

**MONITORING REPORT FORM (F-CDM-MR)**
Version 02.0**MONITORING REPORT**

Title of the project activity	22.5 MW Bhilangana Hydro Power Project (BHPP)
Reference number of the project activity	0743
Version number of the monitoring report	01
Completion date of the monitoring report	03/04/2012
Registration date of the project activity	08/01/2007
Monitoring period number and duration of this monitoring period	Second Monitoring Period 01/01/2011 to 31/12/2011 (First and last days included)
Project participant(s)	Swasti Power Limited
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral scope 1, and Approved baseline methodology ACM0002
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	109,304
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	60,222

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

Swasti Power Limited (SPL) has developed the 22.5 MW hydro electric power project on the Bhilangana River. The project is a run-of-the river hydroelectric project, which harnesses the perennial waters of Bhilangana River – a major tributary of the River Bhagirathi.

The purpose of the project is to generate renewable electricity by utilising the energy of flowing water by installing and operating three Francis type turbo generators, each of 7.5 MW capacities. The power generated in the project activity is evacuated to the Northern Grid of India (presently integrated with NEWNE grid of India) and therefore contributes towards reducing the power shortage in the region and also reduces GHG emissions that would have otherwise occurred from fossil fuel based power generation. A brief summary of the project activity from the date of construction till the date of operation are given below:

Sr. No.	Unit No	Name Plate Capacity of generator	Date of Commissioning	Operation Start Date
1	Unit-1	7.5 MW	12/08/2009	12/08/2009
2	Unit-2	7.5 MW	24/09/2009	24/09/2009
3	Unit-3	7.5 MW	11/10/2009	11/10/2009

The total emission reduction achieved during the monitoring period from 01/01/2011 to 31/12/2011 is 60,227 tCO₂e.

A.2. Location of project activity

The project activity is located a few kilometres North of Ghansali township (Latitude 30.428056° N, Longitude 78.57500° E). The project site is about 45 km from the origin of River Bhilangana in the Ghansali Village, Tehri Garhwal District, state of Uttarakhand in India. The state of Uttarakhand was previously known as Uttaranchal.

A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Private entity: Swasti Power Limited (SPL)	No

A.4. Reference of applied methodology

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

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

A.5. Crediting period of project activity

Choice of the crediting period:	Fixed crediting period (16/04/2007 – 15/04/2017)
Start date of crediting period as per Section C.2.2.1 of PDD registered with UNFCCC	16/04/2007
Start date of crediting period as per actual implementation :	12/08/2009

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

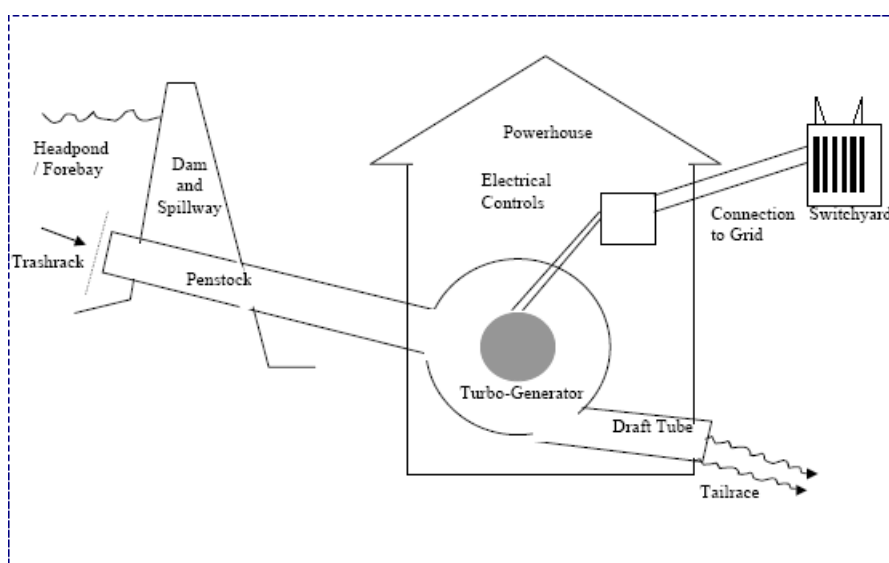
The Bhilangana hydro power project of Swasti Power Limited (“SPL”) comprises a boulder weir with an intake structure to divert and regulate the water into the horse shoe shaped interconnecting tunnel that leads the water into a D-shaped underground de-silting tank. The silt free water is led to a surge shaft via a horse shoe shaped Head Race Tunnel (HRT), which is in two parts namely HRT-1 and HRT-2, with an aqueduct in between the two tunnels for crossing of the Phelenda Nala. The surge shaft at the exit portal emerges as a single steel penstock that trifurcates into three branches just before entering the powerhouse. The powerhouse is a surface type power house, which houses three Francis type turbo generators, each of 7.5 MW capacities. The tail water emerging out from the three machines is led back to Bhilangana River via a short tailrace channel.

