MONITORING REPORT

"300MW Hydro-power Project by JHPL"

Voluntary Carbon Units (VCUs):

1st October 2008-28th Feb 2009
(Both days included)

Monitoring Report Version: Version 1.1
Date: 14/11/2009

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Baspa Hydro-electric Project (BASPA)
Monitoring report for VERs

1. Title of the project activity

Title: 300MW Hydro-power Project by JHPL
Version: 1.1

Date: 14/11/2009

2. Introduction

The purpose of this monitoring report is to calculate the Greenhouse Gas emission reduction achieved by the above mentioned project activity for the period starting from October 2008 to Feb 2009.

The monitoring report covers the activity from 01/10/2008 till 28/02/2009.

3. Reference

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

4. Definitions in the report

PD: Project Document

GHG: Greenhouse Gases

IPCC: Intergovernmental Panel on Climate Change

SEB: State Electricity Board

VCU: Voluntary Carbon Unit

VCS: Voluntary Carbon Standard

5. General description of the project

5.1. Project Activity

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 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.

Emergent Ventures India Pvt Ltd (EVI) is the project advisor for the VCS project.

5.2. 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 JHPL (300 MW) hydro electric project.

6. Monitoring methodology and plan:

The monitoring methodology applied to the project activity is:

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

Keeping in line with the Monitoring Methodology, the following parameters are monitored in the specific project situation:

- Net electricity supplied to the state grid by project activity.
- GEF (grid emission factor) of NEWNE grid, the grid to which project activity supplies power. The GEF has been fixed ex-ante in the PDD; value used is 0.805 tCO_2/ MWh.

7. Quality Control (QC) and Quality Assurance (QA)

Calibration/Maintenance of Measuring and Analytical Instruments

Electricity meters – two main meters and two check meters, are maintained with regular testing and calibration schedules to ensure accuracy. The electricity supplied to the grid is cross-checked with the JMRs for export of electricity to HPSEB. A set of four spare meters are also present at the site. These four meters are calibrated and used alternately every year. The 22 kV transmission line meter which measures the import to the Sholtu site is maintained regularly by HPSEB. All other instruments which form a part of the monitoring of the project are also regularly tested, details of which are provided in Annex 2.

8. GHG Emission Calculations

8.1 Project Activity Emissions

The project emission includes the CH_4 emission from the reservoir. Since the project activity is a run-of-the-river project with a reservoir facility for diurnal storage, the calculation for project emissions as per the methodology is as follows:

Parameters	UoM	Value
Capacity	MW	300
Running hours	per day	24
Reservoir area	ha	33

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity, in W/m^2.

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

Since the reservoir is a newly installed facility and does not result in the increase of existing reservoirs, Cap_{BL} and A_{BL} can be assumed to be zero. The area of the reservoir is 33 ha (FSL).

Thus,

$$PD = \frac{Cap_{PJ}}{A_{PJ}}$$
$$= \frac{300*1000*1000}{33*10000}$$
$$= 909 \text{ W/m2}$$

As per the methodology if the power density (*PD*) of the power plant is greater than 10 W/m2 then the project emissions are zero.

Hence the project emissions = 0 (zero).

A) However, there is some diesel consumption in the DG sets at the site. There are two 625 KVA capacity DG sets of Cummins India Limited make. The records are made on a daily basis in the DG operation logbook. This has been included in the project emission calculation from the project activity. The basis for calculation is the value of density of diesel and emission factor for diesel.

PE_{y1} is the project emission from the DG sets

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

Where
Q_{diesel} = Quantity of diesel consumed, litre
ℓ_{diesel} = Density of diesel, 0.860 kg/ litre[1]
EF_{diesel} = Emission factor of diesel, 3.186 tCO2e/ tonne[2] (IPCC Default value)

Month	Diesel consumption (litres)	Project Emission (tCO2)
Oct-08	17816	48.82
Nov-08	19100	52.34
Dec-08	20090	55.05
Jan-09	35417	97.05
Feb-09	31563	86.49
Total	123986	339.75

PE_{y1} = 340 tCO2e

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

[2] 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.

B) Also 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.

