



**MONITORING REPORT (CDM-MR)**  
**Adopted Template published in EB 54, Annex 34**

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**MONITORING REPORT****Version Number 01, 15/06/2010****Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects****Reference No. 0327****Fourth Monitoring Period covering 01/07/2008 to 31/03/2010 (both days included)****SECTION A. General description of the project activity****A.1. Brief description of the project activity:**

&gt;&gt;

Three Mini Hydroelectric Projects (MHP) aggregating to 5.20 MW at Lohgarh, Chakbhai and Sidhana on the Bathinda Branch Canal, District Ludhiana, Sangrur and Bathinda respectively in Punjab, India have been set-up. Mini Hydroelectric Project at Lohgarh (2 MW) was commissioned in October, 2005, Chakbhai (2 MW) was commissioned in November 2004 and Sidhana (1.20 MW) was commissioned in October, 2007. The plants are operating as described in the PDD.

The purpose of the project activity is to generate electricity by utilizing water flowing through the existing canal system as a renewable energy resource to meet the ever-increasing demand for energy in the region. The development of the project activity contemplates the production of clean hydroelectric power that will contribute to reduce the CO<sub>2</sub> emissions, which would have occurred otherwise, in the absence of these projects.

2.0 MW hydroelectric power plant at Lohgarh, 2.0 MW hydroelectric power plant at Chakbhai and 1.2 MW hydroelectric power plant at Sidhana of this project activity generate electricity and sell it to the Punjab State Electricity Board (PSEB) through Power Purchase Agreement (PPA) contract.

These three plants are of low head, canal drop based mini hydroelectric projects (project activity). The projects are canal based renewable hydroelectric generating plants, which include forebay, mechanical intake gates, trashracks, draft tubes, vertical turbine and a powerhouse with its discharge channel and adjoining roads. The component plants do not involve any type of displacement, rehabilitation or relocation.

The plants are generating electricity successfully by converting the potential and kinetic energy of the canal water and the renewable electricity produced is fed into the Punjab State Electricity Board Grid thereby replacing the equivalent amount of electricity produced from Thermal stations and thus reducing green house gas emissions.

**Equipment Details:**

The MHPs were completed with major equipment of following details:

S.No.	MHP	Equipment	Quantity	Capacity	Manufacturer
1	Lohgarh	Turbine & its accessories	2	---	Boving Fouress Limited, Bangalore
		Synchronous Generator	2	1000 kW	
2	Chakbhai	Turbine & its accessories	2	---	Boving Fouress Limited, Bangalore
		Synchronous Generator	2	1000 kW	
3	Sidhana	Turbine & its accessories	1	----	Boving Fouress Limited, Bangalore
		Synchronous Generator	1	1200 kW	

The project activity was implemented and operated as planned and described in the Project Design Document (PDD). During the present monitoring period i.e. 01st July 2008 to 31<sup>st</sup> March 2010, the net power exported to the grid by the three plants is 57.67 Million kWh which corresponds to 54,297 tCO<sub>2</sub> emissions reduction in this monitoring period.

**A.2. Project Participants****Aqua Power Private Limited**

The name of the Company has been changed from “Aqua Power Limited” to “Aqua Power Private Limited”. The fresh certificate of incorporation and Host Country approval dated 06/05/2008, for the same has been received by the project activity. The records at CDM Registry with respect to the revised modalities of communication signed by all Project Participants have been updated.

**A.3. Location of the project activity:**

LOHGARH: The project is located on R.D.128000 on Bathinda branch canal.

Latitude        30° 55 N ; Longitude   75° 54 E  
Town:           Raikot  
Distt:           Ludhiana  
State:           Punjab  
Country:        India

CHAK BHAI : The project is located on R.D.185000 on Bathinda branch canal .

Latitude        30° 12 N ; Longitude   75° 53 E  
Town :           Mehal Kalan  
Distt.:           Barnala  
State:           Punjab  
Country:        India

SIDHANA : The project is located on R.D. 307000 on Bathinda branch canal having

Latitude        30° 11 N ; Longitude   75° 00 E  
Town :           Rampura Phul  
Distt.:           Bathinda  
State:           Punjab  
Country:        India

**A.4. Technical description of the Project**

The project activity consists of 3 sites of Small hydro Power Plant i.e Chakbhai, Lohgarh & Sidhana utilizing the potential and kinetic energy of the canal water to generate electricity.