The power generated in the project activity is evacuated to the Northern Grid. The point of interconnection is the 33kV bus-bar at Ghansali sub-station of UPCL which is about 3.2 km from the project activity.

Run-of-river hydroelectricity is a type of hydroelectric generation whereby the natural flow and elevation drop of a river are used to generate electricity. Such projects divert some or most of a river’s flow through a pipe and/or tunnel leading to electricity-generating turbines, then return the water back to the river downstream. It is required to ensure there is enough water to enter the “penstock” pipes that lead to the lower-elevation turbines.

The diagrammatic view of this technology is provided in below diagram:

Fig 1





The technical specification for the turbines is given in the table below:

Make	VA Tech Hydro
Type and Reference	Brushless Synchronous
Capacity	7500 kW
Speed of rotation	500 rpm
Head	87.3m
Frequency	50 Hz
Rated power factor	0.85 lag
Normal Voltage between phase	11 kV

There have been no major cases of malfunction or emergency during this monitoring period from 01/01/2011 to 31/12/2011. The project experienced a total downtime of 165 days during this period

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

NA

B.2.2. Corrections

NA

B.2.3. Permanent changes from registered monitoring plan or applied methodology

Revision to the monitoring plan was proposed which was approved by UNFCCC on 11/10/2011 and the same has been applied to the project activity for this monitoring period.

B.2.4. Changes to project design of registered project activity

NA

B.2.5. Changes to start date of crediting period

The start date (=crediting period start date) of operation of the project activity is 12/08/2009. The commissioning of unit 1 of the project activity got delayed and hence the crediting period. The three turbine generator units were commissioned as given in table below.

Sr. No.	Unit No	Name Plate Capacity of generator	Date of Commissioning	Operation Start Date
1	Unit-1	7.5 MW	12/08/2009	12/08/2009
2	Unit-2	7.5 MW	24/09/2009	24/09/2009
3	Unit-3	7.5 MW	11/10/2009	11/10/2009

B.2.6. Types of changes specific to afforestation or reforestation project activity

NA

SECTION C. Description of monitoring systemDescription of monitoring plan

The project activity has main and check (backup) meters to record the net electricity supplied to the grid. Energy meters would be calibrated annually so that the accuracy of measurement can be ensured all the time.

Key Project Parameters affecting Emission Reductions**Net Power exported to the grid**

The project revenues are based on the net electricity supplied which is measured by main metering system. The check metering system is considered decisive in case of failure of the main meter. Joint meter readings are taken jointly by representatives of power purchaser and representative of SPL as per the applicable provisions mentioned in the Power Purchase Agreement (PPA). The joint meter readings are recorded once in a month.