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

Month	Power consumption (kWh)	Project emissions (tCO2)
Oct-08	1730000	1392.65
Nov-08	1740000	1400.70
Dec-08	1620000	1304.10
Jan-09	1590000	1279.95
Feb-09	2173400	1749.59
Total	8853400	7126.99

PE_{y2} = 7127 tCO2e

C) At the project site the PP stores some quantity[3] of SF6 which may be required to top up the circuit breaker compartments in case of any pressure drop. PP would monitor the quantity of SF6 filled into the circuit breaker compartments from the storage cylinders during monitoring period and would account for project emissions.

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

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

Where
Q_{SF6} = Quantity of SF6 topped up from cylinders into circuit breaker compartments; tonnes
GWP_{SF6} = Global Warming Potential of SF6 (23900)

Since the start of operation of the project activity, PP was not required to top up the compartments with SF6 till the end of the current monitoring period and hence,

[3] The PP stores 5 number of SF6 cylinders at the site. The quantity of SF6 stored in the four cylinders is 38.4 kg each and the quantity in the fifth cylinder is 590 kg.

$PE_{y3} = 0$

8.2 Leakages

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 $L_y = 0$

8.3 Baseline Emissions

"The baseline is the MWh produced by the renewable generating unit multiplied by an emission coefficient (measured in tCO2equ/MWh) calculated in a transparent and conservative manner as: **The weighted average emissions (in tCO2equ/MWh) of the current generation mix.**

$BE_y = EF_y$ X 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 in during the year y in tons CO_2/MWh.

Energy supplied to Grid

The energy supplied to grid is measured using electricity meters installed at the intersection point at Jhakri. 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 as follows:

	Generation (MWh)		
Month	**Power Exported to grid**	**Power Import from grid**	**Net power exported to grid**
Oct-08	80370.00	0.00	80370.00
Nov-08	50220.00	10.00	50210.00

Dec-08	40300.00	20.00	40280.00
Jan-09	33180.00	50.00	33130.00
Feb-09	26160.00	40.00	26120.00
Total	**230230.00**	**120.00**	**230110.00**

Grid Emission Factor

GEF has been fixed Ex-ante in the PD at 0.805 tCO2/ MWh and the same has been used in calculation of emission reductions in this Monitoring Report.

Baseline Emissions

Baseline emissions are calculated as the electricity produced multiplied by the grid emission factor.

Month	**Net power exported to grid**	**Emission Factor**	**Baseline Emissions**
	(MWh)	(tCO2/MWh)	(tCO2)
Oct-08	80370.00	0.805	64697.85
Nov-08	50210.00	0.805	40419.05
Dec-08	40280.00	0.805	32425.40
Jan-09	33130.00	0.805	26669.65
Feb-09	26120.00	0.805	21026.60
Total	**230110.00**		**185238.55**

8.4 Emission Reductions

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

Month	**Baseline Emissions**	**Project Emissions from DG set**	**Project Emissions from 22 kV line**	**Project Emissions from SF6 compartments**	**Leakage**	**Emission reductions**
	(tCO2)	(tCO2)	(tCO2)	(tCO2)	(tCO2)	(tCO2)
Oct-08	64697.85	48.82	1392.65	0	0	63256.38
Nov-08	40419.05	52.34	1400.70	0	0	38966.01
Dec-08	32425.40	55.05	1304.10	0	0	31066.25
Jan-09	26669.65	97.05	1279.95	0	0	25292.65
Feb-09	16196.60	86.49	1749.59	0	0	14360.52
Total	**185238.55**	**339.75**	7126.99	**0**	0	**177771.81**

To account for the error[4] in the calculation of project emissions from the 22 kV line in the last verification (ie Jan 07 to Sept 08 period), equivalent project emissions that occurred during the last verification are discounted during the current monitoring period. The calculations are as shown below:

Project Emissions during Jan 07 till Sept 08 as reported in last verification	31.38	tCO_2
Project Emissions during Jan 07 till Sept 08 after correction of error	31382.93	tCO_2
Net Emission reduction in the current monitoring period	146420.27	tCO_2

Net Emission reduction in the current monitoring period = 1,77,771.81 – (31,382.93 – 31.38)

= 1,46,420.27 tCO_2

Thus the total Emission Reduction of **1,46,420 tCO_2 (146420.27 is rounded off for a conservative estimate)** is achieved by the project activity from 1st October 2008 to 28th February 2009.