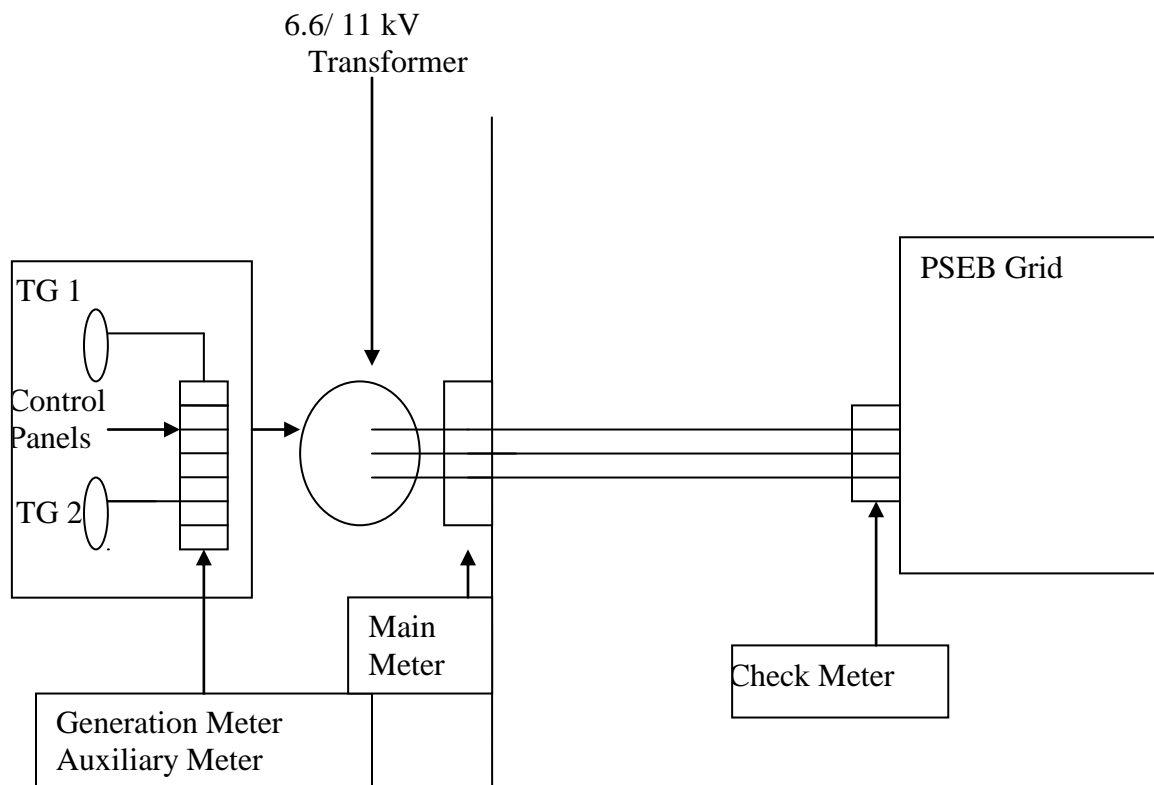
Lohgarh:- The powerhouse comprises of two synchronous generators of capacity 1000 kW each coupled to two numbers of vertical Full Kaplan turbines. The power is generated at a voltage of 6.6 kV, which is further stepped- up to 11 kV to match the nearest substation voltage level.

Chakbhai: The powerhouse comprises of two synchronous generators of capacity of 1000 kW each coupled to two numbers of vertical Full- Kaplan turbines. The power is generated at a voltage of 6.6 kV which is further stepped-up to 11 kV to match the nearest substation voltage level.

Sidhana: The Powerhouse comprises of one synchronous generator of capacity 1200 kW coupled to a vertical Full-Kaplan turbine. The power is generated at a voltage of 6.6 kV, which is further stepped-up to 11 kV to match the nearest substation voltage level.

The principal components of each scheme are:-

- (a) Forebay and Intake: Forebay is partly trapezoidal and RCC and trough section where the water is diverted towards the powerhouse upon closure of main canal gates via the intake.
- (b) Power House:- A semi outdoor type powerhouse has been provided to house the turbines, generators and related electro- mechanical equipment.
- (c) Draft Tube:- RCC draft tube has been provided to convey the tail water emerging from discharge side of the turbine to the main canal via tailrace channel.
- (d) Turbine:- Vertical full Kaplan has been provided for all the three projects.
- (e) Tailrace:- The discharge emerging out the draft tubes is carried back to main canal on downstream of the project by trapezoidal shaped tailrace channel connecting draft tube exit to the main canal.
- (f) Switchyard:- Surface type switchyard has been provided with necessary equipment for interfacing with the Grid.



**Note:- Control panels comprise of Relays, Breakers, Generation Meters and Auxiliary Meters.**

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

Type I- Renewal Energy Projects  
Category: I.D.: Renewable electricity generation for a grid  
Version: 07

**A.6. Registration date of the project activity:**

30/04/2006

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

Crediting Period for this project activity is 20/11/2004 to 19/11/2014 (fixed)  
This is the fourth monitoring report associated with the project activity. The previous monitoring report covered the period from 20/11/2004 to 31/3/2006 (Both days included) and the second monitoring report covered the period from 1<sup>st</sup> April 2006 to 30<sup>th</sup> April 2007 (Both days included) third monitoring report covered the period from 1<sup>st</sup> May 2007 to 30<sup>th</sup> June 2008 (Both days included) and the CERs for the same have already been issued.