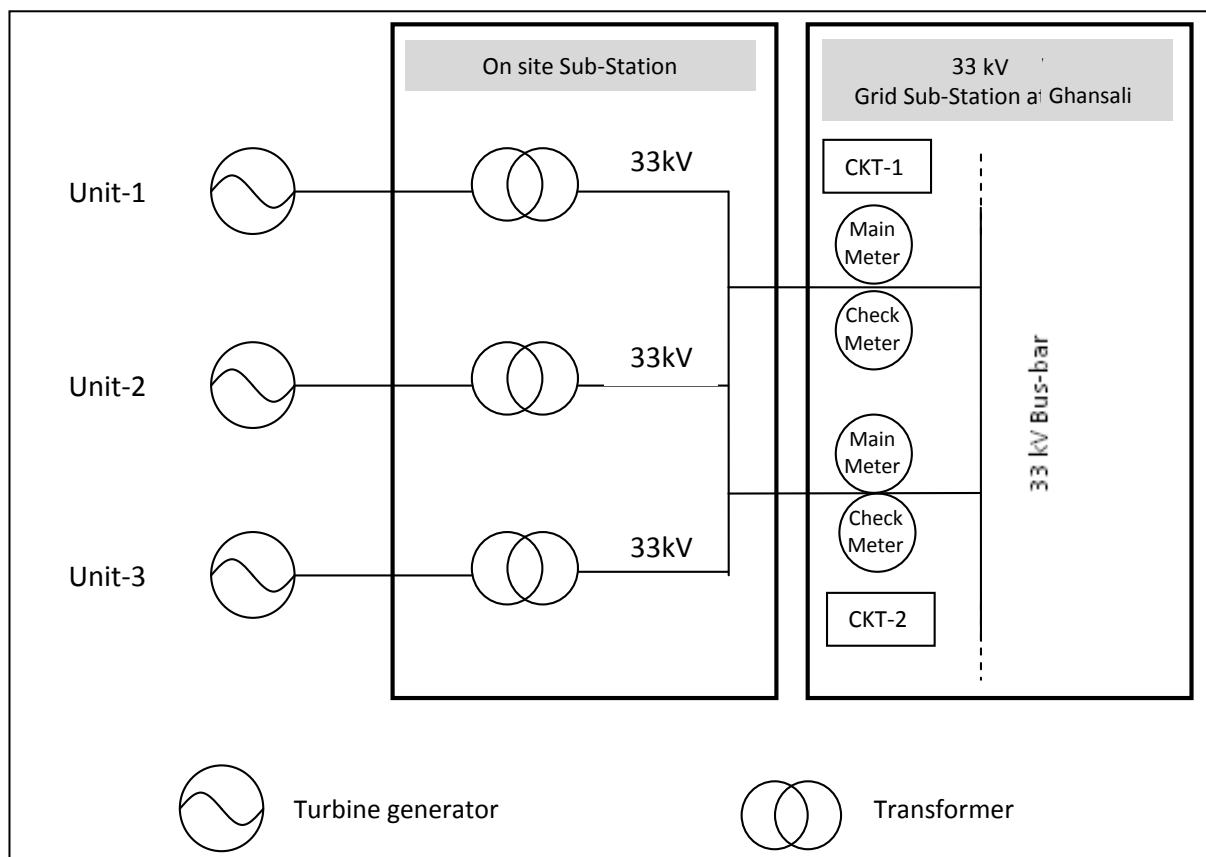
The monitoring and verification system would mainly comprise of these meters as far as power export is concerned. Power purchaser is billed by SPL based on joint meter reading reports

The general monitoring principles are based on:

- **Frequency**
- **Reliability**
- **Registration and reporting**

The schematic for the monitoring parameters is provided in Fig.2

Fig 2



Net power exported to the grid is monitored through a set of parallel metering systems, CKT-1 and CKT-2, each comprising a main (also called “bill”) meter and a check meter of identical type and specification and installed parallel to each other at the 33kV grid interconnection point at Ghansali sub-station of UPCL (Refer Fig. 2). The net power exported from the project activity is obtained by adding the recordings in CKT-1 and CKT-2. The meters are ABT¹ type, bi-directional trivector meters.

Frequency of monitoring

SPL carries out hourly measurement and monthly data recording. Respective Electricity Utility/Power Purchaser and SPL jointly read the main and check (backup) metering system on the mutually decided day as per the provision in PPA.

Reliability

The amount of emission reduction is proportional to the net electricity supplied to grid by the project activity. The reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result. The project proponent also ensures quality of the equipment used for monitoring.

Maintenance of the metering system is as per the terms of the applicable PPA. The meters initially installed by UPCL were of the Accuracy class 0.5s. However, the same were replaced with meters of accuracy class 0.2s on 02/07/2011 and 13/07/2011 in CKT-1 and CKT-2 respectively. The main and check (backup) metering system are sealed in the presence of both parties. All the main and check meters are tested for accuracy as per applicable PPA. When the main metering system and/or check (backup)

¹ Availability Based Tariff meters



metering system and/or any component is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it is repaired, re-calibrated or replaced, as soon as possible. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Any meter seal is broken only by authorised personnel of power purchaser in the presence of SPL's representative whenever the main or check (backup) metering system is to be inspected, tested, adjusted, repaired or replaced.