[4] The error was a factual error due to non-conversion of the units from MWh to kWh in the project emissions from the 22 kV line at the site during the previous monitoring period from Jan 07 to Sept 08.

Annex-1

Monitoring details

In this project the emission reductions depend on following factors.

1. Net Electricity supplied by project activity to the grid during a year.
2. The Grid Emission Factor for NEWNE region grid.
3. Monitoring of SF6 gas leakage from circuit breaker compartments
4. Diesel consumption in DG sets
5. 22 kV Transmission Line which supplies power to the site at Sholtu

As described in PD the following data values are monitored to calculate the emission reductions.

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project activity during the year y
Source of data to be used:	Joint Meter Reading (JMR) by SEB
Value of data applied for the purpose of calculating expected emission reductions	230110 for the current monitoring period
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. 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 taken at the HPSEB substation are taken in the presence of SEB officials and the PP representative. Monitoring Frequency: Monitoring is continuous with monthly recording of data.
QA/QC procedures to be applied:	The main meters and the check meters are maintained and calibrated annually. During monthly monitoring of energy delivered, if the difference between the respective main meter and check meter exceeds the maximum error for such meters

	then both meters shall be tested in turn. During testing, if both the meters are found to be working beyond the permissible limits of error, then the energy delivered for the previous billing month shall be corrected to account for this error. The meters shall be calibrated or replaced with spare meters immediately. During annual calibrations, if the main meter is found to be within the permissible limits of errors, and the check meter is found to be beyond the permissible limits of errors, the main meter shall be used for energy delivered. In case, during the annual tests, the main meter is found to be beyond the permissible limit of error but check meter is found to be within the permissible limit of error, then check meter reading shall be used for energy delivered. In case, during annual tests, both, the main meter and the check meter are found to be beyond the permissible limit of error, then the meters shall be replaced with spare set of calibrated meters. The energy delivered for this period (from the date of last calibration) shall be corrected for the maximum error in meters.
Any comment:	-

Data / Parameter:	**Q_{SF6}**
Data unit:	tonne
Description:	Quantity of SF6 loss during the year y
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	SF6 is stored in cylinders[5] 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 shall be estimated based on

[5] The PP stores 5 number of SF6 cylinders at the site. The quantity of SF6 in the four cylinders is 38.4 kg each and the quantity in the fifth cylinder is 590 kg.

	difference in cylinder weight before and after any such topping up. The PP has installed an electronic balance in March 2009 which is used to weigh the cylinders. Monitoring Frequency: Annually
QA/QC procedures to be applied:	The PP has installed an electronic balance in March 2009 which is used to weigh the cylinders. This electronic meter will be calibrated annually.
Any comment:	-

Data / Parameter:	$P_{BAY\ VT}$
Data unit:	bar
Description:	SF6 gas pressure in the BAY VT
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	3.05 (at 20 Degree C)
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the bay is annually checked with the help of a Digital pressure indicator (DPI-705IS) instrument. If the value of pressure is found to be below 3.05, it will require topping up. Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.
QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis. DPI-705IS is a hand held instrument and is checked at site before measurement of the gas pressure of the bay. The correctness of DPI instrument is checked by calibrating it periodically.
Any comment:	

Data / Parameter:	$P_{breaker}$
Data unit:	bar
Description:	SF6 gas pressure in the Breaker
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected	4.95 bar (at 20 Degree C)

emission reductions	
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the breaker is annually checked with the help of a Digital pressure indicator (DPI-705IS) instrument. If the value of pressure is found to be below 4.95, it will require topping up. Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.
QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis. DPI-705IS is a hand held instrument and is checked at site before measurement of the gas pressure of the breaker. The correctness of DPI instrument is checked by calibrating it periodically.
Any comment:	

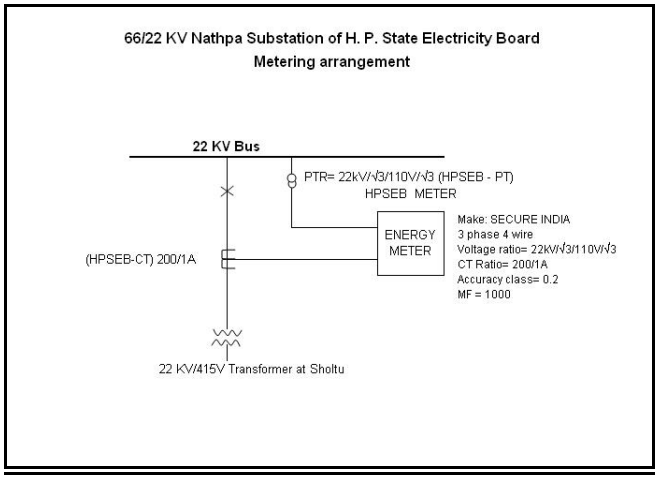
Data / Parameter:	P_{feeder}
Data unit:	bar
Description:	SF6 gas pressure in the Feeder
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	4.55 bar (at 20 Degree C)
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the feeder is annually checked with the help of a Digital pressure indicator (DPI- 705IS) instrument. If the value of pressure is found to be below 4.55, it will require topping up. Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.
QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis. DPI-705IS is a hand held instrument and is checked at site before measurement of the gas pressure of the feeder. The correctness of DPI instrument is checked by calibrating it periodically.
Any comment:	

Data / Parameter:	**Q_{diesel}**

Data unit:	Litre
Description:	Quantity of diesel consumed during the year y
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	123986 for current monitoring period
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.
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. Monitoring Frequency: Daily monitoring with monthly recording of data.
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 / Parameter:	$E_{22\ kV}$
Data unit:	kWh
Description:	Electricity consumed during the year y
Source of data to be used:	Monthly HPSEB invoices/ bills
Value of data applied for the purpose of calculating expected emission reductions	8853400 kWh (Value based on current monitoring period)
Description of measurement methods and procedures to be applied:	The energy meter at the substation is used to measure the reading. Monitoring Frequency: Daily monitoring with monthly records by SEB.

QA/QC procedures to be applied:	The meters are calibrated on a periodic basis by HPSEB.
Any comment:	-



Diagrammatic representation of the 22kV line

Annex 2

Calibration Details of Instruments

1. Monitoring Parameter - $\mathbf{EG_y}$

Details of the calibrated meters (both check meters and main meters) for the verification period from 1st October 2008 – 28th February 2009.

Date of testing	Serial No	Make	Main/ Check	Testing Centre
07.07.08	GEC 04052	M/s Secure Meter	Main – Line 1	Power Grid Corporation of India
07.07.08	GEC 04054	M/s Secure Meter	Check – Line 1	Power Grid Corporation of India
08.07.08	UPU 01762	M/s Secure Meter	Main – Line 2	Power Grid Corporation of India
08.07.08	UPU 01763	M/s Secure Meter	Check – Line 2	Power Grid Corporation of India

2. Monitoring parameter $E_{22\,kV}$

Meter No of 22 kV line at substation is HPS00409 513029 and is maintained by HPSEB.

3. Monitoring parameter $Q_{SF6:}$

Spring Balance was used for weighing SF6 gas cylinders until March 2009. The spring balance is calibrated annually with standard weights at the site. Post March 2009, the PP has installed an electronic balance for weighing the cylinders. The instrument is CSP – 2000K with a maximum capacity of 2000 kg and minimum capacity of 4 kg. The balance was calibrated by the *Weights and Measures Department, Government of NCT of Delhi* on 19th November 2008.

4. Monitoring parameters $P_{\mathbf{BAY\ VT}}$, $P_{\mathbf{breaker}}$, $P_{\mathbf{feeder}}$

Digital Pressure indicator (DPI-705IS)

The digital manometer (DPI 705IS) is a hand held instrument which is used to measure SF6 gas pressure in various compartments of periodically. The correctness is checked by

calibrating the instrument which was done on 6th May 2009. The instrument detail is given below:

Type Number	DPI-705IS
Manufacturer	Druck Limited
Range	0-20 bars g
Serial Number	70549240