The period covered in this monitoring report is from 1<sup>st</sup> July 2008 to 31<sup>st</sup> March 2010 (Both days included). This monitoring report does not cover any period of time covered by the previous monitoring report.

**A.8. Name of responsible person(s)/entity(ies):**

Name:- Pushpinder Singh  
Contact No. +919779450009  
Email:- [pushpindersingh68@gmail.com](mailto:pushpindersingh68@gmail.com)

**SECTION B. Implementation of the project activity****B.1. Implementation status of the project activity**

The projects were completed as planned and described in the Project Design Document (PDD).

The project at Lohgarh (2MW) is in operation continuously (with outages – forced & planned) since October 2005, Chakbhai (2MW) since November 2004 and Sidhana (1.2MW) since October 2007.

**Details of down time from 1<sup>st</sup> July 2008 to 31<sup>st</sup> March, 2010**

<b>PROJECT</b>	<b>DOWNTIME (IN HOURS)</b>
<b>Chakbhai</b>	2358.00
<b>Lohgarh</b>	2918.35
<b>Sidhana</b>	2069.50

**BREAKUP OF DOWN TIME**

<b>PROJECT</b>	<b>DOWNTIME</b>	<b>REASON</b>
<b>Chakbhai</b>	212.42	Grid failure
	120.07	Tripping/ Maintenance/ other beakdown
	2025.11	Low discharge
<b>Lohgarh</b>	330.10	Grid failure
	249.44	Tripping/ Maintenance/ other beakdown
	2338.44	Low discharge
<b>Sidhana</b>	474.40	Grid failure
	144.54	Tripping/ Maintenance/ other beakdown
	1450.16	Low discharge

**B.2. Revision of the monitoring plan**

The monitoring plan has not been revised.

**B.3. Request for deviation applied to this monitoring period**

Not Applicable

**B.4. Notification or request of approval of changes**

Not Applicable

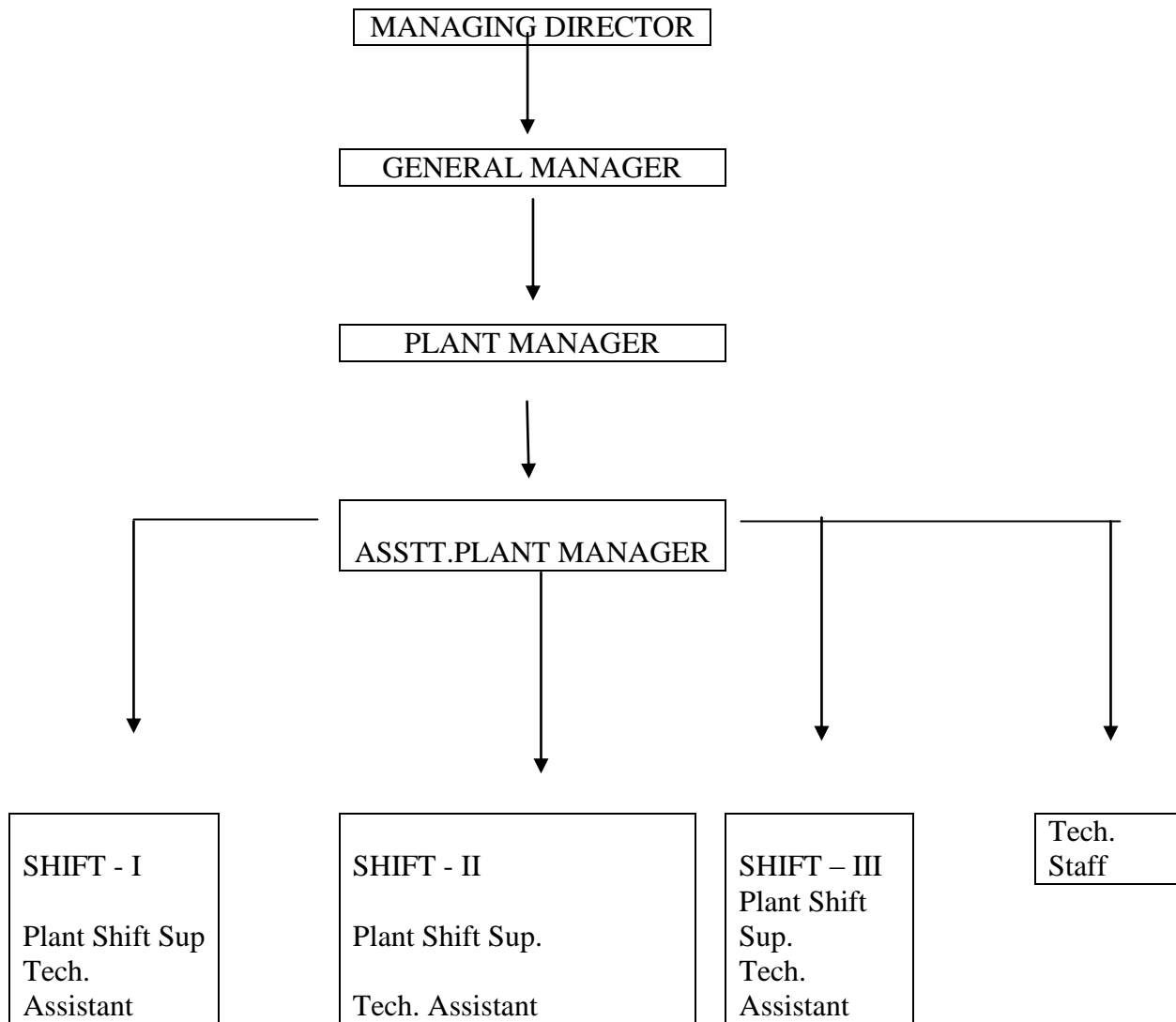
**SECTION C. Description of the monitoring system**