Registration and reporting

Power purchaser and SPL jointly read the metering system and keep complete and accurate records for proper administration. Hourly data recording by the Shift Incharge is available. Weekly reports in spreadsheet format stating the generation are prepared by the Shift Incharge and verified by the Plant Manager.

Verification

The performance of the project would lead to CO₂ emission reductions. In other words, the higher the electricity exports to the grid the more would be the emission reductions. There are two aspects of Verification

Verification of the Monitoring System which includes:

- **Verification of various measurement and monitoring methods**
- **Verification of instrument calibration methods**
- **Verification of measurement accuracy**

Verification of Data collected which includes

- **Net export of power.**
 - a) The project proponent is required to provide the necessary support to enable verification of both the monitoring system and the data archived.

Procedures for Cross Verification of net energy supplied to grid by project activity:

The net energy evacuated from the project activity to the state grid can be cross verified against the payment received from the DISCOM against the corresponding invoice raised by the power generator.

A copy of the payment received from the power purchaser along with the corresponding invoice raised was submitted to the verifier during verification as a cross-reference for the net energy supplied to the state grid.

As stated before, in case of a mismatch between invoice value and payment received value, the net generation figure corresponding to the lower of the two values is considered for calculation of emission reduction.

Fuel usage records in the DG set is cross-verified from records on purchased quantities and stock changes recorded in the stock register.

The project participant is responsible for project management as well as registration, monitoring, measurement and reporting of project related information and data.



Project manager - off-site	Responsible for compiling generation data, CDM related monitoring, providing information to company Management, calculating the emission reductions regularly and preparing the monitoring report possibly through a CDM consultant.
Project site manager	Maintenance of the power generation and evacuation equipment, maintaining record of JMR, maintenance of generation records, running time of DG set, preparation of daily generation and event reports, calibration of meters.

SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

Data/Parameter	EF _y
Unit	tCO _{2e} /GWh
Description	Electricity baseline emission factor
Source of data	Registered PDD
Value(s) applied	896.26
Purpose of data	Baseline emission calculation
Additional comment	The baselines emission factor was determined ex-ante and fixed during the fixed crediting period of 10 years.

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

Data/Parameter	EG_y
Unit	MWh
Description	Electricity supplied to the grid by the project activity
Measured/Calculated /Default	Calculated
Source of data	Electricity meter readings at the substation (interconnection facility connecting the facility to the grid) between the Project and the grid as recorded in the monthly Joint Meter Reading.
Value(s) of monitored parameter	67,193.83

**Monitoring equipment**

Electronic trivector meter

CKT-1

Meter→	Main (bill) meter ²	Check meter	Main (bill) meter ³	Check meter
Period of operation during this operation period	01/01/2011 to 16/03/2011	01/01/2011 to 16/03/2011	17/03/2011 onwards	17/03/2011 Onwards
Serial No.	UPC-95785	UPC-95786	UPK- 00311	UPK-00312
Meter type	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters
Accuracy class	0.5s ⁴	0.5s	0.2s	0.2s
Calibration frequency	Annual	Annual	Annual	Annual
Dates of all calibration s during this monitoring period	14/01/2011	14/01/2011	17/03/2011 and next calibration on 05/11/2011	17/03/2011 and next calibration on 05/11/2011
Valid upto	13/01/2012	13/01/2012	04/11/2012	04/11/2012

CKT-2

Meter→	Main (bill) meter	Check meter	Main (bill) meter	Check meter
Period of opeartion during this operation period	01/01/2011 to 16/01/2011 And 01/07/2011 To 12/07/2011	01/01/2011 to 16/01/2011 And 01/07/2011 To 12/07/2011	13/07/2011 onwards	13/07/2011 Onwards
Serial. No.	UPC-95787	UPC-95788	UPK-00308	UPK-00309
Meter type	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters	ABT type, bi-directional trivector meters
Accuracy class	0.5s	0.5s	0.2s	0.2s
Calibration frequency	Annual	Annual	Annual	Annual
Dates of all calibration s during this monitoring period	14/01/2011	14/01/2011	12/07/2011 and next calibration on 26/11/2011	12/07/2011 and next calibration on 26/11/2011
Valid upto	13/01/2012	13/01/2012	25/11/2012	25/11/2012



