure in all three – bay, feeder and breaker, was much above the required limit. Thus, this again proves that there was no need for SF-6 top ups during this verification period.

PE_{y3} is the project emission on account of leakage of SF6 from the circuit compartments.

[10] SF6 -SCADA logs and wts of cylinders, forms the basis for the SF6 monitoring.

$PE_{y3} = Q_{SF6} \times GWP_{SF6}$

Where

Q_{SF6} = Quantity of SF6 topped up from cylinders into circuit breaker compartments; tonnes

GWP_{SF6} = Global Warming Potential of SF6 (23900)

The SF6 cylinders were installed at the site during the commissioning of the project by Alstom.

As indicated in the PD, an electronic balance has been installed on site in March 2009.

Sr. No.	Weight of SF6 in cylinder before this verification period	Weight of SF6 in cylinder after this verification period	Weight of SF6 consumed	Project Emissions from SF6 consumption (PE_{y3})
	Kg	Kg	tonnes	(tCO_2)
1	1046.2	1046.2	0.00000	0.000
2	68.6	68.6	0.00000	0.000
3	67.6	67.6	0.00000	0.000
4	73.6	73.6	0.00000	0.000
5	73.4	73.4	0.00000	0.000
Total	**1329.4**	**1329.4**	**0.00000**	**0.000**

There is no change in weight of gas in cylinders through this verification period and the SF6 alarm log shows that no top up was needed in this verification period.

Since, in the current monitoring period of the project activity, the PP was not required to top up the compartments with SF6, hence

PE_{y3} = 0.000 tCO_2e

Total Project Emissions:

$$PE_{y1} + PE_{y2} + PE_{y3} = 134.337 + 1244.208 + 0.000 = 1378.545\ tCO_2$$

4.3 Leakage

As per the methodology, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology.

Hence project participants do not need to consider leakage in applying this methodology.

Thus $L_y = 0$

4.4 Summary of GHG Emission Reductions and Removals

Emission Reductions (ER_Y)

$ER_y = BE_y – PE_{y1} – PE_{y2} – PE_{y3}- L_y$

Month	Baseline Emissions (BE_y)	Project Emissions from DG set (PE_{y1})	Project Emissions from 22 kV line (PE_{y2})	Project Emissions from SF6 (PE_{y3})	Leakage (L_y)	Emission Reductions (ER_y)	Rounded down Emission Reductions (ER_y)
Unit	**(tCO2)**	**(tCO_2)**	**(tCO_2)**	**(tCO_2)**	**(tCO_2)**	**(tCO_2)**	**(tCO_2)**
Jan-13	24744.78	38.984	285.292	0.000	0.000	24420.504	24420
Feb-13	20538.03	41.571	223.307	0.000	0.000	20273.152	20273
Mar-13	25048.72	32.030	222.824	0.000	0.000	24793.864	24793
Apr-13	40068.35	10.261	212.681	0.000	0.000	39845.410	39845
May-13	126691.17	2.696	176.617	0.000	0.000	126511.857	126511
Jun-13	172757.78	8.795	123.487	0.000	0.000	172625.495	172625
Total	409848.83	**134.337**	**1244.208**	**0.000**	**0.000**	**408470.281**	**408467**

5 ADDITIONAL INFORMATION

5.1 Appendix I: Records of SF_6 Cylinders weights:

Date	Cylinder 1	Cylinder 2	Cylinder 3	Cylinder 4	Cylinder 5
	Gross Wt. (Kg)	Gross Wt. (Kg)	Gross Wt. (Kg)	Gross Wt. (Kg)	Gross Wt. (Kg)
20/09/2012	1046.2	68.6	67.6	73.6	73.4
19/12/2012	1046.2	68.6	67.6	73.6	73.4
14/03/2013	1046.2	68.6	67.6	73.6	73.4
10/06/2013	1046.2	68.6	67.6	73.6	73.4

09/09/2013	1046.2	68.6	67.6	73.6	73.4

5.2 Appendix II: Results of GIS pressure measurement

Amb. Temp. 26°C **15-12-2012**

UNIT-1

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.95	5.96	5.96	3.93	3.93	3.95	3.90	3.90	3.89	3.90	3.92	3.93
Gas pressure diff.	0.07	0.08	0.08	0.09	0.09	0.11	0.06	0.06	0.05	0.06	0.08	0.09

UNIT-2

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.97	5.95	5.96	3.93	3.94	3.94	3.90	3.89	3.89	3.93	3.93	3.92
Gas pressure diff.	0.09	0.07	0.08	0.09	0.10	0.10	0.06	0.05	0.05	0.09	0.09	0.08

UNIT-3

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.97	5.97	5.97	3.94	3.92	3.94	3.92	3.92	3.94	3.93	3.92	3.93
Gas pressure diff.	0.09	0.09	0.09	0.10	0.08	0.10	0.08	0.08	0.10	0.09	0.08	0.09

Ambient Temp:26°C **15.12.2012**

BUS COUPLER & LIGHTING ARRESTER

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G5(bar)			G6(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.95	5.94	5.96	3.92	3.92	3.93	3.92	3.92	3.94	3.94	3.94	3.97	3.93	3.93	3.92
Gas pressure diff.	0.07	0.06	0.08	0.08	0.08	0.09	0.08	0.08	0.10	0.10	0.10	0.13	0.09	0.09	0.08

BUS VT

COMPARTMENT	G1(bar)			G2(bar)			G3(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	3.93	3.93	3.94	3.93	3.92	3.93	3.96	3.96	3.95	3.98	3.98	3.97
Gas pressure diff.	0.09	0.09	0.10	0.09	0.08	0.09	0.12	0.12	0.11	0.14	0.14	0.13

Ambient Temp:26°c **15.12.2012**

FEEDER-1

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)			G5(bar)			G6(bar)			G7(bar) (At 13°C)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	5.69	5.69	5.69	5.62	5.62	5.62	5.62	5.62	5.62	5.47	5.47	5.47
Measured gas pressure	5.94	5.95	5.96	3.91	3.92	3.91	3.92	3.91	3.91	5.82	5.82	5.83	5.86	5.91	5.71	5.78	5.78	5.79	5.74	5.74	5.75
Gas pressure diff.	0.06	0.07	0.08	0.07	0.08	0.07	0.08	0.07	0.07	0.13	0.13	0.14	0.24	0.29	0.09	0.16	0.16	0.17	0.27	0.27	0.28

FEEDER-2

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)			G5(bar)			G6(bar)			G7(bar) (At 13°C)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	5.69	5.69	5.69	5.62	5.62	5.62	5.62	5.62	5.62	5.47	5.47	5.47
Measured gas pressure	5.97	5.96	5.97	3.94	3.95	3.94	3.92	3.90	3.92	5.80	5.80	5.80	5.83	5.83	5.83	5.89	5.89	5.91	5.68	5.65	5.71
Gas pressure diff.	0.09	0.08	0.09	0.10	0.11	0.10	0.08	0.06	0.08	0.11	0.11	0.11	0.21	0.21	0.21	0.27	0.27	0.29	0.21	0.18	0.24