For this project activity the monitoring procedure was followed as described below.

- i. The Energy exported (kWh) and Energy imported (kWh) at the interconnection points have been measured by the electronic energy meters (i.e. Trivector Meters) installed at the interconnection points of the 3 (three) project sites.
- ii. The Net saleable energy (net electricity exported to grid) has been calculated as a difference between energy exported and energy imported. It is based on monthly joint meter readings.
- iii. Monthly joint meter readings were taken at interconnection points and certified by representatives of Aqua Power Private Limited (APPL) and the purchaser i.e. Punjab State Electricity Board (PSEB).
- iv. The joint meter readings were used to raise invoice for sale of net energy to PSEB.
- v. The energy generated has been measured by the energy meters installed at the generation points on an hourly basis.
- vi. The auxiliary energy consumption has been measured by the auxiliary energy consumption meters installed at the plants on an hourly basis.
- vii. The data of the aforesaid parameters are recorded on hourly basis which are summed into a daily reading.
- viii. The hourly readings of electricity generation and auxiliary consumption were aggregated to daily and monthly electricity figures.
- ix. Monthly reports stating the energy exported, energy imported, energy generated and auxiliary energy consumption were prepared by shift-in-charge and verified by plant managers.
- x. The finance department cross checked the data provided by plant managers.



The Organizational structure responsible for monitoring the various parameters as per Monitoring Plan for each site is as below:-



The Hourly data is monitored and recorded in the log books by the Shift Staff comprising of Plant Shift Supervisor and Technical Assistant. The daily data is checked and countersigned by the Assistant Plant Manager. The daily and monthly data is checked and verified by the Plant Manager. The data is audited annually by the auditor of the Company having financial background.

**The Diagram showing all relevant monitoring points has been displayed in Section A.4.**

**SECTION D. Data and parameters**
**D.1 Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors**

<b>Data / Parameter:</b>	Grid Emission Factor
<b>Data unit:</b>	kg of CO <sub>2</sub> / kWh
<b>Description:</b>	The Grid Emission Factor has been calculated as the weighted average of the operating Margin Emission Factor (EF <sub>OM</sub> ) and the Build Margin Emission Factor (EF <sub>BM</sub> ).
<b>Source of data used:</b>	Northern Region Grid's emission from Central Electricity Authority
<b>Value(s) :</b>	0.942
<b>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</b>	Baseline emission calculations
<b>Additional comment:</b>	This parameter is fixed ex-ante for the full crediting period

**D.2.1 Data and parameters monitored**

<b>Data / Parameter:</b>	Energy exported		
<b>Data unit:</b>	kWh		
<b>Description:</b>	Energy Exported to grid		
<b>Measured /Calculated /Default:</b>	Measured		
<b>Source of data:</b>	Main meters		
<b>Value(s) of monitored parameter:</b>	57,712,224 (Lohgarh: 23,880,120, Chakbhai: 19,842,220 and Sidhana: 13,989,944)		
<b>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</b>	Baseline emissions		
<b>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</b>	<b>Lohgarh</b>	<b>Chakbhai</b>	<b>Sidhana</b>
	Electronic	Electronic	Electronic
	Bidirectional meter	Bidirectional meter	Bidirectional meter
	(Make: L& T )	(Make: L& T )	(Make: L& T )
	S. No.4223075	S. No.4187462	S. No.05271089
	accuracy: $\pm 0.5\%$	accuracy: $\pm 0.5\%$	accuracy: $\pm 0.5\%$
	Calibration Frequency- 6 month	Calibration Frequency- 6 month	Calibration Frequency- 6 month
	Date of Calibration	Date of Calibration	Date of Calibration
	<b>Date</b>	<b>Date</b>	<b>Date</b>
	<b>Valid</b>	<b>Valid</b>	<b>Valid</b>
	<b>Upto</b>	<b>Upto</b>	<b>Upto</b>
	16.01.2008 to	20.06.2008 to	19.08.2008 to
	16.07.2008	20.12.2008	19.02.2009
	16.07.2008 to	24.01.2009 to	09.03.2009 to



	16.01.2009 18.03.2009 to 18.09.2009 20.08.2009 to 20.02.2010 22.10.2010 to 22.08.2010	24.07.2009 30.05.2009 to 31.11.2009 26.11.2009 to 26.05.2010 15.05.2010 to 15.11.2010	09.09.2009 09.09.2009 to 09.03.2010 20.03.2010 to 20.09.2010
Measuring/ Reading/ Recording frequency:	Monthly		
Calculation method (if applicable):	Not Applicable		
QA/QC procedures applied:	<p>The power exported by Aqua Power Private Limited is monitored and recorded on the basis of reading of the Main Meter. The same is cross checked with the Check Meter installed before feeding electricity produced by the project into the Grid. Joint Meters reading are based on the Main Meter reading for the export and import of the electricity to and from the Grid.</p> <p>The principles of Frequency, Data recording and Reliability as mentioned in the PDD are strictly adhered to. The Main Meters and Check Meters were subjected to calibration every six months by Punjab State Electricity Board.</p>		

<b>D.2.2 Data and parameters monitored</b>			
<b>Data / Parameter:</b>	Energy imported		
Data unit:	kWh		
Description:	Energy imported from grid		
Measured /Calculated /Default:	Measured		
Source of data:	Main meters		
Value(s) of monitored parameter:	42,998 (Lohgarh: 8,930, Chakbhai: 15,050 and Sidhana: 19,018)		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>Lohgarh</b>	<b>Chakbhai</b>	<b>Sidhana</b>



	<p>Electronics Bidirectional meter ( Make:L&amp; T ) S. No.4223075 accuracy: <math>\pm 0.5\%</math> Calibration Frequency- 6 month Date of Calibration</p> <p><b>Date Valid Upto</b> 16.01.2008 to 16.07.2008 16.07.2008 to 16.01.2009 18.03.2009 to 18.09.2009 20.08.2009 to 20.02.2010 22.10.2010 to 22.08.2010</p>	<p>Electronics Bidirectional meter ( Make: L&amp; T ) S. No.4187462 accuracy: <math>\pm 0.5\%</math> Calibration Frequency- 6 month Date of Calibration</p> <p><b>Date Valid Upto</b> 20.06.2008 to 20.12.2008 24.01.2009 to 24.07.2009 30.05.2009 to 31.11.2009 26.11.2009 to 26.05.2010 15.05.2010 to 15.11.2010</p>	<p>Electronics Bidirectional meter ( Make:L&amp; T ) S. No.05271089 accuracy: <math>\pm 0.5\%</math> Calibration Frequency- 6 month Date of Calibration</p> <p><b>Date Valid Upto</b> 19.08.2008 to 19.02.2009 09.03.2009 to 09.09.2009 09.09.2009 to 09.03.2010 20.03.2010 to 20.09.2010</p>
Measuring/ Reading/ Recording frequency:	Monthly		
Calculation method (if applicable):	Not Applicable		
QA/QC procedures applied:	<p>The Main and Check Meters installed are bidirectional Tri -Vector Meters capable of recording energy exported and energy imported. The same are test checked for accuracy every six months. The data of the Main Meter is checked / compared with the data of the Check Meter.</p> <p>The principles of Frequency, Data recording and Reliability as mentioned in the PDD are strictly adhered to. The Main Meters and Check Meters were subjected to calibration every six months by Punjab State Electricity Board.</p>		

D.2.3 Data and parameters monitored	
<b>Data / Parameter:</b>	Net saleable energy
Data unit:	kWh
Description:	Net saleable energy to grid
Measured /Calculated /Default:	Calculated
Source of data:	Log book/main meter
Value(s) of monitored parameter:	57,669,286 (Lohgarh: 23,871,190, Chakbhai: 19,827,170 and Sidhana: 13,970,926)
Indicate what the data are used for (Baseline/ Project/ Leakage	Baseline emissions



emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	As this is calculated, this section is not applicable for this monitoring parameter.
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Net saleable energy = Energy exported – Energy imported
QA/QC procedures applied:	<p>Net Saleable energy is the net exported energy to grid which is the difference of energy exported and energy imported. Joint Meters reading are taken from the Main and Check Meter every month to arrive at Net Saleable energy.</p> <p>The Main and Check Meters are subjected to calibration every six months.</p>

D.2.4 Data and parameters monitored			
<b>Data / Parameter:</b>	Energy generated		
Data unit:	kWh		
Description:	Gross energy generated		
Measured /Calculated /Default:	Measured		
Source of data:	Generation Meters		
Value(s) of monitored parameter:	59,340,258 (Lohgarh: 24,365,521, Chakbhai: 20,531,921 and Sidhana: 14,442,816)		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>Lohgarh</b> Make: Minsun Digital Power Meter 882-332 Unit1:6851013 Unit 2:68B0512 Accuracy (±)1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to 07.12.2008 04.12.2008 to 04.06.2009 01.06.2009 to 01.12.2009	<b>Chakbhai</b> Make: Minsun Digital Power Meter 882-332 Unit 1: 6851001 Unit 2 : 6790517 Accuracy (±)1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to	<b>Sidhana</b> Make: Enercon EM 6400 66927/3665-0605 Accuracy (±)1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to 07.12.2008 04.12.2008 to



	01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010	07.12.2008 04.12.2008 to 04.06.2009 01.06.2009 to 01.12.2009 01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010	04.06.2009 01.06.2009 to 01.12.2009 01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010
Measuring/ Reading/ Recording frequency:	Hourly		
Calculation method (if applicable):	Not Applicable		
QA/QC procedures applied:	The readings of the energy generated are taken from the meters installed at generation point. These are subjected to calibration every six months.		

D.2.5 Data and parameters monitored			
<b>Data / Parameter:</b>	Auxiliary energy consumption		
Data unit:	kWh		
Description:	Auxiliary energy consumed for running the plant		
Measured /Calculated /Default:	Measured		
Source of data:	Auxiliary Meters		
Value(s) of monitored parameter:	1,627,887 (Lohgarh: 485,311, Chakbhai: 689,701 and Sidhana: 452,875)		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>Lohgarh</b>	<b>Chakbhai</b>	<b>Sidhana</b>



	<b>Make: Enercon</b> 56248/1285-3404 Accuracy ( $\pm$ )1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to 07.12.2008 04.12.2008 to 04.06.2009 01.06.2009 to 01.12.2009 01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010	<b>Make: Enercon</b> E 64/1640-903 Accuracy ( $\pm$ )1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to 07.12.2008 04.12.2008 to 04.06.2009 01.06.2009 to 01.12.2009 01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010	<b>Make: Enercon</b> 148153/13538-608 Accuracy ( $\pm$ )1% Frequency of calibration- 6 month Date of calibration <b>Date Valid Upto</b> 07.06.2008 to 07.12.2008 04.12.2008 to 04.06.2009 01.06.2009 to 01.12.2009 01.12.2009 to 01.06.2010 15.05.2010 to 15.11.2010
Measuring/ Reading/ Recording frequency:	Hourly		
Calculation method (if applicable):	Not Applicable		
QA/QC procedures applied:	Auxiliary Energy Consumption readings are recorded at the Auxiliary meters installed in the panel. These are subjected to calibration every six months		

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

Code	Description	Formula	Unit	Value
A	Energy exported		kWh	<b>57,712,284.00</b>
B	Maximum inaccuracy specification in the meter		%	<b>0.50%</b>
C	Less: Maximum inaccuracy specification in the meter during the month of January 2009, February 2009 & March 2009 at MHP Lohgarh	$C = \text{Energy exported (Jan. 09, Feb. 09 \& Mar. 09)} * 0.50$	kWh	<b>13,744.25</b>
D	Less: Maximum inaccuracy specification in the meter during the month of January.2009 at MHP Chakbhai	$D = \text{Energy exported ( Jan 09)} * 0.50\%$	kWh	<b>4,641.95</b>
E	Less: Maximum inaccuracy specification in the meter during the period July 2008, Aug., 2008 and March 2009 at MHP Sidhana	$E = \text{Energy exported (July 08, Aug. 08, Feb 09)} * 0.50\%$	kWh	<b>10,549.82</b>
F	Energy exported based on maximum inaccuracy specification of the meters	$F = A - C - D - E$	kWh	<b>57,683,347.98</b>

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<b>G</b>	<b>Energy exported based on maximum inaccuracy specification of the meters – corrected value</b>		<b>kWh</b>	<b>57,683,348.00*</b>
<b>H</b>	Energy imported		<b>kWh</b>	<b>42,998.00</b>
<b>I</b>	Maximum inaccuracy specification in the meter		<b>%</b>	<b>0.50%</b>
<b>J</b>	Add: Maximum inaccuracy specification in the meter during the month of January 2009, February 2009 & March 2009 at MHP Lohgarh	J=Energy imported (Jan. 09, Feb. 09 & Mar. 09)*0.50%	<b>kWh</b>	<b>13.10</b>
<b>K</b>	Less: Maximum inaccuracy specification in the meter during the month of January.2009 at MHP Chakbhai	K=Energy imported ( Jan 09)*0.50%	<b>kWh</b>	<b>7.10</b>
<b>L</b>	Less: Maximum inaccuracy specification in the meter during the period July 2008, Aug., 2008, March 2009 at MHP Sidhana	L=Energy imported (July 08, Aug. 08, March 09)*0.50%	<b>kWh</b>	<b>15.24</b>
<b>M</b>	Energy imported based on maximum inaccuracy specification of the meters	M=H+J+K+L	<b>kWh</b>	<b>43,033.44</b>
<b>N</b>	<b>Energy imported based on maximum inaccuracy specification of the meters – corrected value</b>		<b>kWh</b>	<b>43,033.00*</b>
<b>O</b>	<b>Net Saleable Energy</b>	<b>O=G-N</b>	<b>kWh</b>	<b>57,640,315.00</b>
<b>P</b>	Carbon Emission Factor as per the baseline adopted		<b>kg CO<sub>2</sub>/kWh</b>	<b>0.942</b>
<b>Q</b>	<b>Baseline Emissions</b>	<b>Q=(O*P) / 1000</b>	<b>ton CO<sub>2</sub></b>	<b>54,297</b>

\*Due to the delayed calibration of the export and import meters (main), the electricity figures have been corrected in accordance with Annex 60 of EB 52.

**E.2. Project emissions calculation**

Calculation of project emissions does not apply in accordance with the PDD and methodology.

**E.3. Leakage calculation**

Calculation of leakage does not apply in accordance with the PDD and methodology.

**E.4. Emission reductions calculation / table**

Baseline Emissions : 54,297 (refer Section E.1 above)  
Project Emissions : NIL  
Emission Reductions : Baseline emissions – Project emissions  
= 54,297  
= 54,297 tCO<sub>2</sub>



**E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO <sub>2</sub> e)	47,181	54,297

**E.6. Remarks on difference from estimated value in the PDD**

There is an increase of 7116 CERs in the present monitoring period which covers 2008-2009 and 2009-2010 which is 15.08% increase. This is because of the fact that the said hydro projects are run of the canal power projects and the power generation is a function of head and discharge. Since, the head is fixed therefore the increase or decrease in generation is purely based on release of discharge in the canal which is further dependent upon the discharge in the rivers of the state and the demand pattern. The discharge in the rivers is dependent on the various weather phenomenon like snow fall, rainfall, maximum temperature during the summer etc.

**Annexure - I**

The month-wise data on energy generated is given in Table 3 below: This monthly data is based on the hourly reading taken at the meters installed at the Generation end.

**Table 3: Energy Generation (kWh)**

<b>Billing Month</b>	<b>Year</b>	<b>Chakbhai</b>	<b>Lohgarh</b>	<b>Sidhana</b>	<b>Total</b>
Jul	2008	1,433,095	1,145,490	752,726	3,331,311
Aug	2008	1,366,550	1,078,170	744,094	3,188,814
Sep	2008	1,415,285	1,271,297	827,357	3,513,939
Oct	2008	984,793	850,385	639,013	2,474,191
Nov	2008	898,557	717,078	570,925	2,186,560
Dec	2008	826,570	760,469	397,600	1,984,639
Jan	2009	946,495	818,785	608,325	2,373,605
Feb	2009	1,144,055	973,737	685,250	2,803,042
Mar	2009	1,261,347	1,060,896	804,743	3,126,986
Apr	2009	536,111	450,508	355,157	1,341,776
May	2009	1,495,930	1,144,520	902,440	3,542,890
June	2009	1,364,870	1,237,846	838,460	3,441,176
July	2009	1,333,160	1,265,106	763,555	3,361,821
August	2009	1,497,335	1,144,752	835,458	3,477,545
Sept.	2009	1,372,064	1,114,533	770,620	3,257,217
Oct.	2009	634,531	528,061	325,427	1,488,019
Nov.	2009	861,390	730,152	562,583	2,154,125
Dec.	2009	1,275,965	1,106,972	776,437	3,159,374
Jan	2010	1,162,044	1,041,185	738,242	2,941,471
Feb	2010	1,194,774	989,218	722,688	2,906,680
Mar	2010	1,360,600	1,102,761	821,716	3,285,077
<b>Total</b>		<b>24,365,521</b>	<b>20,531,921</b>	<b>14,442,816</b>	<b>59,340,258</b>

## Annexure II

The month-wise data on auxiliary energy consumption is given in Table 4 below: This monthly data is based on the hourly reading taken at the Auxiliary meters installed at the Panel.

**Table 4: Auxiliary Energy Consumption**

Billing Month	Year	Chakbhai	Lohgarh	Sidhana	Total
Jul	2008	12,971	15,829	14,885	43,685
Aug	2008	13,077	14,417	14,831	42,325
Sep	2008	12,061	16,246	15,260	43,567
Oct	2008	9,472	15,254	11,497	36,223
Nov	2008	8,610	11,837	11,957	32,404
Dec	2008	8,709	13,875	10,386	32,970
Jan	2009	8,503	11,726	14,383	34,612
Feb	2009	7,605	14,054	15,805	37,464
Mar	2009	8,770	17,192	17,403	43,365
Apr	2009	4,569	11,011	18,886	34,466
May	2009	13,123	18,184	17,771	49,078
June	2009	11,324	16,142	16,546	44,012
Jul	2009	14,036	16,802	16,036	46,874
Aug	2009	13,876	14,456	15,499	43,831
Sep	2009	12,090	13,703	15,632	41,425
Oct	2009	9,200	11,999	8,037	29,236
Nov	2009	9,558	11,595	11,065	32,218
Dec	2009	9,135	13,958	12,568	35,661
Jan	2010	8,849	15,801	12,496	37,146
Feb	2010	8,452	12,850	11,494	32,796
Mar	2010	9,585	12,995	13,166	35,746
<b>Total</b>		<b>213,575</b>	<b>299,926</b>	<b>295,603</b>	<b>809,104</b>

The Gross energy generated data and auxiliary Energy consumption data is not used for calculation of emission reductions as the calculations of emission reductions is based on Net Saleable Energy i.e the difference of Energy exported and Energy imported.



## Annexure III

**Net saleable energy:**

Month-wise data on Net Saleable Energy for the monitoring period is given in Table 5 below:

As per the Project Design Document, Emission reductions are to be calculated based on the energy exported minus energy imported during shut-down and start-ups by the power plant.

**Table 5: Net Saleable Energy (kWh)**

Billing Month	Year	Energy Exported				Energy Imported				Net Saleable Energy
		Chakbhai	Lohgarh	Sidhana	Total	Chakbhai	Lohgarh	Sidhana	Total	
Jul	2008	1,403,730	1,108,570	726,144	3,238,444	330	810	1,408	2,548	3,235,896
Aug	2008	1,338,180	1,043,850	719,760	3,101,790	510	770	1,040	2,320	3,099,470
Sep	2008	1,386,140	1,232,220	802,920	3,421,280	240	590	440	1,270	3,420,010
Oct	2008	964,390	819,810	616,580	2,400,780	50	270	400	720	2,400,060
Nov	2008	880,820	690,690	547,520	2,119,030	10	90	180	280	2,118,750
Dec	2008	809,210	730,230	381,340	1,920,780	30	350	2,300	2,680	1,918,100
Jan	2009	928,390	787,600	588,820	2,304,810	1,420	2,120	1,860	5,400	2,299,410
Feb	2009	1,123,600	938,330	664,060	2,725,990	40	300	600	940	2,725,050
Mar	2009	1,238,690	1,022,920	779,060	3,040,670	40	200	340	580	3,040,090
Apr	2009	524,410	433,750	341,740	1,299,900	2,310	3,470	3,520	9,300	1,290,600



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May	2009	1,465,250	1,107,960	875,860	3,449,070	160	670	480	1,310	3,447,760
June	2009	1,337,700	1,202,520	812,900	3,353,120	130	460	1,000	1,590	3,351,530
Jul	2009	1,305,280	1,228,260	741,260	3,274,800	740	1,130	1,140	3,010	3,271,790
Aug	2009	1,466,110	1,112,440	811,160	3,389,710	340	420	700	1,460	3,388,250
Sep	2009	1,344,330	1,081,200	746,720	3,172,250	90	500	580	1,170	3,171,080
Oct	2009	620,300	507,450	315,600	1,443,350	1,800	1,890	2,260	5,950	1,437,400
Nov	2009	843,300	703,600	545,340	2,092,240	510	720	210	1,440	2,090,800
Dec	2009	1,252,490	1,069,230	754,960	3,076,680	60	50	100	210	3,076,470
Jan	2010	1,139,300	1,000,550	716,180	2,856,030	40	40	140	220	2,855,810
Feb	2010	1,172,800	954,020	703,120	2,829,940	50	100	140	290	2,829,650
Mar	2010	1,335,700	1,067,020	798,900	3,201,620	30	100	180	310	3,201,310
<b>Total</b>		<b>23,880,120</b>	<b>19,842,220</b>	<b>13,989,944</b>	<b>57,712,284</b>	<b>8,930</b>	<b>15,050</b>	<b>19,018</b>	<b>42,998</b>	<b>57,669,286</b>