Measuring/Reading/Recording frequency	Hourly measurement and monthly recording.
Calculation method (if applicable)	This parameter is derived by subtracting electricity imported from the grid from the electricity exported to the grid by project activity.
QA/QC procedures	Electricity meters are properly maintained with regular testing and calibration schedules developed as per the technical specification requirements to ensure accuracy. The testing/calibrations are carried out by UPCL Testing Centre. UPCL is a government agency who has carried out the calibrations.
Purpose of data	This is used for Baseline emission calculations
Additional comment	-

Data/Parameter	$FC_{HSD,y}$
Unit	Litre
Description	Quantity of HSD consumed
Measured/Calculated/Default	Measured
Source of data	Stock register
Value(s) of monitored parameter	975
Monitoring equipment	-
Measuring/Reading/Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	The data is used to calculate the project emission
Additional comment	The quantity of diesel purchased is immediately transferred to the fuel sump of the DG set and is considered as consumed. No stock is maintained. This also results in conservative accounting of fuel consumed in the project activity.

⁴ As per clause 14 of PPA signed with UPCL, the responsibility of installation and maintaining the meters was with UPCL. UPCL has initially installed meters of 0.5s accuracy class which were later replaced with meters of accuracy class 0.2s. Hence, a correction factor has been applied to the energy readings from 1/01/2011 till the date of replacement of meters.



Data/Parameter	$\rho_{\text{HSD},y}$
Unit	kg/m ³
Description	Density of HSD
Measured/Calculated /Default	Default
Source of data	Technical specification sheet of supplier (http://www.iocl.com/Products/DieselSpecifications.pdf)
Value(s) of monitored parameter	860
Monitoring equipment	-
Measuring/Reading/Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	The data is used to calculate the project emission
Additional comment	Though the technical data sheet states the density as 820-860 Kg/m ³ , the higher value of 860 kg/m ³ is considered for a conservative calculation of project emission

Data/Parameter	$\text{NCV}_{i,y}$
Unit	GJ/T
Description	Net calorific value of fuel in the year y
Measured/Calculated /Default	Default
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter	43.3
Monitoring equipment	-
Measuring/Reading/Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	The data is used to calculate the project emission
Additional comment	This value will remain fixed for the entire verification period



Data/Parameter	EF _{CO₂,i,y}
Unit	tCO ₂ /GJ
Description	CO ₂ emission factor for diesel
Measured/Calculated/Default	Default
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter	0.0748
Monitoring equipment	-
Measuring/Reading/Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	The data is used to calculate the project emission
Additional comment	This value will remain fixed for the entire verification period

D.3. Implementation of sampling plan

NA

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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The baseline emission BE_y (tCO₂e) during the monitoring period is calculated as:

$$BE_y = EG_y * EF_y$$

Where,

BE_y Baseline emissions due to displacement of electricity during the year y in tons of CO₂

EG_y Net electricity supplied to the grid during the monitoring period (MWh);

EF_y Emission factor of the grid (tCO₂ /MWh) (896.26 tCO₂/GWh)

The baseline emission works out as

$$BE_y = 67193.83 * 0.89626 = 60222.81 \text{ tCO}_2 = \mathbf{60,222 \text{ tCO}_2}$$

E.2. Calculation of project emissions or actual net GHG removals by sinks

Project emissions (PE_y) are.

$$PE_{FC,y} = FC_{HSD,y} * \rho_{HSD,y} * NCV_{HSD,y} * EF_{CO_2,HSD,y} / 10^6$$

That is,

$$\begin{aligned} PE_y &= 975 * 860 * 43.3 * 0.0748 / 10^6 \\ &= 2.72 \text{ tCO}_2 \end{aligned}$$

E.3. Calculation of leakage

Leakage emissions are zero as per registered PDD, i.e.

$$LE_y = 0 \text{ tCO}_2$$

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO _{2e})	Project emissions or actual net GHG removals by sinks (tCO _{2e})	Leakage (tCO _{2e})	Emission reductions or net anthropogenic GHG removals by sinks (tCO _{2e})
Total	60,222	2.72	0	60,220

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO _{2e})	109,304	60,220

E.6. Remarks on difference from estimated value in registered PDD

The plant was not operational for 165 days during this monitoring period.

History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance		